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Curbing Climate Change through a National Development of Climate Change Policy

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1. Introduction

In the last century, global development trends have tended to favour democratic systems and the capitalist ideology. In turn more equitable, economically secure, technologically advanced and intellectually progressive societies have developed around the world. However, at the same time, the side-effects of these trends have also been the creation of a materialistic society, high energy and resource consuming economy alongside inevitable, irreversible environmental damage and resource plundering. Economic analysis has a special role in contemporary national policy-making, as most of the important decisions fall within the economic domain. A country's development level is principally measured by its GDP or monetary economic growth. Therefore, an economic model that is less materialistic and less energy demanding have to be introduced to achieve sustainable development, especially in the long-run. The development of a sustainable economic model has to recognise the environmental impact as part of the development agenda and finding a viable relationship between the two components. One common idea is to internalise the environmental impact into the economic scene with benefits to society and economy at large. To achieve the sustainable economic model, innovative policy instruments are essential in creating the necessary shifts in economic trends or patterns. A climate change policy plays a role in directing a country towards a sustainable economic development model by regulating the GHGs emission with appropriate sectoral policies in place.

2. Non-renewable energy and carbon emission

With 0.4 per cent of the world's population, Malaysia's 27 million people accounted for 0.6 per cent of the global carbon emissions. As a developing country, Malaysia's carbon emissions growth is one of the fastest; it grew by 221 per cent from 1990 to 2004 (UNDP Human Development Report 2007/2008).¹ Malaysia's rapid rise in its carbon emissions is the result of robust expansion in its industrial and automotive sectors, the over dependence on fossil fuel as its TPES (Total Primary Energy Supply), unsustainable waste management and forest and grassland conversion. With a CO₂ emission intensity of GDP of 1.198 million metric tonne (MT) / USD million (IMF & CDIAC, 2006); Malaysia has one of the highest

¹ Source: UNDP Human Development Report 2007/2008.

< http://hdr.undp.org/en/media/HDR_20072008_Summary_English.pdf>

carbon emission intensity of GDP in the world, indicated a low economy output to carbon emission.

Malaysia had announced that it is taking a voluntary reduction of up to 40 per cent carbon emission intensity of GDP by the year 2020 compared to 2005 level at Copenhagen in 2009 (Theseira, 2010). To reach the carbon emission reduction, substantial action has to be taken. This requires first and foremost a viable policy on climate change to achieve this goal.

Country	Annual CO ₂ emissions (in '000 MT)	GDP (in billions of USD)	CO ₂ intensity of GDP (million MT / USD billion)
Malaysia	187,865	156.86	1.198
Thailand	272,521	206.99	1.317
Indonesia	333,483	364.35	0.915
Mexico	436,150	952.34	0.458
Argentina	173,536	212.71	0.816
Turkey	269,452	529.19	0.509
Sweden	50,875	393.76	0.129
UK	568,520	2,435.70	0.233
US	5,752,289	13,178.35	0.437
Japan	1,293,409	4,363.63	0.296

Table 1. Comparison of the carbon dioxide emissions intensity of GDP in 2006²

A high carbon emission intensity of GDP would normally display the following results in the economy: The major sectors that drive the country's economic growth have high carbon emissions with GDP by sector: Industrial: 42.3 per cent, Services: 47.6 per cent and Agricultural: 10.1 per cent (CIA, 2005). In 2000, the country's total primary energy supply (TPES) was 49.47 million tons of oil equivalents (MTOE). The greatest percentage of the Malaysian fuel mix is petroleum products. In 2006, the TPES increase to 68.33 MTOE and it is projected to grow at a 3.5 per cent per year to 147 MTOE in 2030 because of the increase in demand for coal, oil and gas; with coal demand accounting for the highest growth rate at 9.7 per cent per year through 2030 (IEA, 2008).

Higher energy use per GDP indicates a lower economy output per unit of energy use. Malaysia has one of the highest energy uses (oil equivalent) per unit GDP compared with the developed countries in the comparison lists. Although Malaysia shows a lower value compared with regional developing countries; the fossil fuel consumption in the total energy shares (95.5 per cent) is higher than Thailand (81.2 per cent) and Indonesia (68.8 per cent). This finding can deduce that Malaysia has the highest carbon emission intensity of GDP among the countries of comparison.

² Sources: GDP data - IMF (International Monetary Fund), 2006 CO₂ emission - CDIAC (Carbon Dioxide Information Analysis Center), 2006

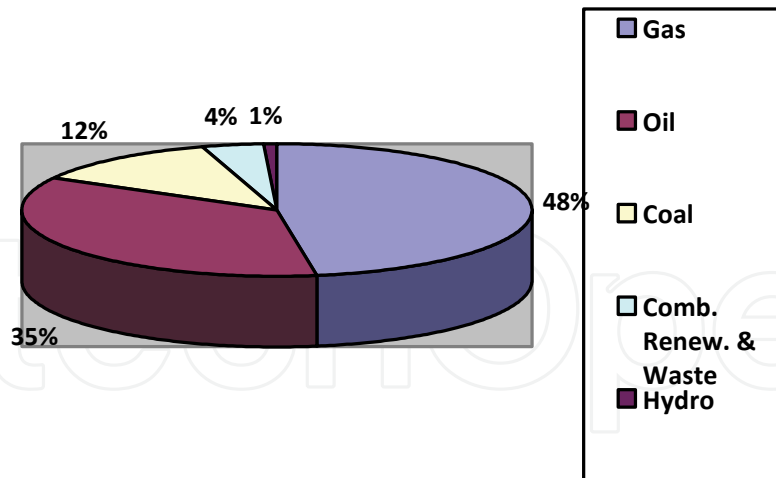


Fig. 1. Malaysia's shares of TPES in 2007³

Country	MT of CO ₂ emission/capita	Energy use (kg of oil equivalent per capita)	Energy use (kt of oil equivalent)	Energy use / GDP (kt of oil equivalent / USD billion)	Fossil fuel energy consumption (% of total)
Malaysia	7.2	2733	72,589	462.76	95.5
Thailand	4.3	1553	103,991	502.40	81.2
Indonesia	1.5	849	190,647	523.25	68.8
Mexico	4.1	1750	184,262	193.48	89.3
Argentina	4.4	1850	73,065	343.50	89.5
Turkey	3.6	1370	100,005	188.98	90.5
Sweden	5.6	5512	50,422	128.05	32.9
UK	9.4	3464	211,308	86.76	89.6
US	19	7766	2,339,942	177.56	85.6
Japan	10.1	4019	513,519	117.68	83.2

*Energy use refers to the TPES

*Fossil fuel refers to coal, oil and natural gas

Table 2. Comparison of energy use and fossil fuel consumption, 2007⁴

3. Unsustainable electricity production

Energy in Malaysia is consumed mainly in the transportation and industrial sectors, 38.2 per cent and 37.8 per cent respectively in 2005, followed by commercial and residential sectors at 12.5 per cent and the non-energy, which consumes 9.7 per cent of the total energy. Electrical energy production increased from 1,622 gigawatt per hour (GWh) in 1963 to 4,971

³ Source: IEA (International Energy Agency), 2008.

<http://www.iea.org/stats/pdf_graphs/MYTPESPI.pdf>

⁴ Source: CDIAC, 2006; IEA, 2007; IMF, 2006.

GWh in 1974 and 57,435 GWh in 1998. In 1996, 16 per cent of electrical production was hydro generated, and over 83 per cent was of thermal origin (National Energy Balance, PTM, 2006). In 2007, the country hit a staggering 101325 GWh of total electricity production with only about 6.4 per cent was hydro generated, (coal 29.5 per cent, natural gas 62 per cent and oil 2.1 per cent) according to the statistic shown by IEA in 2010.

Country	Electricity consumption* (TWh)	Electricity Consumption /Population (kWh/capita)	Electricity (production by source) %			
			Fossil fuel*	hydro	nuclear	others
Malaysia	97.39	3668	93.6	6.4	-	-
Thailand	137.68	2157	91.4	5.7	-	2.9
Indonesia	127.17	564	87.1	7.9	-	5.0
Mexico	214.34	2028	81.4	10.6	4.0	4.0
Argentina	104.99	2658	65.8	26.7	6.3	1.2
Turkey	163.35	2210	80.9	18.7	-	0.4
Sweden	139.40	15238	2.4	44.5	45.0	8.1
UK	373.36	6142	77.6	2.3	15.9	4.2
US	4113.07	13616	71.6	6.3	19.2	2.9
Japan	1082.72	8475	66.8	7.4	23.3	2.5

*Gross production + imports - exports - transmission/distribution losses

*Fossil fuel refers to oil, gas and coal

Table 3. Electricity production by source in 2007⁵

The country's electricity consumption per capita is higher than the regional and other developing countries in the comparison list. Furthermore, the share of fossil fuel of the electricity production is the highest among all the countries in comparison. From the brief findings, it can be deduced that the factor contribute to the high carbon emission in any major sectors is the non-renewable energy supply. To reduce the carbon emission in any sector, a fundamental shift in the country's TPES to a higher share of renewable energy is an imperative determinant.

4. Climate change related policies in Malaysia

In general, Malaysia adopts a "precautionary principle" policy with actions to mitigate or adapt to climate change. A National Climate Committee was formed in 1995 with various government agencies, stakeholders from the business and civil society groups. The strategies adopted by the committee include to reduce the heavy reliance on fossil fuel in energy sector, promote renewable energy and energy efficiency, public awareness programme, sustainable forest management, ensure food sufficiency and undertaking coastal vulnerability index (CVI) study that serve as a basis for the development of adaptive

⁵ Source: IEA, 2010.

measures to mitigate the impact of sea level rise. (Conservation and Environment Management Division, CEMD, 2007)

Existing relevant policies in the country that will, directly or indirectly affect the development of an integrated and coherent climate change policy include:

1. National Policy on the Environment, 2002
2. National Forestry Policy, 1978
3. National Policy on Biological Diversity, 1998
4. National Energy Policy, 1979
5. National Automotive Policy, 2009
6. Third National Agricultural Policy, 1998-2010
7. National Physical Plan, 2006

5. National renewable energy policy 2011

Based on the data below (see Table 4), about 40-50 per cent of the carbon emissions originated from the energy and industrial sector. The emission from the industrial activities is mainly attributed to the energy sector as well. Therefore, the focus has to be on the energy sector in order to achieve any significant reduction goal.

Rank	Sub-sector	GHGs	Emission, CO ₂ e (mil. MT)	Percentage
1	Emission from energy industries	CO ₂	58,486	28.2
2	Transportation	CO ₂	35,587	17.2
3	Manufacturing and construction	CO ₂	26,104	12.6
4	Landfills	CH ₄	24,541	11.8
5	Forest and grassland conversion	CO ₂	24,111	11.6
6	Fugitive emissions from fuel	CH ₄	21,987	10.60
7	Mineral products	CO ₂	9,776	4.7
8	Emission from soil	CO ₂	4,638	2.2
9	Commercial	CO ₂	2,122	1.0
			207,352	99.9

Table 4. Key sources of GHGs emissions in Malaysia⁶

The key policies guiding energy-related activities in Malaysia consisted of:

- National Petroleum Policy 1975
- National Energy Policy 1979
- National Depletion Policy 1980
- Four Fuel Diversification Policy 1981
- Fifth Fuel Diversification Policy (Eighth Malaysia Plan 2001-2005)

In conjunction with these policies, a number of government supported projects to assist the National Energy Conservation plans, have been identified. Under the guidance and supervision of the Malaysia Energy Centre (PTM), some of the projects introduced are CDM (Clean Development Mechanisms), IRP (Integrated Resource Planning), MEDIS (Malaysia

⁶ Source: Abdul Rahim Nik, FRIM (Forest Reserve Institute of Malaysia), 2009.

Energy Database and Information System), MIEEIP (Malaysian Industrial Energy Efficiency Improvement Project), BioGen (biomass power generation and co-generation in palm oil industry), MBIPV (Malaysian Building Integrated Photovoltaic Technology Application Project) and Demand Side Management.

The SREP (Small Renewable Energy Programme) allows Renewable Energy (RE) projects with up to 10 megawatt (MW) of capacity only. The programme was introduced during 8th Malaysia Plan (2001-2005) under the fifth fuel diversification policy which targeted a 5 per cent renewable energy share of total electricity generation; however failed to achieve its target. In 9th Malaysia Plan or 9th MP, (2006-2010), targeted RE capacity to be connected to power utility grid is 300MW in Peninsula Malaysia and 50MW in Sabah with a 1.8 per cent of total power generation mix (65 per cent natural gas, 36 per cent coal, 6 per cent hydro & 0.2 per cent oil). However, RE capacity connected to power utility grid as of 31st December 2009 was 53MW which is barely 15 per cent of 9th MP target. The off grid RE (private palm oil millers and solar hybrids) is more than 430MW (Badriyah, 2010).

The reasons for slow RE development are identified as market failure, absence of legal framework, lack of institutional measures and constraint in financial and technological aspects. A new ministry, Ministry of Energy, Water and Green Technology (KeTTHA) was formed in 2009 following the introduction of Green Technology Policy 2009. The ministry had formulated goals on sustainable use of energy and water. The ministry also provides incentive for the use of green technology. A new policy on renewable energy (National Renewable Energy Policy) will be introduced next year (Loo, 2010). With the new Act, a new feed-in tariff system will be introduced to stimulate the renewable energy sector. The policy statement is "Enhancing the utilization of indigenous renewable energy resources to contribute towards national electricity supply security and sustainable socio-economic development."

6. Potential carbon emission reductions in energy sector

The potential of carbon emissions reduction in energy sectors is discussed in this section. Comparison is made between the existing use of renewable energy and its potential in Malaysia. It is found that Malaysia has a vast potential in renewable energy as compared with the existing utilisation.

Renewable energy	Installed Capacity (MW)	Potential Capacity (MW)
Solar	6.2	6500
Wind	0.2	(low potential)
Municipal Solid Waste	-	400
Hydropower	2225 (year 2000)	22 000
Mini-Hydro	23.8	500
Biomass/Biogas	479	1300 (Palm Oil Waste)

Table 5. Comparison of currently installed and potential capacity of renewable energy⁷

⁷ Source: Loh, T., Yusoff, S., 2009.

Year	Cumulative RE Capacity	RE Power Mix (vs Peak Demand)	Cumulative CO ₂ avoided
2010	73 MW	0.5%	0.3 mt
2015	985 MW	6%	11.1 mt
2020	2080 MW	11%	42.2 mt
2030	4000 MW	17%	145.1 mt

*RE capacity achievements are dependent on the size of RE fund

*Assumptions: Feed-in Tariff (FiT) in place & 15.6 per cent compound annual growth rate (CAGR) of RE power capacity from 2011 to 2030

Table 6. National Renewable Energy Target⁸

The current power generation capacity connected to the Malaysia National Grid is 19,023 MW in 2007 (Energy Commission, 2007). Based on the data in Table 4, the potential power generation by renewable energy is 30,700 MW, which is more than the current power generation. Therefore, if the country can reach 40% of the potential renewable energy capacity, 60% of the existing power generation will be from renewable energy. However, less than 10% of the potential renewable energy is utilized currently.

With the implementation of feed-in tariff, the RE power mix is projected to reach 11% in year 2020 (Badriyah, 2010) and the achievement of the 40% reduction of carbon intensity of GDP will be subjected to the country GDP growth. Therefore, the increase of the renewable energy share in the total power generation is a predominant agenda in the development of a climate change policy.

7. Draft national climate change policy

The policy study on climate change was conducted by CEMD under the Ministry of Natural Resource Environment (MNRE) in collaboration with LESTARI (Institute for Environment and Development). The study adopted a three-pronged approach to support the national positions at the UNFCCC and Kyoto Protocol meetings, formulation of a national policy and action plan, and delineation of state level responses to climate change adaptation and mitigation (Figure 2). The first approach is the critical review of several international and local research papers and public documents that was related to post-2012 responses, decision documents of the UNFCCC and Kyoto Protocol, Malaysia's Third Outline Perspective Plan (OPP3), Ninth Malaysia Plan (RMK9), relevant national policies, and Malaysia's Initial National Communication (INC). The second approach involved the comparative studies of national policies or strategies on climate change from selected countries and the third approach focused on stakeholder consultation through national and regional workshops, interviews and surveys which were carried out in a four overlapping phases. The need for a national policy on climate change was articulated in the first and second phase; while in the third and fourth phase, the policy framework including its key actions was supported as a promising tool to mainstream climate change in national development (Tan, et al, 2009).

⁸ Source: Badriyah, KeTTHA, August 2010.

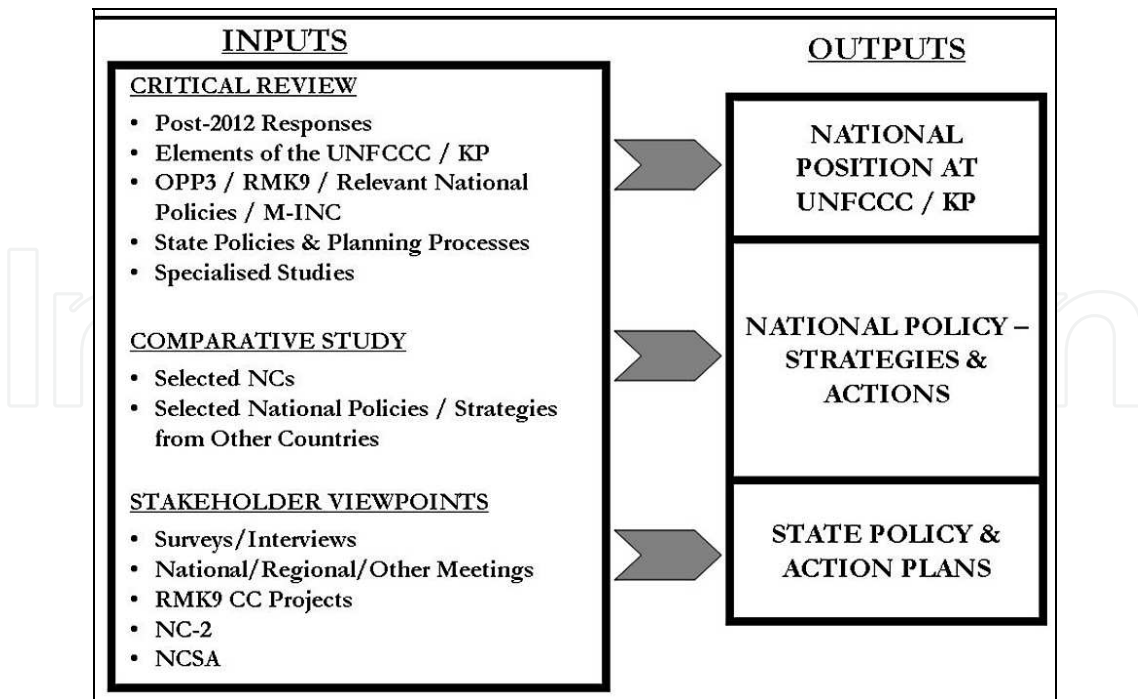


Fig. 2. Climate change policy study approach and expected outputs⁹

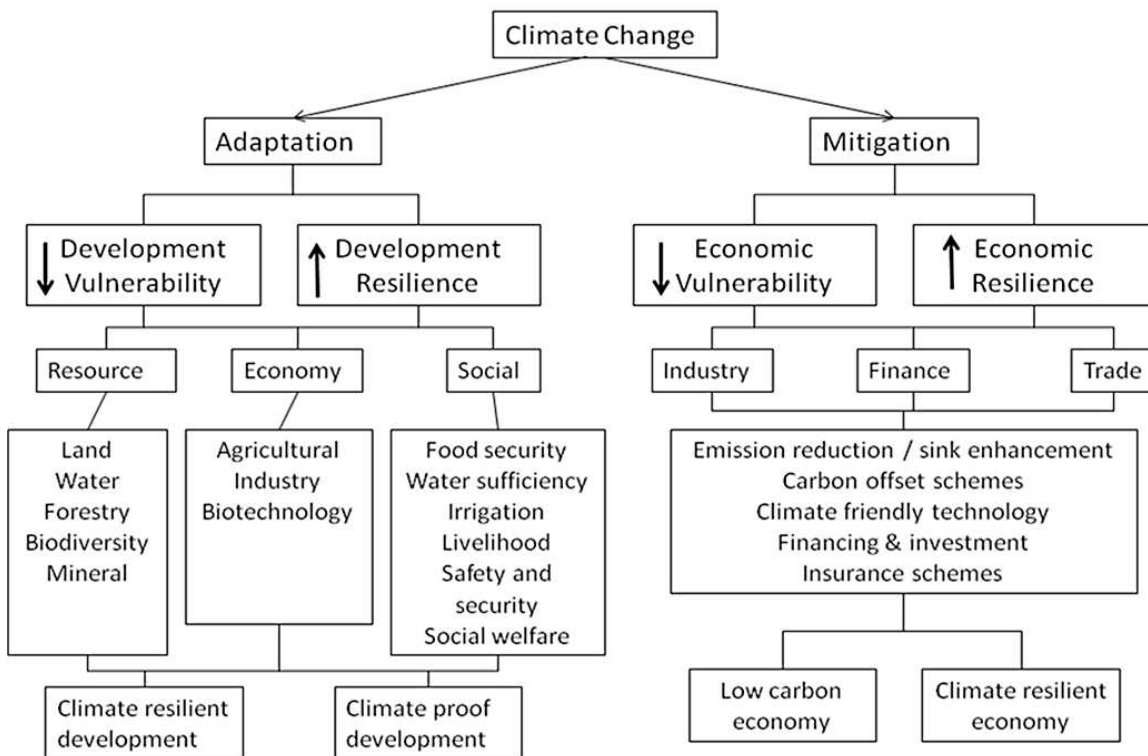


Fig. 3. Overall framework of a national climate change policy¹⁰

⁹ Source: Tan, C. T.; Pereira, J. J. & Koh, F. P. (2009). Stakeholder Consultation in the Development of Climate Change Policy: Malaysia's Approach. Environmental Policy: A multinational conference on policy analysis and teaching methods, KDI School of Public Policy and Management, Seoul, Korea.

Objectives
<ul style="list-style-type: none"> • Mainstreaming of measures to address climate change challenges through strengthened economic competitiveness, wise management of resources, environmental conservation and enhanced quality of life for sustainable development. • Integration of responses into national policies, plans and programmes to strengthen the resilience of development from arising impacts of climate change. • Strengthening of institutional and implementation capacity to better harness opportunities in reducing negative impacts of climate change.
Principles/Strategic Thrusts
<p>Principle 1. Development on a Sustainable Path: Integrate climate change responses in national development plans to fulfil the country's aspiration for sustainable development.</p> <ul style="list-style-type: none"> • Strategic Thrust 1. Facilitate the harmonisation of existing policies to address climate change adaptation and mitigation in a balanced manner. • Strategic Thrust 2. Institute measures to make development climate-resilient through low carbon economy to enhance global competitiveness and attain environmentally sustainable socio-economic growth. • Strategic Thrust 3. Support climate-resilient industrial development and investment in pursuit of sustainable socio-economic growth. <p>Principle 2. Sustainability of Environment and Natural Resources: Initiate actions on climate change issues that contribute to environmental conservation and sustainable use of natural resources while enhancing energy efficiency and sufficiency as well as water and food security.</p> <ul style="list-style-type: none"> • Strategic Thrust 1. Adopt balanced adaptation and mitigation measures to climate-proof development, strengthen environmental conservation and promote sustainability of natural resources <p>Principle 3. Integrated Planning and Implementation: Integrate planning and implementation to climate-proof development.</p> <ul style="list-style-type: none"> • Strategic Thrust 1. Institute measures to integrate cross-cutting issues in policies, plans, programmes and projects in order to increase resilience to and minimise negative impacts of climate change. • Strategic Thrust 2. Support knowledge-based decision making through intensive climate related research and development and capacity building of human resources. <p>Principle 4. Effective Participation: Improve participation of stakeholders and major groups for effective implementation of climate change responses.</p> <ul style="list-style-type: none"> • Strategic Thrust 1. Improve collaboration through efficient communication and coordination among all stakeholders for effective implementation of climate change responses. • Strategic Thrust 2. Increase awareness and public participation to promote behavioural responses to climate change. <p>Principle 5. Common but Differentiated Responsibility: International involvement on climate change will be based on the principle of common but differentiated responsibility.</p> <ul style="list-style-type: none"> • Strategic Thrust 1. Strengthen involvement in international activities on climate change based on the principle of common but differentiated responsibility.

Table 7. The Draft National Policy on Climate Change – Objectives, Principles and Strategic Thrusts¹¹

¹⁰ *Op. cit.* Tan, et al. (2009).

¹¹ Source: Pereira, 2008

8. Challenges in the development of climate change policy in Malaysia

8.1 Institutional reformation and policy restructuring

The formation of an institutional framework on climate change issue is the foundation to achieve any result in carbon emission. A clear cut government policy direction on sustainable development has to be established in the quest of achieving goal on carbon emission reduction. The agenda toward low carbon economy requires strong and persistent institutional reformation and political will and direction in a long term basis. A government's primary concerns are the country's economic growth and social welfare. Urgency and priority are the major considerations for the development of any public policy especially for a developing country. Tackling climate change issue or striving towards the sustainable development model is a long term planning process. A country abundant in natural resources may lack urgency in policy planning and implementation in climate change. Coordination and cooperation between various government agencies toward a achieving a common goal on carbon emission reduction is lacking at the moment. In the Malaysian context, political influence is always the prime mover in creating any trends as the decision making power is lacking among the civil servants. Another constraint in policy making process is the conflict in authority and power distribution between federal and state government.¹²

8.2 Lack of expertise in climate change issue

The R&D in climate change is relatively new in the country with concern on the matter is primarily driven by the signing and ratifying of Kyoto Protocol in carbon emission reduction and now more recently, the 40 per cent reduction of carbon emission intensity of GDP as pledged in COP 15. Local expertise on climate change issue especially the trend in the country is important and a proper data management plan needs to be implemented. The country need climate change experts that possess knowledge in climate change globally as well as have a strong understanding on the local socio economic development. Education from primary level is important to instil the understanding of climate change issue to the people since young. With proper education system, the topic can become more pertinent among the people and hopefully will produce more climate change experts.

8.3 Economic status (lack of financial capacity)

State of the art technology and solution to any environmental issue are readily available as solutions. The constraint is in its economic viability (*i.e.* pricing). The economic status does not allow solution for long term environmental issue which typically consume huge amount of money. For example, in waste management sector, the polluter pay principle (PPP) can directly encourage recycling. However it must be equipped with a proper pricing mechanism such as a variable unit based pricing scheme which will serve as a basis of the carrot and stick approach (Munasinghe, 2008). Another example is greywater or sullage that contributes to of 6 per cent of the total river point source pollution (DOE, 2001). The solution to sullage discharge is to retrofit the existing piping back to the sewer line for further treatment. However, the constraint is always related to the cost and priority. The DID (Department of Irrigation and Drainage) had introduced some measures in tackling river

¹² Based on the stakeholders discussion session at SLiM 2010 Roundtable: Creating an Institutional Framework for Implementing Sustainable Development (8th July)

pollution such as gross pollutant trap (GPT) and FOG (fat, oil and grease) trap, but these have not been very effective. The most pragmatic solution is sullage pipe retrofitting which is costly and require strong political will to implement it.¹³ The same situation happens to renewable energy such as solar, biomass, biogas and the like. The example shows the inadequacy of financial capability in solving a pertinent local environmental issue.

8.4 Public understanding on climate change issue

Public understanding on environmental issue is imperative in the development of the climate change policy as it directly affect the life of an individual. In Malaysia, the understanding of climate change by the public at large is rather insufficient. For example, most of the people are not aware that driving a car or petrol consumption can lead to climate change by carbon emission. Awareness campaigns by the government or NGOs does not take into account the bigger picture provide an understanding of the cause of environmental issues such as climate change. The publicity drive by the government produces only a superficial understanding on the part of the general public so it does not accurately reflect or actually lead to good environmental practices as such. That is to say, the rhetoric is not matched by the reality of an environmentally-friendly situation.

One of the tools to analyse the entire environmental impacts of an issue is LCA (Life Cycle Assessment) which the public in general do not understand. One example is the issue of the banning on the use of plastic bags by certain states in the country. For most, plastic is something “negative” to the environment because of its non-biodegradable nature. Plastic which is beneficial as a “carrier” or for packaging may pose a problem when it comes to “inconsiderate” disposal, especially to any water bodies. However, banning the use of plastic bags will never solve the inconsiderate disposal problem and is myopic, impracticable and counter-productive. The solution has to be proper education and management since plastic bags are still a necessity as its use has yet to be outlasted by environmental concerns. The use of plastic packaging has lesser negative environmental impact if compared with other materials such as paper and metal because of the lower carbon emission in a life cycle perspective. In fact, plastic has reduced the consumption of fossil fuel on transportation and manufacturing.¹⁴

8.5 Equity in socio-economic development

An important social criterion must be that climate change should not be a hindrance to the development of a more equitable society where no one is made worse off. Thus, environmental policies must leave room for the proper allocation and distribution of resources in the pursuit of socio-economic welfare of the least better off in society. Furthermore, without an equitable society, environmental policies are very difficult to be implemented. For example, solar panel is burdensome for most middle and lower income household without incentives. The total elimination of logging activities will cause the loss of employment among low income workers. However there are also counter-examples: An effective public transport system can bring benefit to the poor as well as reduce carbon emission.

The development of a climate change policy has to include a concern of the poor as the policy may affect their livelihood. In a global perspective, the use of parameters like carbon

¹³ (Keizrul, 2010, Public Lecture at Faculty of Engineering, University of Malaya, on World Water Day, 22nd March).

¹⁴ Source: MPMA (Malaysian Plastics Manufacturers Association), 2010.

emission per GDP and per capita is questionable in relation to its applicability to all countries with differing levels of economic growth. Developed countries usually have a lower carbon emission per GDP but a higher carbon emission per capita; because of their high economy power. While developing countries usually have comparably higher carbon emission per GDP but lower carbon emission per capita. The measurement of emission with GDP (economy) correlation should be a short term parameter to provide incentive and opportunity for developing countries to boost their economy without much emission liability. However, for developed countries, the focus should be the emission per capita with the strong economy status. Kverndokk (1995)¹⁵ argued that conventional justice and moral principles should favour the equitable allocation of future GHG emission rights on the basis of population, consistent with the UN human rights declaration underlining the equality of all human beings.

9. Discussion

The paper had introduced the existing carbon emission status in the country, two policies (National Renewable Energy and National Climate Change Policy) and identified the challenges of the development and implementation of these policies. To overcome the constraints arise in a viable approach, the climate change impacts have to be embedded into any policy development. Internalization of climate impacts in economic with mixed instruments, establishment of GHGs information centre, adaptation strategy and institutional redesigning and education at all levels are the keys to achieve the carbon reduction target.

9.1 Internalize climate change impact into the economy domain

As an externality in the current economy trend, environmental issue always meets the problem of market failure. To achieve any goal and substantial result in environmental issue, it has to be internalized in the economy domain by putting a price tag on it. When there is a price to pay for any environmental damage caused, people will be able to feel it. For example, climate change issue is something either people can't feel it or due to mere selfishness. Another example is landfill, which most people has never seen before and do not understand its negative impacts. The economic functions of the environment have to be valued for an internalization to happen. Three outlines for the evaluation of the functions are amenity services (natural beauty, recreational, etc), natural resources (minerals and non-minerals, forest, etc) and assimilation of waste products (land, water and air). With this perception of recognizing the economic value of environment, the traditional economic system and the environment will be dynamically interrelated (Munasinghe, 2008).

The entire activity or process of an environmental issue has to be integrated with price mechanism to create a "market based" solution. Market based instrument (MBI) is an economic approach to influence people to include environmental matters in any decision making. Some of the examples are tradable permits, polluter pay principle, green levy, eco-labeling, landfill tax, etc.

The polluter pay principle argues that those who create negative impact to the environment should pay the corresponding costs. The economic rationale is to provide alternatives and

¹⁵ Source: Kverndokk, S., 1995. Tradeable CO₂ Emission Permits: Initial Distribution as a Justice Problem, *Environmental Value*, 4(2), 129-48. <http://www.frisch.uio.no/sammendrag/14_eng.html>

incentive for polluters to reduce their impact or emission to optimal level. This “carrot and stick” approach that incorporated in the principle can be further extended to principle of recompensing victim by using the revenues collected by polluters (Munasinghe, 2008). The approach is important to ensure fairness in the context of social equity. In this method, economic valuation is an important prerequisite. CBA (cost benefit analysis) can be applied to work out the valuation and quantify the damage in a monetary way.

Multi-criteria analysis will be useful for environmental solution that can't be evaluated with single criterion approach like CBA. MBI provides individual or company greater flexibility in their approaches to pollution management. Contrary to the command and control approach which is more prescriptive; MBI provides incentive to innovate and individual at large to make the correct decision. By having a clear and inclusive monetary structure in punishing or rewarding in the context of an environmental issue, the result will be more obvious.

9.2 Mixed instrument: A practical approach in the decoupling of economy growth and environmental impact (carbon emission)

While MBI can be more cost-effective than regulatory instruments it has its own drawbacks. The major weaknesses of MBI are: (Munasinghe, 2008)

- Their effects on environmental quality are not as predictable as those under a traditional regulatory approach as polluters may choose their own solutions.
- In the case of pollution charges, some polluters opt to pollute and to pay a charge if the charge is not set at the appropriate level.
- Require sophisticated institutions to implement and enforce them properly, particularly in the case of charges and tradable permits.

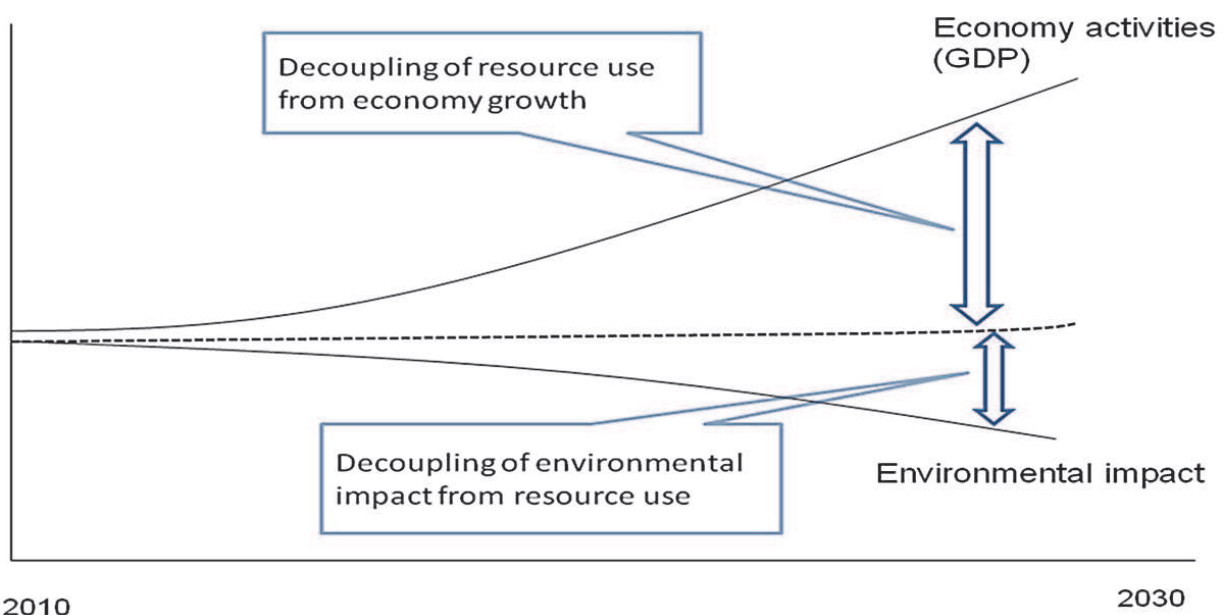


Fig. 4. Decoupling of resource use with economy growth and environmental impact

Internalization of environmental impact in an economic perspective alone can't bring out a comprehensive solution in carbon emission reduction. The most apparent drawback is the rich will pollute more while the poor will pollute less. It doesn't solve the fundamental issue

of sustainable consumption and production as the rich countries have the financial capacity to choose whether to increase or decrease their carbon emission. Therefore, both economic and non-economic approaches have to be considered in the internalization process with a flexible mode. Command and control policy such as placing standard, agreement, protocol, etc; is predominantly significance in ensuring a healthy development of MBI. Besides, command and control, as a non-economic approach, may be beneficial as a starting point, when regulators are faced with a significant problem yet have too little information to support a MBI.

In practice, the mixture of both command and control and MBI is more effective. The policy and economy instruments have to be implemented hand in hand to achieve any tangible target in carbon emission reduction. For the example, the readjustment of electricity tariff by TNB (Tenaga Nasional Berhad), the main electricity distributor in Malaysia. With the differential tariff, users that consume less electricity are exempted from the levy which will be exerted on user that exceeds a certain levels of electricity consumption. (Rao, P.K., 2000)

9.3 Establishment of GHGs information management system

GHGs emission shouldn't be merely calculated by the looking at the carbon source. The GHGs sequestration or carbon sink especially by natural sink such as forest has to be taken into account in figuring out the net carbon emission. The net emission data will represent a better overview and bigger picture of the issue in a country context.

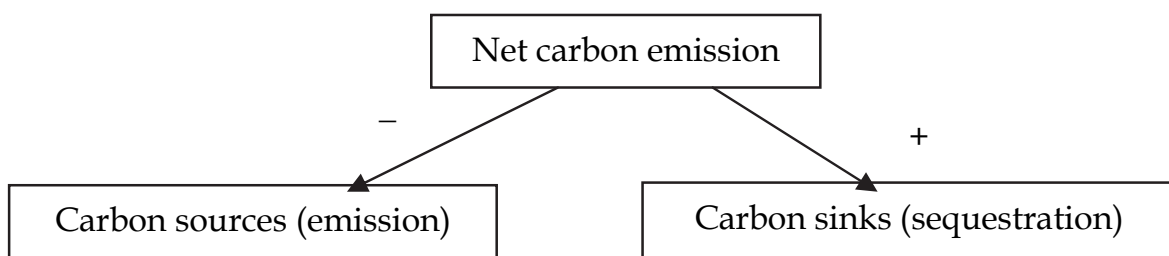


Fig. 5. Net carbon emission

Malaysia with collaboration of the regional countries has to set up a world recognized independent body in the collection and management of data pertaining to carbon emission in the region. Data inconsistency can be an important factor that leads to the failure of the development of an environmental policy. For example, IEA reported that the CO₂ emissions in Malaysia in 2005 was 5.45 MT/capita, UNEP revealed a value of 6.2 MT/capita in 2002, while CDIAC documented a 7.2 MT/capita in 2006; and on the other hand, WRI (World Resource Institute) published a value of 5.4 MT / capita in 2000. The questions are not only the consistency of the volume emissions but also the base year of those data. (Wee et al, 2008).

One reliable GHGs emissions inventory of the country was developed by Malaysia National Steering Committee on Climate Change; which was established following the signing of Kyoto Protocol. The national GHGs emissions inventory was introduced during the preparation of the Initial National Communication (INC) for UNFCCC. In 2000, Malaysia submitted its INC comprising the national GHGs inventory and the assessment of possible

impacts of climate change. It detailed the policies and plans in place that represent the national sustainable development agenda of the country. The preparation of Second National Communication (NC2) is a continual step towards further implementation of the UNFCCC at national level which aims to generate a comprehensive report on climate change related issues in Malaysia. (CEMD, 2007)

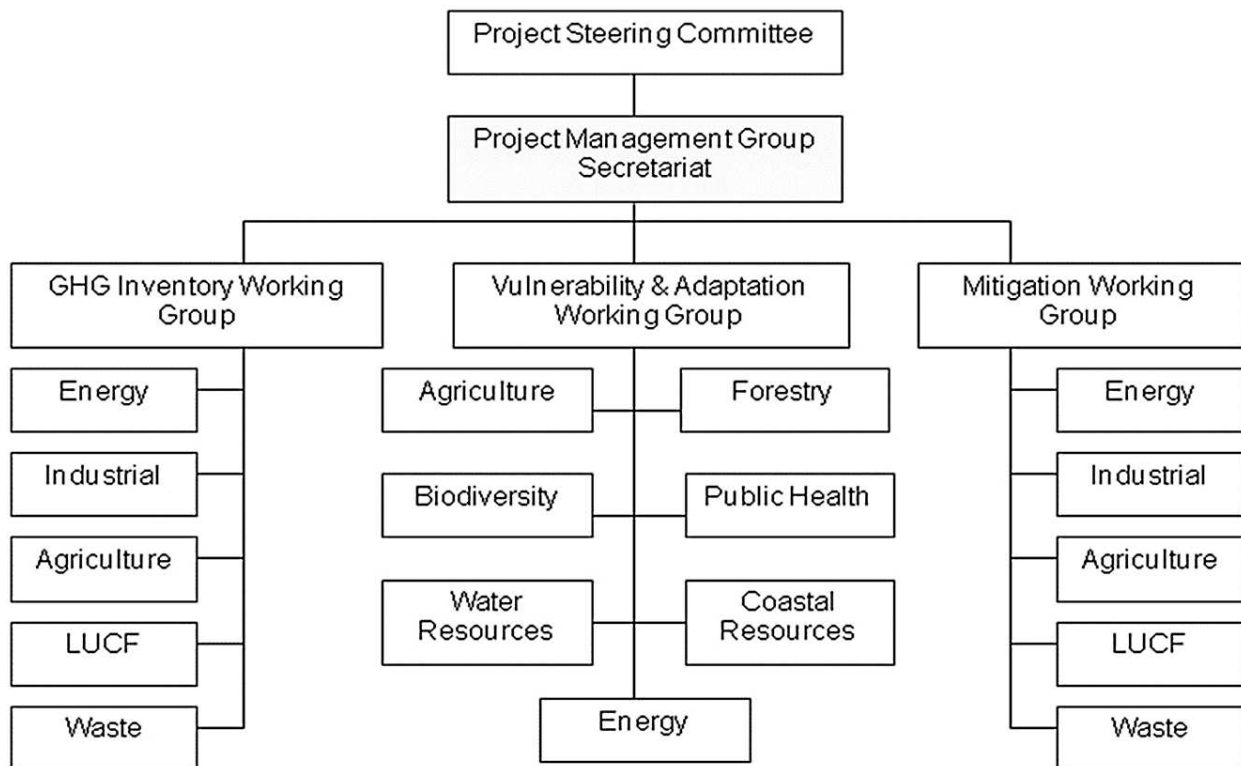


Fig. 6. NC2 Institutional Arrangement (Source: DOE (Department of Environment), 2010)

9.4 Adaptation strategy to climate change

Adaptation strategies to climate change are inevitable because of the limited available knowledge. As a global issue, the effects of climate change will happen everywhere around the world. Therefore, adaptation measures have to be taken as well besides the mitigation measures; to ensure the welfare of the society is under control. Adaptation is a shared responsibility between government, community and business entities; that have a stake and role in responding to the climate change impact. Government has to put efforts in studies and research in climate change vulnerability areas and develop the relevant policies. For example, the recent findings revealed in the national coastal vulnerability index (CVI) study conducted by the Drainage and Irrigation Department (DID) in 2006 shows that sea levels off the west coast of Peninsular Malaysia will rise by 10cm to 13cm in the next 100 years and 288.4km or 6% of the peninsula's 4,809km-long coast is being eroded by sea water.

As vulnerability to climate change is a new risk to a country, business and community need to assume the responsibility to manage the risk by factor climate change into everyday decision making. It takes time to adapt and as uncertainty exists in climate change effect, the reasons for taking the relevant action are flexibility and creativity. It is not cost effective for adaptation response measures to prevent all adverse impacts of current and future climate change. Adaptation actions will need to achieve a suitable balance between the risks of

acting too early or too late, and to balance the potential benefits of actions with the likely magnitude of impacts. In this context, the government plays a vital role in leading the action by providing information and setting the right conditions for business and community to adapt.

9.5 Institutional framework redesigning

Institution refers to a specific organization or a policy program. Organizations such as a specific government agency, departments, association are a manifestation of institution. For an institution to be changed, organizations are needed. But institutional change is harder to achieve than organizational change. For instance it is easier to restructure the Department of Environment than to transform Malaysia's federal system which is constitutionally defined. Instructive guiding principles are found in Professor Dovers' public lecture delivered in 2009 entitled *Implementing Sustainable Development*; six generic principles may be adopted and adapted by governments to suit relevant contexts:

1. Factoring in the long term
2. Integrating environment, society and economy in policy
3. Precautionary Principle
4. Global dimensions
5. Innovative policy approaches
6. Community participation

Institutionalizing sustainability by embedding these principles in their institutions is no easy feat for any government. A suggestion in institution reformation is the forming of "Green" ministries clusters typically share matters related to climate change; for example the alliance between Ministry of Natural Resource and Environment, Ministry of Energy, Green Technology and Water, Ministry of Housing and Local Government and Ministry of Science, Technology and Innovation.

9.6 Decision making at all levels

Any decision making related to climate change is fundamentally affected by money and awareness. To look at the micro level in the implementation of the climate change policy, decision making process of all levels are the determining factor. For example, for an individual level, changing to energy saving light bulb can be costly for low income people; however the awareness can drive the individual to take the action. Same for the government level; for instance to embark in renewable energy technology will take tremendous efforts in various agencies; however, with proper planning and collaboration, the positive outcomes of the effort can outweigh the short term unfavorable financial constraint in an entire system outlook. Decision making is always affected by an individual's knowledge, ethic, integrity and mindset. Education is the key toward correct decision making by all levels regarding matters related to climate change. Government had made the move to incorporate environmental issues in science and geography lessons at primary and secondary levels. The question remains is the comprehensiveness and sufficiency of the subject and the qualification and understanding of teachers on the subject.

10. Conclusion

Mainstreaming sustainability has always proven difficult in any country either developed or developing. Nevertheless, the global challenge of climate change will serves as an impetus

for the government to set new energy policy that based on clean and renewable energy. With a holistic policy and economy model in place, the achievement of sustainable development is not impossible. However implementation of the policy requires high quality governance and vast pools of expertise with high ethical and integrity. It is time to change the "Business As Usual" attitude and "NATO" (No Action Talk Only) syndrome.

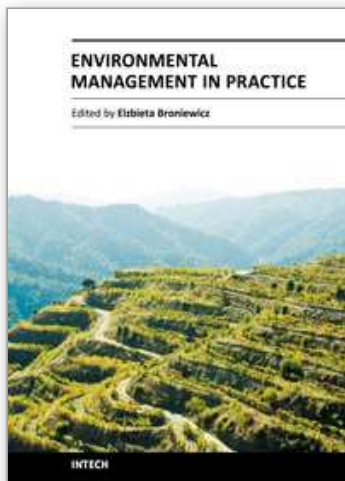
The country politicians, all business sectors and the community at large have to be involve and dwell on the environmental and especially climate change issue as it entails on numerous diverse topics and disciplines. Pending to the formulation of the climate change policy, the planning of the implementation part (enforcement, monitoring, measurement, improvement, etc) has to go concurrently. The introduction of a climate change policy is imperative for any country and in the right timing for the country to act as a strategic trajectory toward sustainable development.

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In recent years the topic of environmental management has become very common. In sustainable development conditions, central and local governments much more often notice the need of acting in ways that diminish negative impact on environment. Environmental management may take place on many different levels - starting from global level, e.g. climate changes, through national and regional level (environmental policy) and ending on micro level. This publication shows many examples of environmental management. The diversity of presented aspects within environmental management and approaching the subject from the perspective of various countries contributes greatly to the development of environmental management field of research.

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