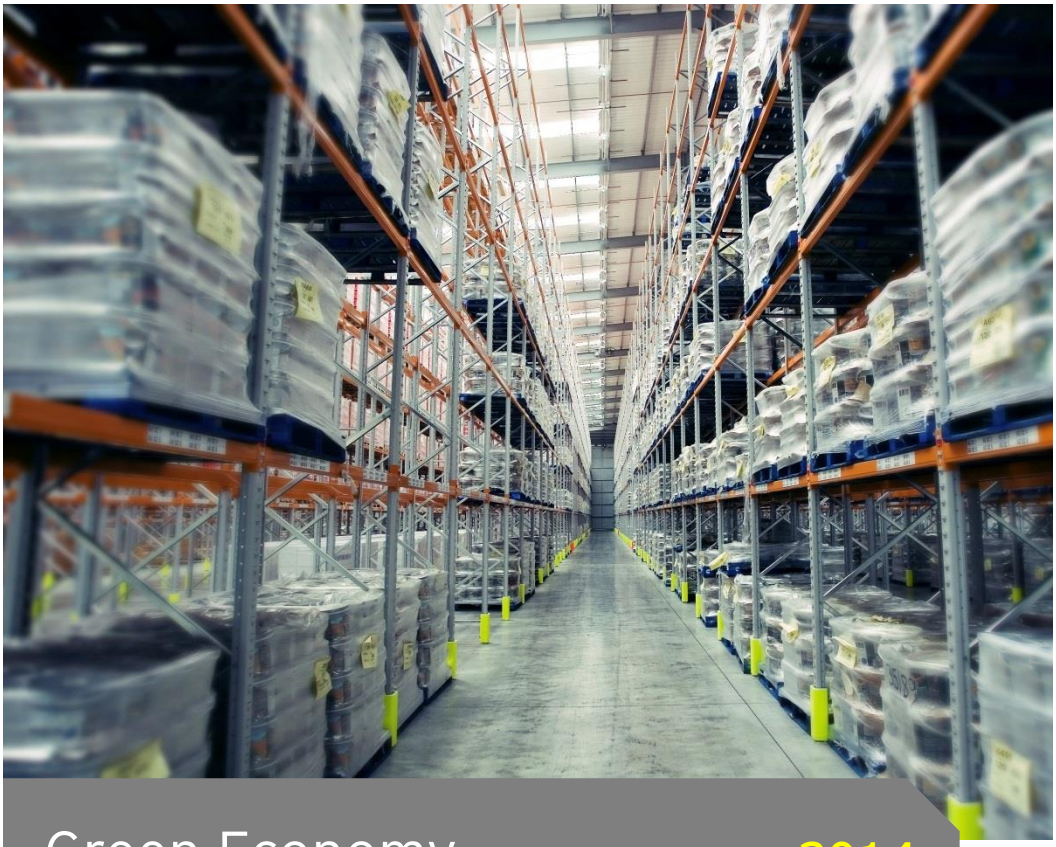


Green Economy Guideline Manual

2014

EY
Building a better working world

Logistics

ISKANDAR
REGIONAL DEVELOPMENT AUTHORITY

ISKANDAR MALAYSIA

Invest, Work, Live & Play

MEET ISKANDAR MALAYSIA

Since its inception in 2006, Iskandar Malaysia has experienced unprecedented growth in the development of projects that not only create new values, enhance societal well-being and induce multiplier effects but also those that challenge conventional wisdom, making it the hive of activity in Malaysia.

Taking the role as one of South East Asia's main gateways, Iskandar Malaysia invites you to experience the region that is envisioned to be a Strong & Sustainable Metropolis of International Standing where a host of opportunities to Invest, Work, Live and Play awaits you.

To learn more about Iskandar Malaysia, visit www.iskandarmalaysia.com.my

Electrical and Electronics

Oil, Gas & Petrochemical

Food and Agro processing

Education

Healthcare

Tourism

Logistics

Creative Industries

Financial Services & Real Estate

http://facebook.com/Iskandar.My

@iskandarmsia

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 up to 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 **logistics industry**.

We hope businesses in Iskandar in the logistics 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

Table of Contents

Glossary 6

1. Industry Overview 8

1.1. Environmental Impacts..... 11

2. Identifying Green Growth Opportunity ... 16

2.1. Areas of Intervention 19

2.1.1. Warehousing and Inventory 19

2.1.2. Network..... 21

2.1.3. Fleet Operation and Management..... 21

2.2. Potential Options..... 23

3. Recommended Actions for Strategic Direction and KPIs 25

3.1. Facility Efficiency..... 25

3.1.1 HVAC Efficiency..... 26

3.1.2 Lighting Efficiency 33

3.1.3 Improving Energy Efficiency in Warehouse Operation 38

3.2. Reduction in Waste 42

3.3. Reduction in Water 47

3.4. Promote Efficiency in Inter- and Trans- Modal Transportation System. 51

3.5. Increasing Utilization of Alternative Fuelled Vehicles (AFVs) and Technological Improvements on All Vehicles ... 55
3.6. Efficient Operation of Vehicles 62
3.7. Monitoring and Reporting..... 68
3.8. Educating and Training Employees 70
3.9. Compliance to Local Regulations..... 73
3.10. Case Study..... 76
3.10.1 Fedex 76
4. Social Responsibility 83
4.1. Human Rights, Labor Standards & Ethical Behavior.... 84
4.2. Disclosure Requirement 88
4.3. Responsible Procurement..... 91
5. Conclusion 94
Useful Links..... 95
Key Industry Contacts..... 96
Bibliography 97

Glossary

AFV	Alternative-Fuelled Vehicles
ATMS	Automated Transfer Management System
BEMS	Building Energy Management Systems
CFL	Compact Fluorescent Lighting
ESG	Environmental, social and governance
GBI	Green Building Index
GDP	Gross Domestic Product
GFA	Green Freight Asia
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 Regional Development Authority
KeTTHA	Malaysia Ministry of Energy, Green Technology and Water
LCCF	Low Carbon Cities Framework
LDV	Light duty vehicles
LED	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
LEP	Light-emitting plasma
LNG	Liquefied Natural Gas
MATR	Malaysia Automotive Technology Roadmap
MHE	Mechanical Handling Equipment
NAP	National Automotive Policy

Logistics Sector

1. Industry Overview

The logistics industry is a broad industry, which facilitates mobility and manages movement of goods and people. The transportation sector plays a significant role in developing country economies, accounting for 6% to 12% of GDP (World Bank, 2014). The value of the global transport sector has consistently outpaced overall economic growth over the past decade, growing at an average of 5.6% per year versus global GDP growth of 2.6% per year (Figure 1). Furthermore, there appears to be a strong interrelationship between growth in the value of the global transportation industry and growth in global GDP (Figure 1).

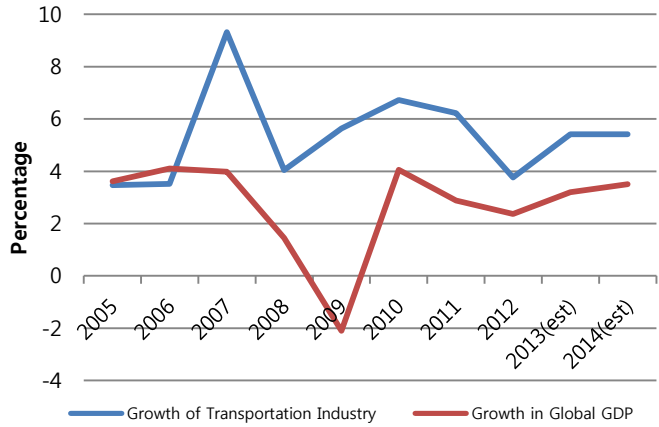


Figure 1: Growth in GDP and logistics sector (Datamonitor, 2012)

The logistics sector involves the management of goods and integration of a range of sub-sectors, including distribution, inventory, warehousing, material-handling and packaging. This guideline will focus primarily on improving efficiencies and identifying opportunities for sustainable development ("greening") in the logistics and distribution sector, excluding passenger transportation.

In absolute terms, the logistics and distribution sector has experienced constant growth, expanding continuously at 5.4%

per annum and the sector is forecasted to grow further (Figure 2).

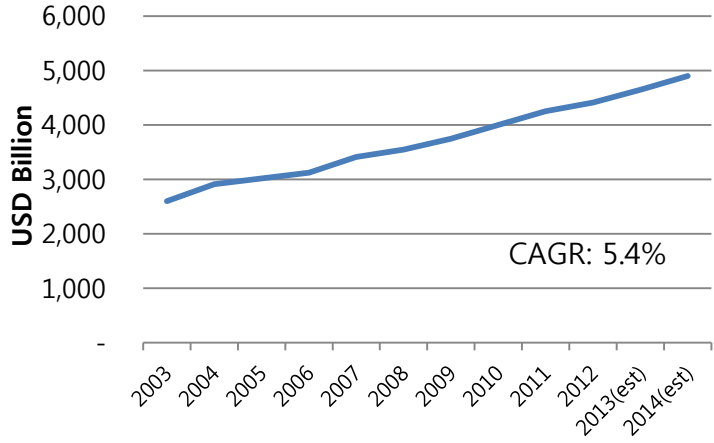


Figure 2: Global Logistics and Distribution Sector Market Size and Forecast (Datamonitor, 2012)

In Iskandar Malaysia (IM), the logistics industry is rated as one of the fastest growing industry for the period 2005 – 2025, with 6% growth contribution in 2005 to rise to 8% in 2025. The industry has a great prospect given its strategic location at the Straits of Malacca, which is a key southern international gateway. It is also accessible to other key business centers, such as Kuala Lumpur and Singapore, and other air and sea ports, such as Senai International Airport,

Changi Airport in Singapore, Johor Port and Port of Tanjung Pelepas. In addition, IM's location allows it to tap into the hinterland for expansion of land-intensive storage facilities.

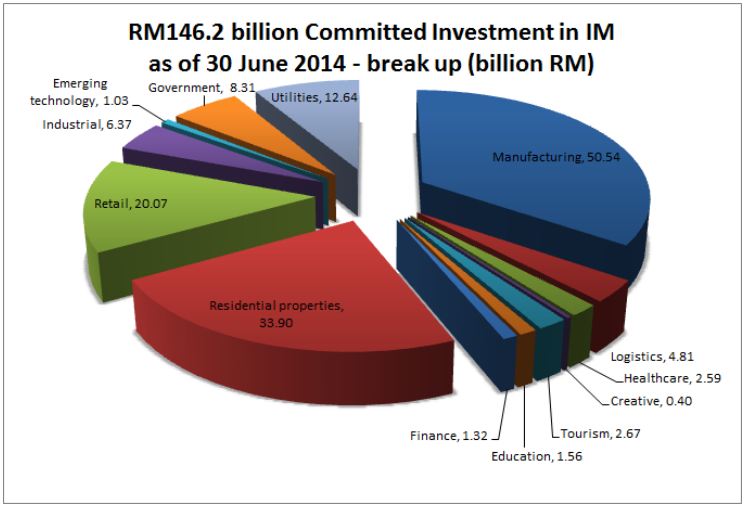


Figure 3: Cumulative investments in IM (Low & Kasmuri, 2014)

1.1. Environmental Impacts

Along with energy and water consumption and waste production, greenhouse gases (GHG) emissions are a key issue for the industry. GHG emissions from the global transport sector account for 5.5% of total global emissions (EU logistics hub, 2011), and makes up 23% of global energy-

related GHG emissions (GFEI, 2009). Transport sector GHG emissions rose continuously at a rate of 1.4% between 2005 and 2011 (Figure 2) and are expected to increase at a faster rate of 2.16%.

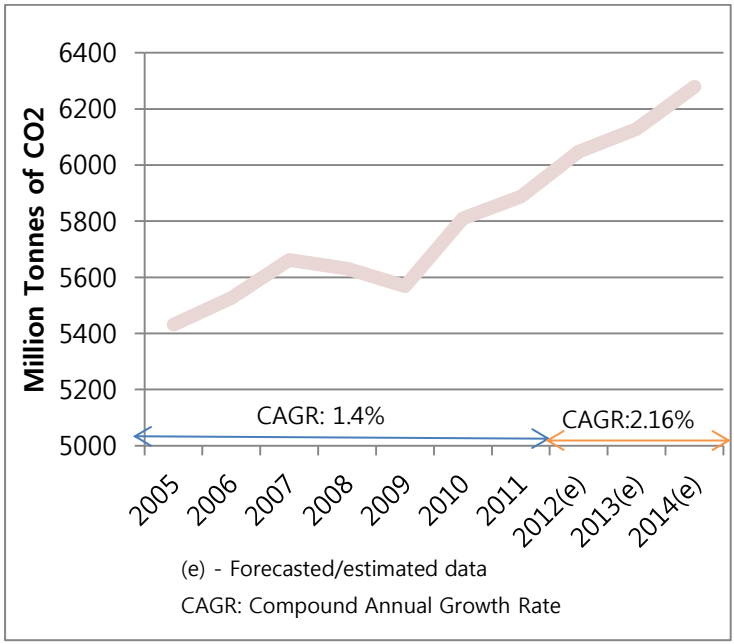


Figure 4: GHG Emissions from Transport (World Bank, 2014)

Given the contribution of the logistics sector to both global GDP and global emissions, additional action needs to be taken to reduce emissions and emissions intensity of the

global logistics sector over the medium to long term. Various approaches are being taken in order to mitigate such harmful impacts to the environment. Despite technological improvements, these measures have not been sufficient to offset the impact of rapid growth in demand.

The potential for reduction in energy intensity is high due to the fossil-fuel-intensive nature of the industry (WEF, 2011). The greatest opportunities exist in developing countries and regions where investment and planning decision can be made today.

The Government of Malaysia recognizes this potential and has implemented the National Automotive Policy (NAP), which targets technological advancements, human capital and infrastructural changes to cut down on transportation-related GHG emissions. IM has action plans for integrated green transportation to achieve its goal of a sustainable global logistics hub. More information on the NAP and IM's transportation blueprint can be found on the Ministry of Energy, Green Technology and Water (KeTTHA)'s website www.kettha.gov.my and on IM's website www.iskandarmalaysia.com.my respectively.

Comparing emission data with market growth (Figure 4), the

sector seems to be decarbonizing, as emissions (2.16%) are increasing at a slower rate than market growth (5.4%) in Figure 2. While this trend is encouraging, the emissions intensity of the transport sector is falling at a slower rate than the decline in global emissions intensity of GDP (-3.8% on average in the logistics sector, compared with -4.3% on average per GDP between 2005-2011 (World Bank, 2014) (Datamonitor, 2012). Leading companies in the sector are adopting various measures to minimize regulatory risk posed by fiscal disincentives to emit carbon (such as limit based approaches and tariff-based schemes) and unlock cost reduction potentials from reduced energy use (fuel for transportation and electricity for storage facilities). With volatile fuel prices, implementing de-carbonization measures reduces business exposure to energy cost volatility. This guideline draws on the practices pursued by the top 5 leading companies in the logistics and distribution sector globally to identify and prioritize greening options (Table 1).

Company	Revenue (in billion USD)	Key Green Initiatives
Deutsche Post AG	75.7	• Alternative-Fuelled Vehicles (AFV) & Energy efficient fleet • Green office buildings • Pollution control
United Parcel Service, Inc.	55.5	• AFV & Fuel efficient fleet • Green facilities • Recycling & Green Procurement
Hyundai Heavy Industries Co., Ltd.	51.3	• Reduction in material and energy consumption • Eco-design
A.P. Møller-Maersk A/S	49.0	• Energy efficient fleet • Innovative ship design
FedEx Corp.	44.3	• Material conservation • Fuel efficient fleet • Solar & Green Energy

Table 1: Top 5 industry leaders (Factiva, 2014)

2. Identifying Green Growth Opportunity

The transport and logistics sector is an integrated system that links production and consumption via a range of transport modes and stages depicted below as a simplified logistics and distribution industry value chain (Figure 5). The large variety of transport modes, specialist transport requirements (e.g. bulk, refrigerated, liquids and secure) and potential distribution routes results in a wide range of possible efficiency interventions.

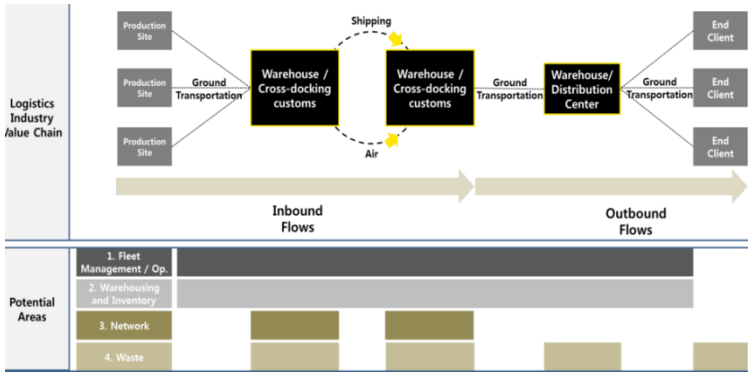


Figure 5: Typical Industry Value Chain

The industry value chain is complex and common areas can be grouped together as a basis for identifying potential areas of efficiency. Figure 5 groups the industry supply chain into four key areas: (i) fleet management and operation, (ii) warehousing and inventory, (iii) network, and (iv) waste.

By classifying the logistics value chain into these main sub-sector groupings, interventions and potential options for greening the logistics chain can be identified.

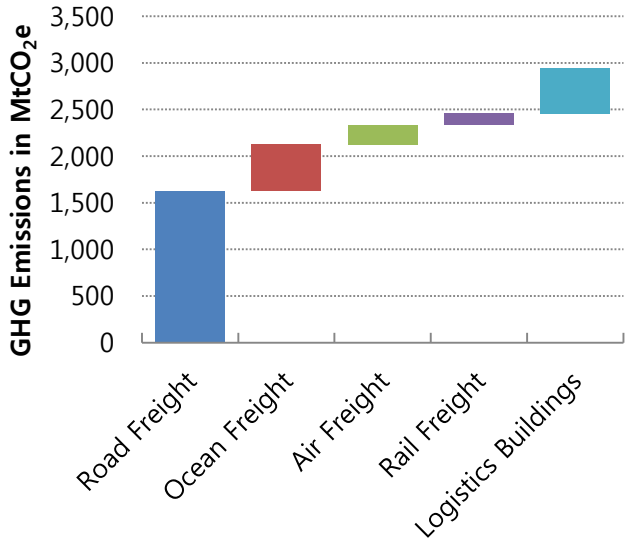


Figure 6: Breakdown of emissions from logistics industry (WEF, 2009)

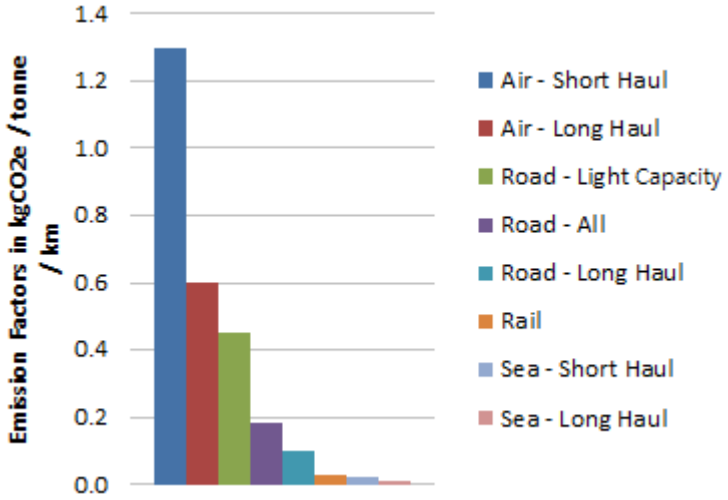


Figure 7: Emission Assessed in terms of emissions intensity per tonne-km (WEF, 2009)

On an absolute emissions basis, road/vehicle distribution is therefore a key area of intervention for emissions abatement, while air freight represents an area of intervention on the basis of emissions intensity. Emissions from vehicles can be abated either through increasing the efficiency of the vehicles (via technological improvements or the purchase of more efficient models) or fuel-switching to a less intensive fuel source.

Liquefied Natural Gas (LNG) is considered one of the most promising alternatives to conventional diesel-powered trucks for long-haul, with LNG vehicles delivering fuel costs almost half those of traditional diesel vehicles, and lower emissions, becoming more affordable as more of them are manufactured (UPS, 2012). These options will be explored in more detail in Section 3.

2.1. Areas of Intervention

2.1.1. Warehousing and Inventory

'Warehousing and inventory' refers to the way in which goods are stored when not in transit, either at the start/end point of transportation or in staging facilities throughout the journey. Logistics buildings are relatively GHG intensive, with emissions contributions up to 13% of the total sector emissions (Figure 6) and often have specific requirements for lighting, temperature and/or security. The emissions arising from energy use in this sector is dependent on the efficiency of the storage facility, and the GHG emissions intensity of the energy used at the site. While electricity used by high-bay lighting is a common source of energy usage, facilities that require refrigeration, or maintain a constant temperature, tend to also be significant energy users. Efficiency, within the

constraints of site and customer requirements, is therefore a key area of intervention within the warehousing sub-sector, along with energy production systems (installation of renewable energy).

Iskandar Regional Development Authority (IRDA) recognizes that buildings and facilities take up a large proportion of energy consumption in an urban setup and have implemented measures such as the Low Carbon Cities Framework (LCCF) formulated by KeTTHA to target the greening of the built environment.

2.1.2. Waste

'Waste' refers to the disposed material of the byproducts of production and distribution. This commonly takes the form of discarded packaging and equipment (pallets, boxes, plastic etc).

Minimizing waste is a common area for action for all industries. Major waste issues associated with this sector is with packaging, which uses a lot of raw material to ensure goods are distributed efficiently. There is a need to consider environmentally friendly design and the use of recyclable materials for distribution purposes in order to reduce waste. The benefit of waste reduction would not only be a cut in

emissions, but also a cut in costs.

2.1.2. Network

'Network' encompasses the proportion of emissions contributed as a result of decisions over how goods are transported. While similar to the Fleet Management sub-sector (Section 2.1.4), network decisions focus particularly on the way in which goods are transported and distributed at a systemic level, rather than the emissions associated with individual vehicles. Optimization of routes is of key importance to logistics companies for the purposes of cost management. This optimization can be extended to include consideration of the emissions associated with both particular routes and the mode or modes of transportation that are utilized. Consequently, optimization of both the route and mode or modes of transport are key areas of intervention addressed in Section 3, though the ability to switch modes will be dependent on existing transportation routes and networks, we also have to consider the transferability of cargo and pricing/timing coordination.

2.1.3. Fleet Management and Operation

'Fleet management and fleet operation' refers to the

emissions that are produced as a result of physical transportation of goods. Global transportation fleets, comprising road, ocean, air and rail freight, emit approximately 2,450MtCO_2e annually, with road freight contributing the greatest proportion amongst different modes. While road freight contributes a significant amount on an absolute basis (around 57%), emissions per-tonne-km vary markedly between transport modes: for example, the emissions intensity (CO_2/t/km) of air freight is almost eight times higher than the emissions intensity of average road transport. Some areas of intervention for fleet management are vehicle design (efficiency/consumption, fuel type) and usage patterns of vehicles.

IM aims to be a global logistics hub with elaborate distribution networks and holding sites, located away from the populated areas, such as commercial or industrial zones. This would allow companies to better manage their freight operations.

2.2. Potential Options

Following the analysis on key areas for intervention, the following measures have been identified which act to minimize environmental impacts from the sector (Table 2). These actions were prioritised in terms of ease of implementation and abatement potential, based on the issue priority matrix (**Error! Reference source not found.**). These actions are then explored in the following sections.

Areas for Intervention	Recommended Actions
Warehousing & Inventory	Facility Efficiency • HVAC efficiency • Lighting efficiency • Efficiency of Warehouse Operations
Waste	• Reduction in waste (packaging design initiatives) • Reduction in water use
Network	• Promoting Inter-Modal Shifting and Efficiency
Fleet Management & Operation	• Increasing utilization of AFV and technological improvements on vehicles • Efficient operation of vehicles (during operation)

Monitoring & Reporting	• Developing / Adopting green technologies • Creating a carbon budget • Measuring of environmental indicators

Table 2: Key actions in the transport and logistics sector

3. Recommended Actions for Strategic Direction and KPIs

3.1. Facility Efficiency

Improving energy efficiency in inventory and storage can play a significant role in minimizing environmental impact considering its contribution to GHG emissions in the transport sector, accounting for approximately 13% – or around 371 $MtCO_2e$ emissions per year (WEF, 2009). Furthermore, energy costs can account for as much as 15% of a warehouse's operating budget (DHL, 2013) and even 10% of total revenue (Warehousing Logistics International, 2014). However, with various efficiency measures, energy savings can be up to 6% (DHL, 2013).

Improving facility efficiency 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 and Smart Metering) to implementing sustainable building designs.

3.1.1. HVAC Efficiency

Action: Installing efficient HVAC systems

According to Carbon Trust, a 1°C decrease in internal building temperature results in 10 percent energy consumption savings which would automatically lead to decrease in GHG emissions (CarbonTrust, 2002). 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.

- 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 hose, 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 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 8: 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: 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, glare protection, privacy, view out, 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

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 **KeTTHA**, which recommends specific carbon reduction solutions in buildings and infrastructure. Malaysia has also launched the **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 (IRDA), 2014)

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

3.2. Waste

Sustainable packaging initiatives can make a substantial contribution to carbon abatement across the supply chain (WEF, 2009). Packaging initiatives primarily 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.

Action: Light-weighting and reducing volume

This action directly reduces energy used to transport which can lead to direct cost savings. For instance, if a company uses 25% less plastic or cardboard per unit, it will be able to fit 25% more product per pallet, resulting in fewer shipments and lower transportation costs (Inbound Logistics, 2009).

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). The carbon abatement of eliminating packaging is significant in the production phase of the lifecycle – at up to 125 $MtCO_2e$ per year globally (WEF, 2009).

Action: Selecting alternative material that can be recycled

When companies are considering packaging options, they often turn to the lightweight materials such as paperboard, aluminum, and plastic. Paperboard, plastic and aluminium are lightweight and are able to protect finished items. Also, paper, cardboard and plastics reduce waste going to landfills. Corrugated cardboard is a very popular product used for efficient exterior packaging, mainly due to its strength, light weight, and recyclability. The corrugated cardboard consists of organic material, paper and starch glue, and can be up to 80% recycled (Murray, 2014).

Subaru assembly plant in Indiana, US, sources parts from Japan. These parts are protected by molded polyurethane foams which can be reused for subsequent distribution. This delivers cost savings up to USD1.3 million per year and a reduction of approximately 2,000 tonnes of CO_2 (Parcel Industry, 2009).

Action: Reducing packaging

Avoid use of unnecessary packaging, for instance Amazon reduced packaging for books that are required for shelving as a part of their Frustration-Free Packaging program (Parcel

Industry, 2009).

HP (Atkinson, 2008)

Reducing shipping trips by improving on packaging

HP quadrupled the number of packages that can be carried in a single truckload by reducing 80% of the weight in inkjet cartridge multipacks, since 2003.

Also, the current LaserJet toner cartridge packaging is 45% lighter and as a result, reduced shipping volume by 30%. Shipping pallet can now hold 203 cartridges which is an increase from 144 cartridges.

HP redesigned its print cartridge packaging to eliminate 15 million pounds of materials, including 3 million pounds of corrugated cardboard, and almost 7 million pounds of PVC. The new clear packaging design for high-end printers eliminates extra packaging, such as outer corrugated box and extensive foam packaging by using minimal foam and supports with transparent film (made from polyethylene which is recyclable) to encase the shipping.

Key Performance Index

Key Performance Index	Objective	Ease of implementation
Initiatives for sustainable	Higher	Easy

packaging		
Use of reusable, recyclable material	Higher	Easy
Percentage of packaging recycled / reduced	Higher	Easy
Weight / volume reduced for each packaging	Higher	Easy
Percentage of travel avoided	Higher	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

3.3. Reduction in water

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

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.

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

UPS (UPS, 2012) identified that 80-20 rule applies to water, where 80% of the water usage comes from 20% of the operation units. Therefore, identifying and targeting high usage areas are essential before initiating water reduction strategies. Although transportation, distribution and logistics industry is not a significant water-consuming industry, many leading companies are implementing strategies as water scarcity and conservation are becoming global concerns.

Action: Installing water-saving fixtures

Waterless urinals, dual-flush toilets, and motion-detecting faucets can all reduce water usage.

Action: Minimizing water use during vehicle wash

Wash vehicles only as necessary to maintain appearance. Environmentally-friendly enzyme washing agent reduces the need for rinse water. "Dry wash" technique is adopted by UPS (UPS, 2012). It uses a soapy liquid and limits the use of water in the process.

Action: Re-using greywater for washing

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 Consumption – includes all facility related water and water used to wash vehicles in cubic meters	Lower	Moderate

Although water is not a significant issue in the sector, water scarcity is a global concern. Malaysia's Ministry of Natural

Resources and Environment identifies water shortage as a potential area of improvement in near future and is implementing new guidelines to protect future water security.

At a national level, the government aims to carefully monitor its existing water resources and increase awareness for sustainable water use. Within IM, strategies are in place to manage important water sources such as lakes and river ecosystems through its Environmental Planning Blueprint.

Reducing and recycling measures can be a mitigating option for the sector, where water management is integrated into economic sectors such as manufacturing and distribution to ensure water security. The cooperation of stakeholders and partners is required for active water conservation. By reducing water consumption, individuals and businesses can substantially mitigate the threat of water scarcity.

More information on initiatives on water management can be found at www.nre.gov.my and www.irda.com.my

3.4. Promote Efficiency in Inter and Trans-Modal Transportation System

This guideline has identified that different modes of transportation have different emission intensity. Companies must therefore focus on utilizing the most fuel-efficient mode of transportation or combination of modes to reduce GHG emissions.

GHG emissions, when expressed in in terms of emissions per tonne-km, shipping is the most efficient transportation mode, in the region of 1% to 2% of those of airfreight per tonne-km. Therefore, optimizing mode of transportation, especially switching:

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

These can be an option for transport, logistics and distribution industries to maximize their efficiency in transport.

As supply chains become more complex, the opportunity to

improve efficiency during inter- and trans-modal transportation systems is significant.

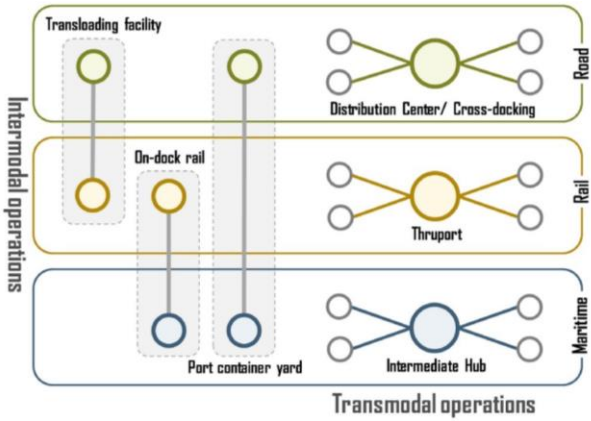


Figure 9: Inter and trans-modal operation (Rodrigue, 2012)

Figure 9 demonstrates the distribution points between different and identical modes. Improving efficiency in each of the connecting points that allow distribution will improve speed, save time and allow cost and environmental benefits (from decreasing idling time, reduce fuel usage and GHG emissions). In a world where supply chains are getting integrated, the time component in supply chain management is imperative (John Zumerchik, 2010). Inter-modal and trans-modal connection points are regarded as the weakest link.

Action: Creating an automated transfer management system (ATMS) to streamline 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 Inter-continental air to ocean freight;	Lower	Easy
	Proportion of short haul air to road transport	Lower	Easy
	Proportion of long distance road freight to rail or waterways	Lower	Easy
Improving efficiency	Average idle time for stand-by for loading	Lower	Easy

during intermodal transfers	and unloading between inter-modal transfers		
Improving efficiency during intermodal transfers	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

Switching to less GHG-intensive mode of transportation and improving efficiency during modal shift are green options for the transportation, logistics and distribution industry. A careful analysis of potential switches should be identified internally.

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 are key factors in economic growth. Stakeholders and partners can add to IM's efforts by improving their strategies for distribution, which can also maximize time and cost.

3.5. Increasing Utilization of AFV and Technological Improvements on All Vehicles

AFV refers to an increasing number of vehicles which run on fuels other than petrol or diesel. This category includes vehicles which run on less-emissions-intensive or renewable fuels, and comprises a number of technologies at varying stages of commercialization (Table 3). Increasing the utilization of AFVs can mitigate GHG emissions and result in fuel cost savings throughout the sector. According to WEF (WEF, 2009), clean vehicle technologies and increasing utilization of these vehicles can bring potential abatement of

175MtCO_2e globally.

AFV Type	Innovation Type	Current Status	Barriers
LPG, LNG, CNG[1]	Incremental	Mass production	Infrastructure
Hybrid Vehicles[2]	Incremental	Mass production	Cost of battery
2nd Gen Biofuels[3]	Incremental	Demonstration	Technology Fuel supply
Electric Vehicles	Radical	Pre-commercial	Range Infrastructure
Hydrogen Fuel Cell Vehicles	Radical	Research / Pre-commercial	Vehicle cost Infrastructure

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

Two types of AFV's in common usage: gas-based systems

[1] LPG: liquefied petroleum gas; LNG: liquefied natural gas; CNG: compressed natural gas

[2] Hybrid vehicles use a combination of an internal combustion engine, electric motor and electricity storage to power the vehicle. A range of configurations are currently produced.

[3] 2nd generation biofuels are those that utilise the cellulose and lignin in plants, rather than sugars

(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 requirements (load characteristics, range of travel) 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.

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 lower cost and is widely available; the technology is a proven alternative for long-haul diesel trucks, and current market for LNG vehicles are mature and commercialized (Intelligent Energy Europe, 2010). 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).

Commercial use of LNG

UPS, a global logistics and transport company, currently has a fleet of 2,688 AFVs operating across 10 countries, replacing the use of gasoline-powered vehicles for more than 100 million miles **(UPS, 2012)**. Another global logistics and transport company, DHL has expanded its alternative fuel/advanced technology fleet: CNG, propane, LNG, LPG, diesel hybrid electric, gasoline hybrid electric, diesel hybrid hydraulic and full electric vehicles accounted for 200 million miles (320m km) in 2010 and 295 million miles (470m km) in 2012. DHL forecasts that AFV's in its fleet will account for 1 billion miles (1.6b km) in 2016 **(DHL, 2013)**.

Action: Operating electric light duty vehicles (LDV) / increase LDV usage in urban areas

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 and delivery operations. With regards to the range issue of electric vehicles, operating LDVs within regional-boundary is a viable option. Leading companies, such as DHL, continuously monitor the operation of AFVs, with plans to replace LDV with AFVs, mainly electric.

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).

Key Performance Index

Key Performance Index	Objective	Ease of Implementation
CO_2 emissions / 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
Technology measures installed in the vehicles and its fuel savings	Higher	Moderate

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 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 NAP 2014 by supporting industries and businesses with renewable energy technological investment and adoption.

IM 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 fleet 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.

Another resource available for companies in IM would be Green Freight Asia (GFA), an organization that aims to lower fuel consumption across Asia Pacific sourced freight movement. GFA organizes workshops and conferences to share best practices and facilitate understanding of sustainable supply chain practices, and is a highly inclusive

network that engages companies of all sizes. Logistics companies can be entitled to receive the Green Freight Label if they meet criteria for sustainable freight as outlined in the GFA website, www.greenfreightasia.org. Companies not only boost their reputation by obtaining the GF Label, but also use less fuel and consequently cut costs.

3.6. Efficient Operation of Vehicles

Efficient operation of vehicles can be achieved by reducing fuel usage and avoiding miles driven. These actions provide an effective, low cost strategy compared to the first option. Furthermore, where the introduction of AFVs requires considering external factors, namely maturity, infrastructure and government support, the current option provides actions that can be decided internally.

Reducing Fuel Usage

Action: Promoting eco-driving / training drivers and operators to improve fuel efficiency

Different transport modes have optimum speed which maximizes fuel efficiency. For shipping, regarding efficiency of the vessels, a 6% reduction in speed (from 9 to 8.5 kt)

results in a fuel savings of approximately 11% and an immediate 15% reduction in CO_2 is achievable (Ronald, 2010).

Road vehicle fuel usage depends on the driving habits of the drivers. Decreasing speeds and eco-driving measures are few of the key options and these should be communicated to the drivers by holding training sessions. Major leading companies such as UPS (UPS, 2012), FedEx (FedEx, 2013) are training their drivers to eco-drive and monitor their driving patterns through information and communications technology (ICT). Monitoring driver habits will discourage drivers to drive in a fuel-consuming manner and allow identification of measures that can reduce fuel consumption. For instance, limiting maximum rpm or minimizing idling time.

Companies should make sure new and existing drivers are educated. This option offers an environmentally effective, low-cost strategy.

Action: Ensuring timely maintenance

Companies should be conducting proactive, just-in time maintenance on vehicles to keep their miles-per-gallon performance as high as possible.

Action: Using ICT-enabled optimized route planning.

Avoiding congested areas, facilitated by investment in installing real-time navigation system with traffic information allows higher average speed with less start-stop, improving fuel economy and vehicle utilization. ICT can also contribute in avoiding miles driven:

- Allocate pick-ups and deliveries to the most efficient number of vehicles each day at each facility, thus keeping vehicles off the road whenever possible.
- Routing vehicles so that they reach all required destinations in the least amount of time and miles driven.
- Identifying loading and unloading locations that enable multiple deliveries.
- Dynamically re-routing drivers based on events such as changing customer pick up needs or a requested change in delivery location, to avoid wasted miles.

The following case study provides an innovative option to avoid miles driven, that has been adopted in South Korea.

CVSnet

Offering a lower price delivery service by arranging customers to pick up packages from local convenience stores

Encouraging pick-ups at local convenience stores for end-users to pick up, can reduce miles driven significantly. CVS, a South Korea based logistics company, offers a lower price service for their customers to pick-up their deliveries at local convenience stores which they can prick-up at any time of the day from any convenience store. This may only be possible for non-commercial packages but as distributing packages within regions is a polluting process as it involves frequent start-stops, this may be a viable option for logistics companies to consider.

UPS Utilization of ICT (UPS, 2012)

Adopting modern technology and employee training to help communicate information necessary to make the most efficient delivery

UPS utilizes IT and engineering technology to reduce greenhouse gases. Telematics outputs combine maps of routes derived from GPS data and detailed reports on driver behavior. These and other outputs drive planning, training, and maintenance activities.

ICT captures more than 200 elements including speed, seatbelt use, and engine idling. This information and driver education reduces fuel consumption, emissions, and maintenance costs while improving safety.

Telematics helped UPS to decrease 206 million minutes of idling time in 2012 – avoiding more than 1.5 million gallons of fuel use.

Since 2001, UPS has avoided 364 million miles through technology – avoiding 39 million gallons of fuel use, and lowering fleet emissions by 369ktCO_2.

Key Performance Index

Performance Index	Objective	Ease of implementation
CO_2 Emission / distance travelled (CO_2 / t / km)	Lower	Difficult
Rate of telematics installation / vehicle	Higher	Easy
Fuel economy of before and after installation of telematics	Higher	Moderate
Analysis/ monitoring on driving patterns	Higher	Easy
Number of trainings conducted for eco-driving	Higher	Easy
Vehicle average speed to assess performance on the route optimization	Higher	Moderate
Load factor	Higher	Moderate

Vehicle utilization rate	Higher	Easy
Miles avoided (number of stops drivers made during the year per mile they traveled)	Higher	Moderate
Packages per gallon of fuel / Gallons of fuel per package	Higher	Moderate
Percentage of miles run by vehicle empty	Lower	Moderate

Malaysia has an action plan to improve energy efficiency of its transportation network. KeTTHA has outlined the inclusion of lowered taxes and grants for the use of energy efficient vehicles, which is publicly visible on its main webpage. IDRA's transportation blueprint has been drafted to improve energy efficiency of urban transportation, forming a Mobility Management System to facilitate energy efficient transport and route options. Road networks and public transit systems are also extensive to increase utility and efficiency of the system.

At both national and regional levels, efforts to increase energy efficiency of transport vehicles exist, but stakeholders and partners are required to cooperate for maximum results. The actions outlined in the section provide set of measures

which can increase efficiency in operation of vehicles for companies to pursue. The key enabling factor here is ICT and behavioural change.

3.7. Monitoring and Reporting

Action: Development/Adoption of green technologies

The 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

A Building Energy Management Systems (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 US 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

3.8. 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

3.9. 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.

3.10. Case Study

3.10.1 FedEx

FedEx acknowledges the cost reduction potential in its business by adopting greening approaches in its operations. FedEx has established clear goals and assesses their progress every year. Their objectives are (FedEx, 2013):

- Increase FedEx Express vehicle fuel efficiency 30% from a 2005 baseline by 2020
- Expand on-site generation and continuing procurement of renewable energy for our facilities
- Seek LEED certification on all new U.S. FedEx Express

buildings

FedEx primarily aims to improve efficiency in: Road, Facility, Inter-modal transport solutions and waste. The case study outlines the key approaches, details and their results (FedEx, 2013).

1. Ground transport

Road	
Approaches	**Details and Results**
Reduce	• **Fuel-efficient Driving Habits** Eco-Driving Program - top performing stations improved their fuel mileage by more than 10% • **Vehicle Improvements** 32% of vehicles with automatic transmission / 38% of trailers with aerodynamic trailer skirts. Fuel mileage increased by more than 10% and improved fleet efficiency by 1.3% Extend trailer length from 28' to 33' - 18% higher load factor, reducing the number of

	trucks on the road and the amount of fuel used Low rolling resistance tires - improve fuel economy by 2% ~ 5%
Replace	Efficient, Advanced Technology Diesel Vehicles - 5% improvement in fuel efficiency in FY13.
Revolutionize	Alternative Fuel Vehicles: Increase in number of hybrid electric, electric and natural gas-powered vehicles

2. Intermodal Transport Solutions

FedEx employs both intermodal containers and trailers that can be facilitated by both truck and train. In FY13, they have increased rail use to approximately 15% of total line-haul miles in the US and improved 70% fuel efficiency on a per-tonne-mile basis.

3. Facility improvements

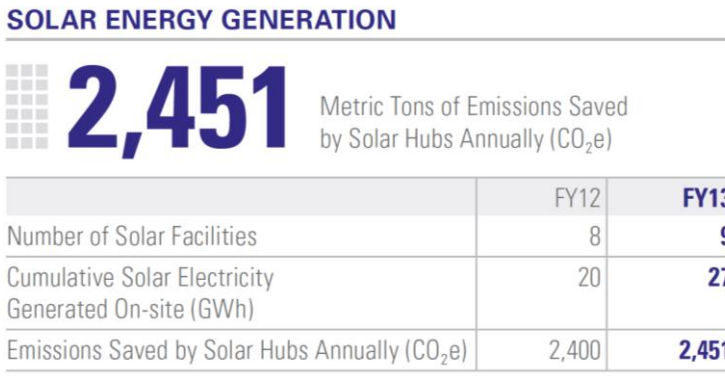
Lighting

FedEx has cooperated with lighting manufacturers to develop LED lights that can replace 1,000 bulbs with High-Intensity Discharge lights at aircraft gates. This has saved 23 million

kWh of energy. In addition, they have installed sensors to measure the luminosity in their warehouse to maximize use of daylight and minimizing need for fluorescent lighting. They have achieved approximately 38%-58% reduction in electricity consumption. In total, they have saved 222 million kWh of energy and avoided 156,768 million metric tonnes of CO_2e emissions.

Renewable Energy

UPS invested in on-site solar energy generation since 2005, and now have nine facilities worldwide – six in the U.S. and three in Europe. The results are summarized below.



SOLAR ENERGY GENERATION

2,451 Metric Tons of Emissions Saved by Solar Hubs Annually (CO_2e)

	FY12	FY13
Number of Solar Facilities	8	**9**
Cumulative Solar Electricity Generated On-site (GWh)	20	**27**
Emissions Saved by Solar Hubs Annually (CO_2e)	2,400	**2,451**

Figure 10: Renewable energy generation in FedEx (FedEx, 2013)

4. Waste

The company uses significant amounts of paper and cardboard in branded packaging. Therefore, their focus on reducing waste is on reducing packaging materials and maximizing use of recycled material. As a result, proportion of FedEx packaging containing recycled materials grew by 5%, from 60% in 2012 to 65% in 2013.

3.10.2. Singapore Post

Singapore Post Limited (SingPost) is an e-commerce logistics and communications company that provides services in Singapore. It aims to be a regional leader in logistics and has expanded into overseas markets. SingPost focuses on delivering reliable and affordable services with sustainable growth, and has looked at several areas for green growth, including:

a. Facility Efficiency

One of the green initiatives undertaken by SingPost is ensuring the efficiency of their buildings and facilities. Their flagship building, Singapore Post Centre, has energy efficient cooling units installed, as well as an overall chiller plant system that reduces the amount of energy used to condition

the air space within the building. This has reduced their carbon footprint by 2,531 tonnes per year, which is equivalent to about 626 cars on the road per year. The change to energy efficient systems has saved more than SGD$1 million a year for SingPost. This project also won the ASEAN Energy Award 2008.

Image 1: Singapore Post Center equipped with energy efficient cooling units (SingPost, 2014)

All of SingPost's branches and post offices have also been certified green by the Singapore Environment Council since 2013. This was part of the Project Eco-Office program, where Eco-Post Office labels were awarded to post offices with environmentally friendly practices. Areas of consideration included environment policy, energy and water management and waste management.

b. Fleet Efficiency

SingPost implemented an eight-year Green Fleet program to replace existing vehicles with environmentally friendly and

energy-efficient alternatives. SingPost has adopted Euro-IV compliant vehicles which are more fuel- and cost- efficient. Route optimization is also a key contributor to reduced GHG emissions, as it minimizes the number of wasted trips either to cancelled delivery locations or return trips to mail transit rooms. 295 of SingPost postmen also operate via bikes and 145 operate on foot to utilize a more environmentally-friendly form of logistics and transport.

Lastly, SingPost supports environmental initiatives such as WWF's Earth Hour as part of its commitment to sustainability. SingPost is a major sponsor of Earth Hour Singapore, to increase awareness of environmental responsibility in the society.

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. MNCs like Nike have been accused of exploiting low cost labour and have faced public pressure to introduce better working conditions and a minimum wage. (Business Insider, 2013) Businesses cannot ignore the impact that NGOs, 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 Global Reporting Initiative 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 IM.

To achieve a more sustainable logistics 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 Global Reporting Initiative 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.

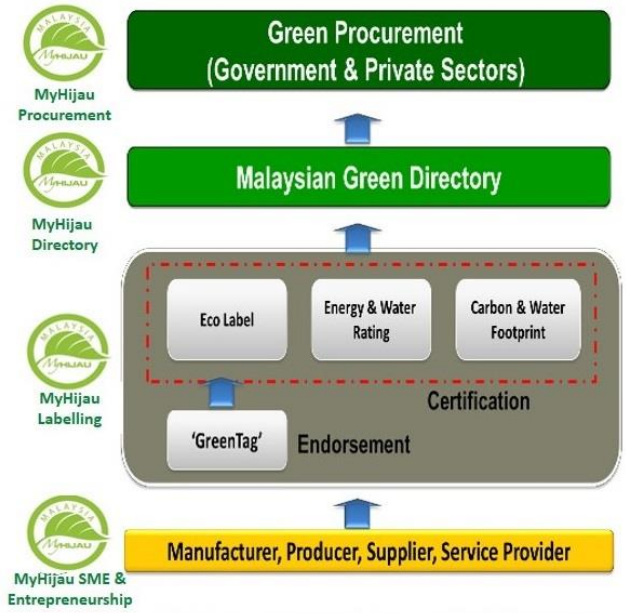


Figure 11: Malaysia Government Green Procurement (Greentech Malaysia, 2013)

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.

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

At the federal level, Malaysia has strategic plans in place to green the logistics industry. At IM, parallel goals have been identified in the transportation blueprint to create a green economic zone. Supplementary action plans have been identified in Section 3 as further green growth opportunities to aid sustainable development goals. All the actions outlined above not only mitigate environmental impacts but also improve profit margin for firms in the transportation, logistics and distribution industry by cost savings from lower fuel (hedging the risk of volatile fuel prices) and energy costs, higher efficiency and revenue growth by meeting emerging demand for sustainable products.

As transport and logistics companies are major consumers of petroleum based fossil fuels, significant opportunity exists for the transformation of operations by improving energy efficiency and technological innovation. This guideline has identified opportunity for energy efficiency and renewable energy, prioritized actions and the key indicators to monitor its progress.

Useful Links

Bursa Malaysia regulations on sustainability disclosures
http://www.bursamalaysia.com/misc/system/assets/5949/regulation_rules_main_market_bm_mainchapter9.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 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) Ministry of International Trade and Industry (MITI)
www.miti.gov.my

Ministry or Transport (MOT)
www.mot.gov.my

Ministry of Natural Resources and Environment (NRE)
www.nre.gov.my

Bibliography

Atkinson, 2008. *Green Packaging: Waste Not, Want Not.* [Online]
Available at:
http://www.inboundlogistics.com/cms/article/green-packaging-waste-not-want-not/
[Accessed 9 06 2014].

Barkan, 2009. *Railroad Transportation Energy Efficiency,* s.l.: University of Illinois .

BBC, 2011. *Low Energy Lighting Guide for TV Production,* s.l.: BBC, ARUP.

Brambley, M., 2005. *Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways.* s.l.: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 , s.l.: Carbon Trust.

CarbonTrust, 2002. *Good Practice Guide 319: Managing energy in warehouses.*, s.l.: HMSO.

Datamonitor, 2012. *Global Transportation Industry,* s.l.: Datamonitor.

DeSimone and Popoff, 1997. *Eco-Efficiency: The Business Link to Sustainable Development*, s.l.: MIT Press.

DHL, 2013. *Delivering Tomorrow*, *Sustainability Report*, s.l.: DHL.

DHL, 2013. *DHL Annual Report*, s.l.: DHL.

EC, 2013. *Quantifying the Effects of Sustainable Urban Mobility Plans,* s.l.: European Commission.

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

EU logistics hub, 2011. *Green is the future for the logistics industry.* [Online]
Available at:
http://www.eulogisticshub.com/blog/2011/03/green-is-the-

future-for-the-logistics-industry/
[Accessed 10 06 2014].

European Environmental Bureau, 2010. *Designing Greener Electronic Products* , s.l.: EEB.

Factiva, 2014. *Distribution Industry Snapshot*. [Online]
Available at: https://global.factiva.com/pis/default.aspx
[Accessed 15 06 2014].

FedEx, 2013. *Sustainability Report,* s.l.: FedEx.

Film London, 2009. *Green Screen,* s.l.: Film London.

GEA, 2012. *Energy End-Use: Transport,* s.l.: Global Energy Assessment.

GeSI, 2008. *Smart 2020,* s.l.: s.n.

GFEI, 2009. *www.globalfueleconomy.org*. [Online]
Available at:
www.globalfueleconomy.org/pages/homepage.aspx
[Accessed 2014].

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

Green Building Index, 2009. *Benefits of Going GBI Green*.

[Online]
Available at:
http://www.greenbuildingindex.org/Resources/20091116%20-%20GBI%20Update%20On%20Incentives/20091116%20-%20Benefits%20of%20Going%20GBI%20Green%20Presentation.pdf
[Accessed 13 July 2014].

Greenovate, 2012. *Guide to Resource Efficiency in Manufacturing,* s.l.: Greenovate.

Greentech Malaysia, 2013. *Government Green Procurement in Malaysia.* [Online]
Available at:
http://www.greentechmalaysia.my/content.asp?cmscategoryid=397&zoneid=2#.VARHbPmSwYo
[Accessed 1 September 2014].

IEA, 2007. *Tracking Industrial Efficiency and CO2 Emissions,* s.l.: IEA.

IEA, 2009. *Transport, Energy and CO2:Moving Towards Sustainability,* s.l.: IEA.

IEA, 2010. *Energy Technology Perspectives* , s.l.: IEA.

IEA, 2011. *Biofuels for Transport Roadmap,* s.l.: IEA.

IEA, 2012. *Fuel Economy of Road Vehicles,* s.l.: IEA.

Inbound Logistics, 2008. *Getting leand and going green*. [Online]
Available at:
http://www.inboundlogistics.com/cms/article/getting-lean-and-going-green-innovations-in-warehouse-operations/
[Accessed 10 06 2014].

Inbound Logistics, 2009. *Good Things Come From Green Packages.* [Online]
Available at:
http://www.inboundlogistics.com/cms/article/good-things-come-from-green-packages/
[Accessed 10 06 2014].

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

Iskandar Regional Development Authority, 2011. *Invest logistics Iskandar Malaysia: Asia's Most Central and Expandable Logistics Hub.* 1st ed. Johor Bahru: IRDA.

Iskandar Regional Development Authority, 2014. *5th High*

Level Seminar on Environmentally Sustainable Cities. [Online]
Available at: http://www.hls-esc.org/documents/5hlsesc/Iskandar.pdf
[Accessed 8 July 2014].

John Zumerchik, J.-P. R. a. J. L. S., 2010. *Automated Transfer Management Systems and the Intermodal Performance of North American Freight Distribution,* s.l.: s.n.

Low, M. L. & Kasmuri, A., 2013. *IM Biz Watch.* [Online]
Available at:
http://www.iskandarmalaysia.com.my/sites/default/files/IM%20BizWatch%20Nov%202013%20.pdf

Low, M. L. & Kasmuri, A., 2014. *IM Biz Watch.* [Online]
Available at:
http://www.iskandarmalaysia.com.my/sites/default/files/IM%20BizWatch%20July%202014.pdf
[Accessed 22 August 2014].

Malaysia Green Technology Corporation, 2013. *MyHIJAU Mark.* [Online]
Available at:
http://www.greentechmalaysia.my/content.asp?zoneid=28&articleid=220#.U_xhGfmSwYo
[Accessed 26 August 2014].

Monash University Malaysia, 2014. *Quest to Solve Water Scarcity.* [Online]
Available at: http://www.monash.edu.my/news/researchers-say/quest-to-solve-water-scarce
[Accessed 15 August 2014].

Murray, 2014. *Packaging In The Warehous.* [Online]
Available at:
http://logistics.about.com/od/operationalsupplychain/a/Packaging-In-The-Warehouse.htm
[Accessed 10 06 2014].

NREL, 2013. *Potential for Energy Efficiency Improvement Beyond the Light-Duty-Vehicle Sector,* s.l.: NREL.

OECD, 2008. *Measuring Material Flows and Resource Productivity,* s.l.: OECD.

OECD, 2011. *Towards a Green Economy* , s.l.: OECD.

Parcel Industry, 2009. *Ideas for Green Packaging,* s.l.: Parcel Industry.

Rabindra, 2004. *Use of Earth Air Tunnel HVAC system in minimizing indoor air pollution; Air Quality Monitoring and Management.* s.l., proceedings of Better Air Quality 2004.

Rodrigue, 2012. *The Geography of Transport Systems.* [Online]
Available at: https://people.hofstra.edu/geotrans/eng/ch3en/conc3en/interrmodal_transmodal.html
[Accessed 12 05 2014].

Ronald, 2010. *Ocean Shipping lines cut speed to save fuel costs,* s.l.: LA Times.

SingPost, 2014. *SingPost Corporate Social Responsibility.* [Online]
Available at: http://www.singpost.com/corporate-information/corporate-social-responsibility.html#Green_Initiatives
[Accessed 8 August 2014].

Sustainable Energy Authority of Ireland, 2014. *Building Energy Management Systems (BEMS).* [Online]
Available at: http://www.seai.ie/Your_Business/Technology/Buildings/Building_Energy_Management_Systems_BEMS_.html

Sustainable Energy Authority of Ireland, 2014. *Building Energy Management Systems (BEMS).* [Online]
Available at:

http://www.seai.ie/Your_Business/Technology/Buildings/Building_Energy_Management_Systems_BEMS_.html

Sustainable Stock Exchange Initiative, 2013. *Bursa Malaysia (Malaysian Exchange).* [Online]
Available at: http://www.sseinitiative.org/fact-sheet/bursa/
[Accessed 26 August 2014].

T5 Lighting USA, 2014. *Benefits.* [Online]
Available at: http://t5lightingusa.com/t5-lighting-benefits/
[Accessed 10 06 2014].

Tufts University, 2014. *Bulb Exchange,* s.l.: s.n.

UNEP, 2011. *Towards a Green Economy,* s.l.: UNEP.

UNESCAP, 2009. *Economic and Social Survey of Asia and Pacific,* s.l.: UNESCAP.

UNIDO, 2011. *Green Industry Initiative for Sustainable Development,* s.l.: UNIDO.

Universiti Utara Malaysia, 2014. *Universiti Utara Malaysia.* [Online]
Available at: http://www.hiccob.uum.edu.my/
[Accessed 27 August 2014].

University of Twente, Unilever, 2013. *Sustainable Warehousing,* s.l.: University of Twente, Unilever.

UPS, 2012. *UPS Sustainability Report* , s.l.: UPS.

US Department of Energy, 2014. *LED Lighting.* [Online]
Available at: http://energy.gov/energysaver/articles/led-lighting
[Accessed 13 July 2014].

US EPA, 2009. *A Guide to Energy-Efficient Heating and Cooling.* [Online]
Available at:
http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL_9-4-09.pdf?7abc-7028
[Accessed 13 July 2014].

USEPA, 2011. *Alternative Fuel Data Centre.* [Online]
Available at: http://www.afdc.energy.gov/data/
[Accessed 12 05 2013].

Warehousing Logistics International, 2014. *Greening the Warehouse.* [Online]
Available at:
http://warehousinglogisticsinternational.com/practice-details/greening-the-warehouse-1/

[Accessed 13 06 2014].

WEF, 2009. *Driving Sustainable Consumption - Closed Loop Systems,* s.l.: World Economic Forum.

WEF, 2009. *Supply Chain Decarbonization,* s.l.: World Economic Forum.

WEF, 2011. *Green is the Future for the Logistics Industry.* [Online]
Available at: www.eulogisticshub.com/blog/2011/03/green-is-the-future-for-the-logistics-industry/
[Accessed 29 05 2014].

World Bank, 2014. *CO2 emissions from transport (million metric tons).* [Online]
Available at:
http://data.worldbank.org/indicator/EN.CO2.TRAN.MT
[Accessed 10 06 2014].

World Bank, 2014. *GDP (current US$) | Data | Table - The World Bank.* [Online]
Available at:
http://data.worldbank.org/indicator/NY.GDP.MKTP.CD
[Accessed 10 06 2014].

WRI, 2007. *Slicing the Pie,* s.l.: World Resources Institute.

EY | Assurance | Tax | Transactions | Advisory

About EY
EY is a global leader in assurance, tax, transaction and advisory services. The insights and quality services we deliver help build trust and confidence in the capital markets and in economies the world over. We develop outstanding leaders who team to deliver on our promises to all of our stakeholders. In so doing, we play a critical role in building a better working world for our people, for our clients and for our communities.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. For more information about our organization, please visit ey.com.

About EY's Climate Change and Sustainability Services
Governments and organizations around the world are increasingly focusing on the environmental, social and economic impacts of climate change and the drive for sustainability.

Your business may face new regulatory requirements and rising stakeholder concerns. There may be opportunities for cost reduction and revenue generation. Embedding a sustainable approach into core business activities could be a complex transformation to create long-term shareholder value.

The industry and countries in which you operate as well as your extended business relationships introduce specific challenges, responsibilities and opportunities.

Our global, multidisciplinary team combines our experience in assurance, tax, transactions and advisory services with climate change and sustainability knowledge and experience in your industry. You'll receive tailored service supported by global methodologies to address issues relating to your specific needs. Wherever you are in the world, EY can provide the right professionals to support you in reaching your sustainability goals.

www.ey.com

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.

EY
Building a better working world

ISKANDAR REGIONAL DEVELOPMENT AUTHORITY

ISKANDAR
REGIONAL
DEVELOPMENT
AUTHORITY

Iskandar Regional Development Authority (IRDA)
#G-01, Block 8
Danga Bay, Jalan Skudai
80200 Johor Bahru
Tel: +607 233 3000
Fax: +607 233 3001