"A Comparative Study on the Energy Policies in Japan and Malaysia in Fulfilling Their Nations' Obligations Towards The Kyoto Protocol"

FINAL REPORT

JUNE, 2009

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PREFACE

Global warming and the associated changes in the world climate pattern have been accepted world wide as the gravest threat to humanity in the 20th century. To mitigate the impacts of global warming, the Kyoto Protocol was established in 1997 with the objective of reducing global greenhouse gases (GHGs) emission, in particular carbon dioxide (CO_2), by 5.2% below 1990 levels. Developed nations that ratified the Protocol are committed to GHG reduction targets while developing nations are encouraged to reduce GHG emissions on a voluntary basis. Since most of the GHGs emissions come from the energy sector, energy policy plays an important role in fulfilling the Kyoto Protocol obligations. This year marks the beginning of the commitment period for the 2012 Kyoto Protocol. In this case, it would be worthwhile to compare the energy policies in Malaysia and Japan as these nations move towards fulfilling their obligations towards the Kyoto Protocol; bearing in mind that both countries ratified the Protocol, but that Japan commits a reduction target of 6% while Malaysia bears no obligation. Based on the comparison, recommendations were made on how a developing nation like Malaysia could adopt the policies implemented in Japan to suit local conditions and contribute significantly to GHG reduction.

1.0 INTRODUCTION

Excessive emission of greenhouse gases (GHGs), such as carbon dioxide and methane, into the atmosphere as a result of human activities is one of the major causes of climate change. Since 1980, global carbon dioxide (CO_2) emission has been increasing as shown in Figure 1 (Energy Information Administration, 2006). The result is an unstable atmospheric equilibrium and extreme climate change.

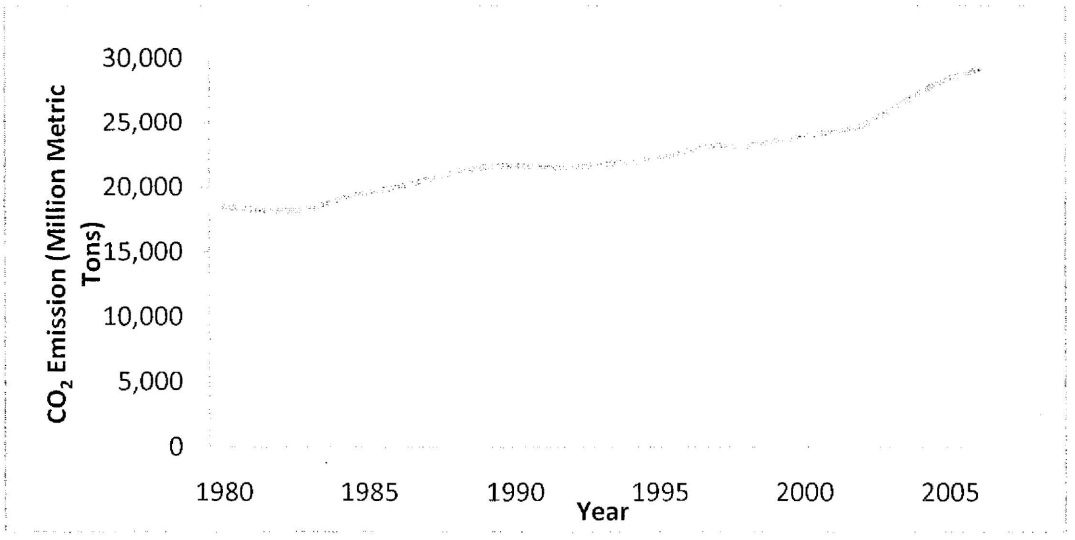


Figure 1: Global Carbon Dioxide (CO_2) emissions from 1980-2005

To mitigate climate change, the Kyoto Protocol was established in 1997. Six greenhouse gases were identified as the main causes of global warming or the greenhouse effect. They are: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride (United Nations Framework Convention on Climate Change, 2008). The massive amount of carbon dioxide emitted annually throughout the world makes other gases comparatively insignificant as shown in Table 1 (Dones et al, 2003; Energy Information Administration, 2006). Thus, the Kyoto Protocol

has set the carbon dioxide equivalent emission reduction target for all developed countries (Annex I countries) that have ratified the treaty and promotes GHG emission reduction projects in developing countries (non-Annex I countries). In the effort to reduce GHG emissions, the protocol has introduced the Clean Development Mechanism (CDM) and the Joint Implementation (JI) programs.

Table 1: Greenhouse gases and their global warming potential

Greenhouse Gases	Global Warming Potential	Emission in 2005 ($MtCO_2eq$)
Carbon Dioxide	1	28,192.74
Methane	23	6,407.49
Nitrous Oxide	120	3,285.63
Hydrofluorocarbons:		503.41
HFC-23	12000	
HFC-134a	1300	
HFC-152a	120	
Perfluorocarbons:		
Perfluoromethane	5700	
Perfluoroethane	11900	
Sulfur Hexafluoride	22200	

Generally, the emission of carbon dioxide (CO_2) is closely related to human activities. The CO_2 emission according to sectors in the United States is as shown in Figure 2 (Energy Information Administration, 2008). CO_2 is released when fossil fuels such as oil, natural gas and coal are used as a source of energy. As energy demand is on the rise due to the rapid development and growing populations, diverting energy from

fossil fuels to a renewable and sustainable energy sources may become one of the many solutions.

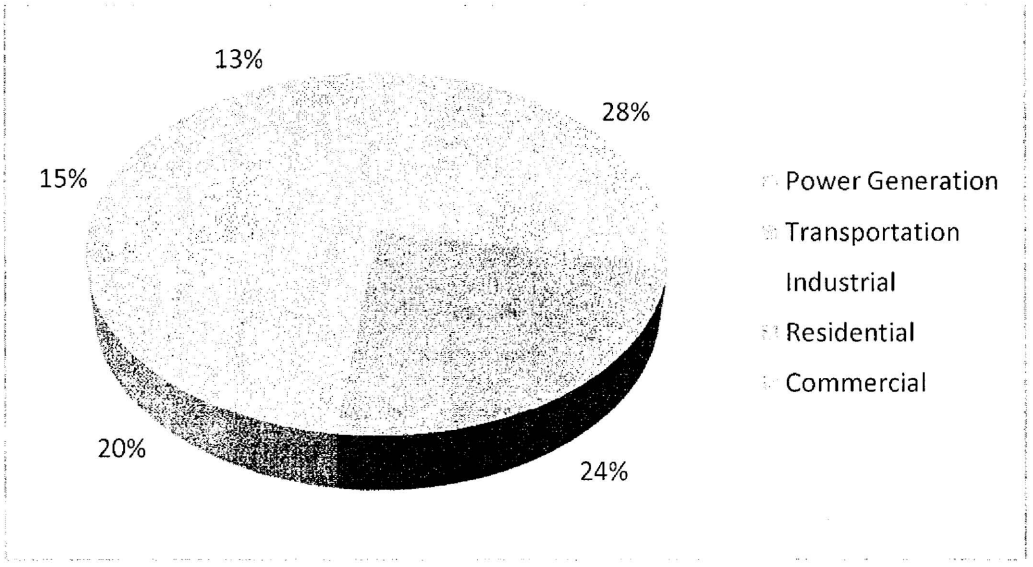


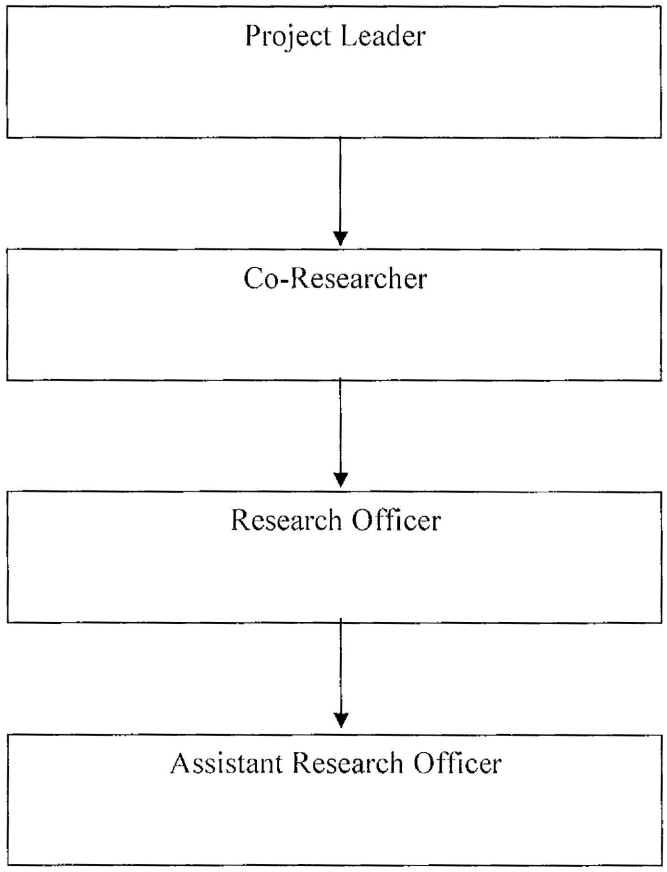
Figure 2: Carbon Dioxide (CO_2) emissions by sectors in the United States of America

1.1 OBJECTIVES

The objectives of this study are:

- To compare the energy policies in Malaysia and Japan for fulfilling their obligations towards the Kyoto Protocol.
- To study and suggest how Malaysia could adopt the energy policies implemented in Japan for GHG reduction.

2.0 RESEARCH TEAM



3.0 MALAYSIAN ENERGY POLICY

Throughout the years, the government of Malaysia has formulated numerous energy-related policies included the National Energy Policy (1979), the National Depletion Policy (1980) and the Fuel Diversification Policy (1981, 1999) (Mohamed and Lee, 2006) to ensure the long-term reliability and security of the energy supply for sustainable social-economic development in the country. One of the main and direct consequences of these strategies is the drastic drop in the contribution of oil to the energy mix from a high of 90% dependence in 1980 down to 47.2% in 2002.

Under the Eighth Malaysian Plan (2001-2005), the Five Fuel Diversification Strategy was implemented with renewable energy (RE) regarded as the fifth fuel in the country's energy supply mix. The other four types of energy are oil, gas, coal and hydroelectric. The renewable energy target was set at 5% of the country's electricity generation by the year 2005. With this target in mind, a reduction of 70 million tonnes of CO_2 will be achieved over a span of a 20 year period. Under this policy, the Small Renewable Energy Program (SREP) was launched. Under this program, the installation of RE resource-based small power plants is encouraged.

By July 2004, 60 projects were approved under the SREP. The statistics on these projects are shown in Table 2 (Shigeoka, 2004). Out of the 60 projects, 7 projects had signed the REPPA (Renewable Energy Power Purchase Agreement). Under this program, there are two types of financial incentives established to encourage the development of renewable energy: Pioneer Status (PS) and Investment Tax Allowance (ITA). For Pioneer Status, the maximum capacity allowed is 10 MW; higher capacity companies are eligible for the Investment Tax Allowance.

Table 2: Projects approved under the Small and Renewable Energy Program (SREP)

Types	Sources	Approved	Capacity (MW)	Capacity Connected to grid (MW)
Biomass	Palm waste	22	200.5	165.9
	Wood waste	1	6.6	6.6
	Rice husk	2	12.0	12.0
	Municipal solid waste	1	5.0	5.0
	Mix	3	19.2	19.2
Landfill gas	-	5	10.2	10.0
Mini-hydro	-	26	99.2	97.4
Wind & Solar	-	0	0	0
Total	-	60	352.7	316.1

Nevertheless, the target of 5% RE in the energy supply mix by 2005 was not achieved successfully (Shigeoka, 2004). In fact, the utilization of RE is still very low due to lack of a policy framework and a financial mechanism. Moreover, there are not enough incentives and no specific loans for RE development. Beyond this, a lack of consulting services and access to the information on RE are also restricting its development. In addition, the high capital cost of RE and the low sales price of electricity (17 cents per kWh) are causing the production of RE to become uneconomical (BioGen, 2005).

The National Biofuel Policy (NBP) was announced in 2005 as the country's subsequent effort in promoting renewable energy (RE) development. Under this policy, Malaysia's petroleum diesel was blended with 5% methyl ester derived from palm oil (named B5 diesel) as a fuel for the transportation and industrial sectors (World Resources Institute, 2007). It was estimated that the replacement of 5% diesel with methyl ester can result in a CO_2 emission reduction of 9.5 million tonnes per year.

3.1 ENERGY EFFICIENCY

Malaysian government is also promoting energy efficiency as another means to minimize energy and electricity usage that indirectly contributes to the mitigation of GHGs emission. The government has constructed a Low Energy Office (LEO) building as the administration office for the Ministry of Energy, Water and Communications (MEWC). This is the first government building that incorporated energy efficiency features and technologies.

There are several energy efficient design features highlighted in a LEO building including orientation, envelope, natural ventilation and interior space layout. The performance of the LEO building was monitored from October 2004 with an air-conditioned area of 19,237 m^2 and an operating period of 2,930 hours. The LEO building shows a reduction in energy consumption of 62% for air-conditioning, 18% for lighting and 20% for equipment compared to other government buildings with conventional designs. The LEO building was able to achieve an energy savings of more than 50% (Ministry of Energy, Communications and Multimedia Malaysia, 2004), as the Building Energy Index (BEI) was only 114 kWh/m^2 per year, which is considerably less than the 275 kWh/m^2 per year observed with a conventionally designed building. Although extra construction cost is required to put in the energy efficiency features in the LEO building, the energy saving of 55.1% pays back the additional cost in only 8.4 years. The details of the economic analysis of the LEO building compared to a conventional building are shown in Table 3 (Ministry of Energy, Water and Communications Malaysia, 2006).

Table 3: Basic economic analysis of a LEO vs. a conventional building

LEO Building base cost = RM 50,000,000 (air conditioned area =19,200 m^2) Additional cost for installation of energy efficient features in LEO building = RM 5,048,000 (10% of the base cost) Yearly energy saving = RM 604,000/year Payback period = 8.4 years			
Description	Energy Cost (RM/year)		
	Cooling Energy	Electrical Energy	Total
Conventional building BEI = 275 kWh/m^2	478,000	620,000	1,099,000
LEO Building BEI = 114 kWh/m^2	156,000	338,000	493,000
Savings	322,000	282,000	604,000
Savings (%)	67.4	45.5	55.1

The government also constructed a ZEO (Zero Energy Office) for the administration and research office for the Malaysian Energy Centre in 2007. The ZEO building was designed at a higher level of energy efficiency, with a BEI value of 35-40 kWh/m^2 per year (United Nations Framework Convention on Climate Change, 2008). Building-Integrated Photovoltaic (BIPV) panels are integrated into the building design to generate solar electricity during the daytime for building consumption. Excess electricity from the BIPV system is connected to the national grid (Pusat Tenaga Malaysia, 2007). However, during the night when no sunlight is available, electricity from the national grid (generated mainly from fossil fuels) is used to meet the building energy demands. Nevertheless, the building can still maintain zero net energy since the excess energy generated during the daytime from solar is fed to the national grid.

4.0 JAPANESE POLICY

In 2004, Japan is the fourth largest GHG emitter in the world. (Nippon Keidanren, 2007). Under the Kyoto Protocol, Japan is committed to reduce its CO_2 emission by 6% during the first commitment period of 2008 – 2012, with 1990 as the base year (Nagamatsu, 2005).

Among the policies and programs initiated by the Japanese government that have yielded good results in GHG reduction with the cooperation of both the governmental and the private sectors are the Voluntary Action Plan, the Top Runner Approach and the Renewable Portfolio Standard.

One of the successful strategies adopted by Japan to reduce CO_2 emissions is the Keidanren Voluntary Action Plan initiated by Nippon Keidanren. Under this plan, the CO_2 emission limit and the CO_2 emission intensity are set for each industry. The goal is to reduce energy consumption and energy intensity with the objective of suppressing CO_2 emissions from the industrial sector below the 1990 level by 2010. All of the industries that participated in this plan are subjected to annual reviews to track their progress. The Voluntary Action Plan is implemented through the P-D-C-A cycle (P-Plan, D-Do, C-Check, and A-Action). Initially, voluntary action plans are established for individual industries. In this stage, numerical targets are set and specific measure and actions for climate change mitigation are laid out. The next step is the implementation of the Voluntary Action Plan by the individual industries. During the implementation stage, there is coordination among participants and national policies as well as the international cooperative schemes, such as the Clean Development Mechanism and Joint Implementation. After the implementation stage, the actual performance of the plan in the

form of CO_2 emission and energy consumption reduction achieved is checked. The final step in this cycle includes additional measures for future action. In the meantime, the results on CO_2 emission reduction are published to ensure credibility and transparency.

Based on Japan's CO_2 emission profiles in 2005, it was found that the emissions

consideration. Table 4 lists some of the products with energy efficiency improvement and their initial expectation (The Energy Conservation Center, Japan (ECCJ), 2008).

Table 4: Target improvement for several products under the Top Runner Approach and their initial expectations

Product Category (Period)	Energy Efficiency improvement (kWh/year)	Initial expectation
TV sets (1997-2003)	25.7%	16.4%
VCRs (1997-2003)	73.6%	58.7%
Room air conditioners (1997-2004)	67.8%	66.1%
Electric refrigerators (1998-2004)	55.2%	30.5%
Electric freezers (1998-2004)	29.6%	22.9%
Gasoline passenger vehicles (1995-2005)	22.8% (km/L)	22.8%
Diesel freight vehicles (1995-2005)	21.7% (km/L)	6.5%
Vending machine (2000-2005)	37.3%	33.9%
Computers (1997-2005)	99.1%	83.0%
Magnetic disk units (1997-2005)	98.2%	78.0%
Fluorescent lights (1997-2005)	35.6%	16.6%

Apart from that, the Japanese government has also been continuously improving the transportation system in the regional and urban sectors in order to reduce the amount of vehicles on the road that will lead to a reduction in CO_2 emissions. In addition, construction of two-level crossings and the promotion of Intelligent Transport Systems (ITS) have created a smooth road traffic system in Japan (Minamikawa, 2007). In addition, the promotion of environmentally friendly habits such as eco-friendly driving

techniques and anti-idling in stationary vehicles are also other measures in improving the energy efficiency in transportation sector.

Next, in order to reduce energy consumption by air-conditioners, the government of Japan has promoted Cool Biz and Warm Biz. In this campaign, the temperature in the room is set to 24°C in the summer. In contrast, in the winter, the heater is set at 20°C. It was estimated that from June to August in 2005, the Cool Biz campaign has helped to reduce energy consumption by 210 million kWh. Meanwhile, the result from the Warm Biz campaign was also encouraging as 1.41 million tons of CO_2 emission were avoided during the autumn and winter of 2005 (Minamikawa, 2007).

In Japan, the RPS (Renewable Portfolio Standard) system was implemented in 2002 and enforced by METI (Ministry of Economy Trade and Industry) in 2003, based on the Special Measures Law Concerning the Use of New Energy by Electric Utilities (RPS law). Under the RPS law, an obligation is imposed on electricity retailers to generate a specific amount of electricity from renewable energy source. The target is to generate 12.2 TWh from renewable sources by the year 2010. The electricity retailers can either generate the new energy electricity, purchase the new energy electricity from another party or purchase a 'New Energy Certificate' from another party (RPS, 2002).

The utilization of solar electric energy, also contributes significantly toward the Kyoto Protocol. Japan has been successful in developing solar industries by introducing incentives to stimulate the photovoltaic market. There are two types of incentives used: feed-in tariffs and capital incentives (Parker, 2008). Feed-in tariffs will pay fees to residents for electricity generated from PV system. In contrast, capital incentives are a capital cost subsidy to help consumers overcome the high capital cost barrier of using the

PV system. In fact, 400 MW of installed capacity for PV energy had been achieved in 2001, and Japan is hoping to reach 4.8 GW in 2010, which would provide the equivalent of 5 million tons of CO_2 emission reduction (Parker, 2008).

5.0 COMPARATIVE STUDIES AND RECOMMENDATIONS

As indicated in Figure 3 (Wikipedia, 2007), the carbon dioxide emissions per capita for Japan have been relatively stable compared to Malaysia, where an increasing trend was observed. Factor that could contribute to Japan's success in suppressing CO_2 emission compared to other countries, including Malaysia is Japan has limited natural resources such as crude petroleum and natural gas. Therefore, Japan has to be very cautious in dealing with its energy-related issues to avoid an energy crisis that will could severe negative impact on its economy. Meanwhile, Malaysia is blessed with large reserve of natural gas (75 trillion cubic feet, tcf).(The Encyclopedia of Earth, 2007), being a net exporter of fuel is less sensitive to the issue. Malaysian electricity tariffs were 25.8 cents/kWh (ASEAN Centre for Energy, 2001), while Japanese electricity tariffs are 23.38 yen/kWh (71cents/kWh) in 1999 (United Nations Economic and Social Commission for Asia and the Pacific, 2002). This situation forced Japanese consumers to adopt a more energy-saving lifestyle. This factor would have contributed favorably to all of the programs and policies implement by the Japanese government aimed at reducing energy consumption and therefore reducing CO_2 emissions. Nevertheless, there are many important lessons that Malaysia and other countries in the world can learn from Japan's successful programs and policies in mitigating CO_2 emission:

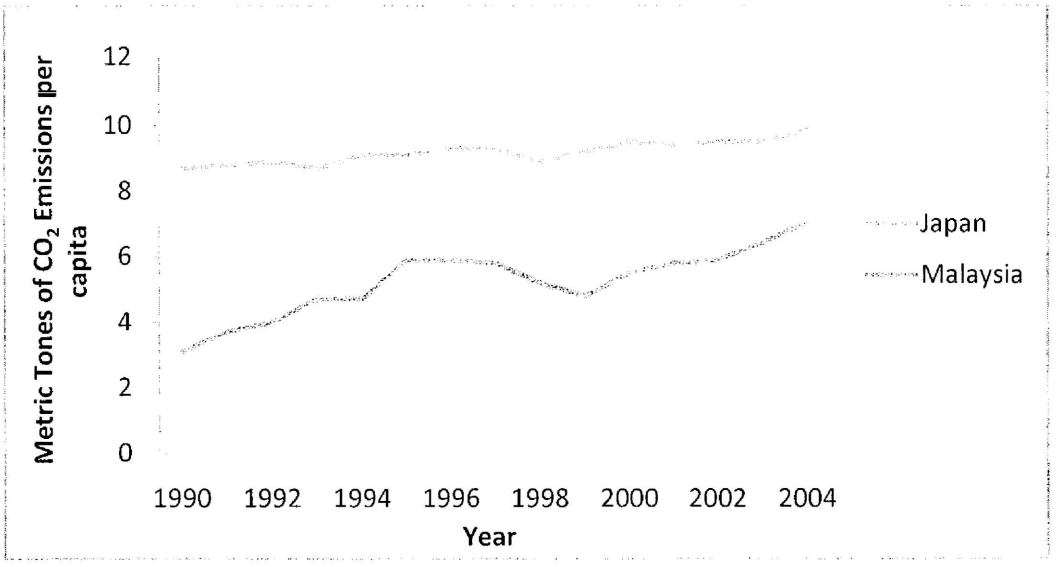


Figure 3: Carbon Dioxide (CO_2) emissions per capita for Japan and Malaysia

- In Japan, incentives and financial aids are well established in order to help and stimulate achievements of the private sector in the promotion of renewable energy (RE) development. The Malaysian government, on the other hand, should be aware of the weaknesses in policy, especially regarding the financial mechanism for promoting RE.
- SREP established in 2001 was not as successful policymakers hoped due to the lack of financial support from the bankers. Without a proper financial policy framework, bankers will hesitate to get involved in the development of renewable energy in Malaysia.
- It is also important to gather information and track the progress of a particular program. In this way, Malaysia might also be lacking. In fact, when the transparency and credibility of the government's policies in supporting activities toward increasing energy efficiency and greenhouse effect mitigation could be

seen directly, private sectors would had more confidence and motivation to get involve and invest in RE programs.

- The same can be said about the National Biofuel Policy (NBP), which is one of the most recent policies regarding renewable energy in Malaysia. Sufficient incentives and financial support mechanisms should be provided to boost the involvement of the private sector. Furthermore, a follow-up system should be established so that the government can coordinate and monitor the efforts of various parties while promoting continuous effort on the NBP.
- Another sector in which Malaysia can reduce CO_2 emission is the transportation sector. Vehicles produced and used in Japan are well known for energy efficiency features that reduce fuel consumption and ultimately lower CO_2 emissions. In Malaysia, most of the vehicles used are locally manufactured, so there is a clear need for the government to support local car manufactures to develop new models that are more fuel efficient.
- The use of public transportation is another important strategy that can help in the CO_2 emission reduction effort. Japan has an efficient transportation network, and was found to be among the most reliable in the world in terms of punctuality (Japan-guide.com, 2008b). This has encouraged the public to use public transportation instead of private transportation.
- As for the Malaysian public transport sector, the transit network is only available in the area of Kuala Lumpur (the Malaysian capital), with limited area coverage and capacity. Moreover, the punctuality of the local bus system is quite poor, mainly due to major traffic jams. Therefore, Malaysians generally still prefer

using private transportation instead of public. Another factor contributing to the preferred use of private transportation is the subsidized cost of gasoline.

- The whole transportation system in Malaysia needs to be revamped and integrated, and funding for the development of a better transportation system should be prioritized to encourage the usage of the public transportation system. Once the public transportation system network is developed, subsidies for transportation fuel should be completely removed.
- Japan being a country with four seasons, the photovoltaic (PV) system is aggressively being promoted. In a country like Malaysia that is located near the equator, with higher solar radiation intensity and year-round availability, the PV system should be made mandatory in all governmental and commercial buildings. Malaysia could also imitate Japan and provide incentives (such as capital incentives) to promote members of public to install PV panels in residential homes.
- Every human being on the earth should bear the responsibility to reduce the emission of greenhouse gases. In this respect, Malaysian should learn from Japan and raise the civic consciousness of its citizen towards the environment.
- One effective way to provide a younger generation with a positive attitude towards the environment is through an effective education system. Meanwhile, continuous campaigns must be conducted to educate citizens about the dangers of global warming to build a society with a more environmentally-responsible mentality. On top of that, top governmental officials should become role models by participating in projects that can mitigate CO_2 emissions.

6.0 CONCLUSION

This study has shown that Malaysia, while a developing nation, is very committed to reducing its GHG emissions. Although its achievements might not be as great as those of Japan, nevertheless, credit should be given to the Malaysian government for making a good effort. If all of the developing nations in the world were to give the same commitment, then the prospect of global GHG emission reduction could become a reality, owning to the establishment of the Kyoto Protocol.