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Climate Change and Carbon Reduction Initiatives for Sustainable Campus

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Abstract

Climate change is a global issue that needs to be tackled by every individual, groups, organization and nations. With our current path of development, climate change seems inevitable. Mitigation measures and adaptation strategies need to be set up just to avoid any further destruction. As IPCC reported that current CO₂ level is around 380ppm and will increased to 450ppm under business as usual scenario, stabilization at this point will increased temperature by 2°C. Any increasing in temperature beyond this point will risk human life. This research promote one of mitigating measure, Carbon Reduction Initiatives (CRI) that involved behavior changes on individual and using financial gains as encouragement point.

Keywords: Climate change, carbon reduction, sustainable campus, climate change mitigation

1. Introduction

Inevitable and irreversible, so said the scientists about climate change and its implications to us. The past century has witnessed unprecedented economic growth and human prosperity. Global per capita income has nearly tripled (World Business Council on Sustainable Development, 1997), average life expectancy has increased by almost two thirds (World Resources Institute, 1994), and the past century has also witnessed unprecedented damage to the natural environment. The human population is expanding while crop land is eroding, forests are declining, species are facing extinction, fresh water supplies are dwindling, fisheries are collapsing and pollution threatens human health (Brown, 1998). We are pursuing economic growth and utilizing natural resources in effort to increase our quality of life (or maintaining the present lifestyle!).

Climate change or generally the environmental problems are not primarily technological or economic, but behavioral and cultural. It is both; the behavior of the decision maker and the consumers. While technological and economic activity may be the direct cause of environmentally destructive behavior, it is individual beliefs, cultural norms and societal institutions guide the development of that activity (David, 1985; Barley, 1986). While most scientific researches probably suggested various mitigation and adaptation strategies to combat climate change, we would consider how individual and social behavior, organizational, and institutional values perpetuate behavior that damages it. This paper highlights a carbon reductive initiative that purposely targeted simple behavioral changes which could also give financial gains.

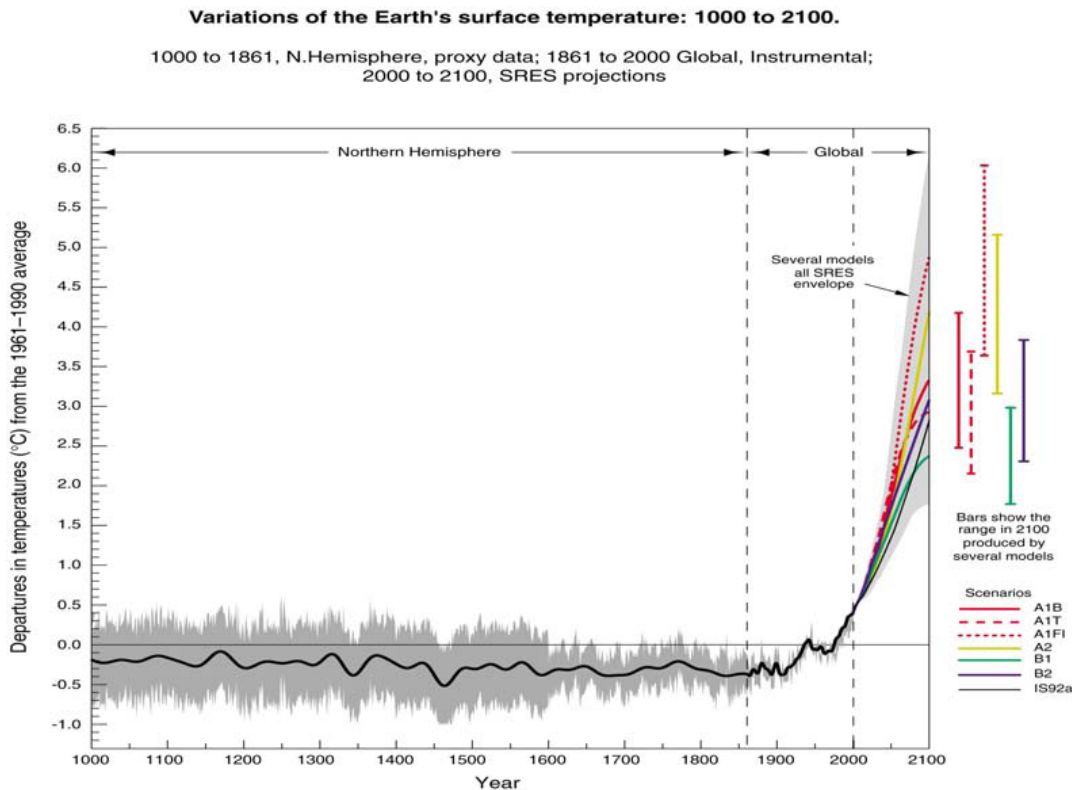
2. Climate Change Pressures

Environmental pollution is not just localized in its impact. Worldwide concentrations of greenhouse gases, such as carbon dioxide (CO₂), have increased steadily. Before 1750, the mixing ratio of atmospheric CO₂ was approximately 280 ± 10 ppm (512 ± 18 mg m⁻³). In 1950, world annual CO₂ emissions were 1.6 billion tons per year. By 1997, they had reached 7.0 billion tons per year. As a result, atmospheric concentrations have grown from 280 ppm to 380 ppm since the beginning of the industrial revolution in the middle of the 19th century (Office of Science and Technology Policy, 1997; IPCC, 2007).

Latest IPCC 4th Assessment Report (AR4) stated that the total temperature increase from 1906–2005 is 0.76 [0.56 to 0.92]°C. Eleven of the last twelve years (1995–2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850). Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases. The average global surface temperature is projected to increase by between 1.4 and 5.8°C over the period 1990 to 2100. Satellite data since 1978

show that annual average Arctic sea ice extent has shrunk by 2.7 [2.1 to 3.3]% per decade. Global average sea level rose at an average rate of 1.8 [1.3 to 2.3] mm per year over 1961 to 2003. The rate was faster over 1993 to 2003, about 3.1 [2.4 to 3.8] mm per year (IPCC, 2007).

This build up is caused by continued economic growth despite its potential to alter the global climate (Hoffman 1998). Commonly predicted effects include drier weather in midcontinent areas, sea level rise, more violent storms, and northward migration of vector-borne tropical diseases and climate-sensitive species (IPCC, 1990). Many species would not be able to migrate quickly enough and would become extinct.



Sources: IPCC, 2007

According to Stern (2006), whatever mitigation measures currently taken, it is no longer possible to prevent the climate change that will take place over the next 2 to 3 decades. Furthermore, the cost in implementing mitigation and adaptation measures is only a fraction of the actual devastation due to impact from business as usual scenarios, even if only 50% of the prediction as a result of business as usual materializes.

Predicted scenarios in Malaysia are nothing less significant. According to Chong and Mathews (2001), Malaysia will face an increased temperature by 0.18°C per decade. However, the more concerned should be given to changes in rainfall which has been predicted will vary between -30% to +30% from current trends (Chong & Mathews 2001). Less rainfall will increase drought episodes whereas increased rainfall will result in severe floods. Rainfall variation in Malaysia will have very significant impacts on agricultural activities.

3. Malaysia's Carbon Dioxide Emission

CO₂ is the most important anthropogenic greenhouse gas (IPCC, 2007). Malaysia's CO₂ generation has increased from 55.3 MtCO₂ in 1990 to 177.5 MtCO₂ in 2004 which is well above the global average (Table 1).

Table 1: CO₂ emission in selected countries, 1990-2004.

CO ₂ Emitters	Total emissions (MtCO ₂)		CO ₂ emissions annual change (%)	CO ₂ emissions share of world total (%)		Population share (%)	CO ₂ emissions per capita (tCO ₂)	
	1990	2004	1990-2004	1990	2004	2004	1990	2004
US	4,818.3	6,045.8	1.8	21.2	20.9	4.6	19.3	20.6
China	2,398.9	5,007.1	7.8	10.6	17.3	20.2	2.1	3.8
Russia	1,984.1	1,524.1	-1.9	8.8	5.3	2.2	13.4	10.6
Korea	241.2	465.4	6.6	1.1	1.6	0.7	5.6	9.7
Indonesia	213.8	378.0	5.5	0.9	1.3	3.5	1.2	1.7
Malaysia	55.3	177.5	15.8	0.2	0.6	0.4	3.0	7.5
Singapore	45.1	52.2	1.1	0.2	0.2	0.1	14.9	12.3
Myanmar	4.3	9.8	9.2	0.0	0.0	0.7	0.1	0.2
Brunei	5.8	8.8	3.7	0.0	0.0	0.0	23.0	24.0
Cambodia	0.5	0.5	1.3	0.0	0.0	0.2	0.0	0.0
Global aggregates								
High-income OECD	10,055.4	12,137.5	1.5	44.3	41.9	14.3	12.0	13.2
Low human development	77.6	161.7	7.7	0.3	0.6	7.8	0.3	0.3
World	22,702.5	28,982.7	2.0	100.0	100.0	100.0	4.3	4.5

Source: UNDP (2007)

Global concentration of CO₂ has increased to 380ppm in 2005. In business as usual scenario, stabilization of CO₂ at 450ppm CO₂ will limited temperature increase by 2^oC above preindustrial level, while stabilization of CO₂ at 750ppm CO₂ will increase temperature by 5^oC (IPCC 2007). Scientists have warned that temperature increase more than 2^oC will be very risky to our life.

During a period of 1990 to 2004, Asian countries has the most significant increase in CO₂ generation. This mainly due to rapid development and industrialization especially in China and India where both countries amounted 22% of world emissions (Wee et al. 2008). Based on Human Development Report, UNDP (2007), Malaysia’s CO₂ generation has increased from 55.3 MtCO₂ in 1990 to 177.5 MtCO₂ in 2004. Per capita CO₂ emission for Malaysia has increased from 3 tCO₂ per person in 1990 to 7.5 tCO₂ in 2004. Malaysia’s CO₂ per capita in 2004 are exceeding global average (4.5 tCO₂). Rapid economic development in developing countries such as Malaysia will hampered global initiatives to mitigate climate change if specific efforts are not taken as early as possible. This study promoted specific initiative for individual to make changes. However, changing behaviour or life style are difficult if not supported by enough information and incentives.

4. Changing Behaviour through Carbon Reduction Initiative

Core to the earth’s destruction are millions of decisions made by consumers (Bazeman & Hoffman, 1999). The last four decades of behavioural decision research have resulted in researchers being able to predict, how people will make decisions that are inconsistent, inefficient, and based on normatively irrelevant information. People rely on simplifying strategies, or cognitive heuristics. While these heuristics are frequently useful shortcuts, they also lead to a wide variety of decision biases (Kahneman & Tversky, 1973, 1979; Bazerman, 1998).

According to Bazeman and Hoffman (1999), consumers ignored the future of environment even though there are well informed about the risks. They found out that consumer still giving **high discount rates** in their consumption behavior by purchasing energy-inefficient appliances, despite the

implications for future energy costs. It is understood that most consumer in developing countries will consider the lower price of goods than the product itself and green product always cost more.

Since behaviour changes are inter related to monetary issues, this study try to tackle both aspects by pursuing initiative that suited consumer. Carbon reduction programs have been applied in various part of the world, however, more concentration has been given to industrial activities and larger organization. Approach on changing individual behaviour has started by Carbon Reduction program in East of England since 2003. Since climate change issues encompasses various aspect, this program give concentration on energy based aspects (Gerrard, 2008).

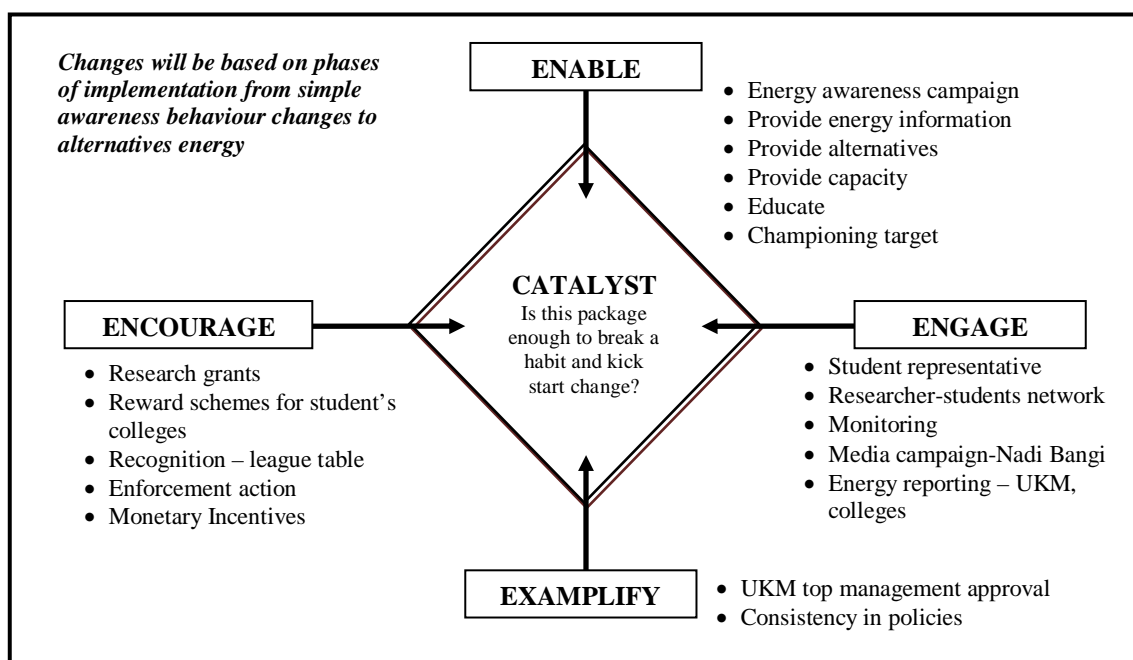
5. Research Method

This research promoted on developing research framework on behaviour change for energy efficiency programme. Secondary data on organisation’s energy consumption was used to establish the carbon reduction program. Various important internal and external aspects were considered in designing the program which includes types of information prepared, organisation’s working conditions and ways to disseminate information to target groups.

6. Framework for Carbon Reduction Initiatives in University Campus

This research applies DEFRA Diagrammatic Representation 4E Model (Figure 1) in implementing the initiative. The development of carbon reductive framework was also taking into consideration the application used by Carbon Reduction Program (CRed), University of East Anglia, United Kingdom.

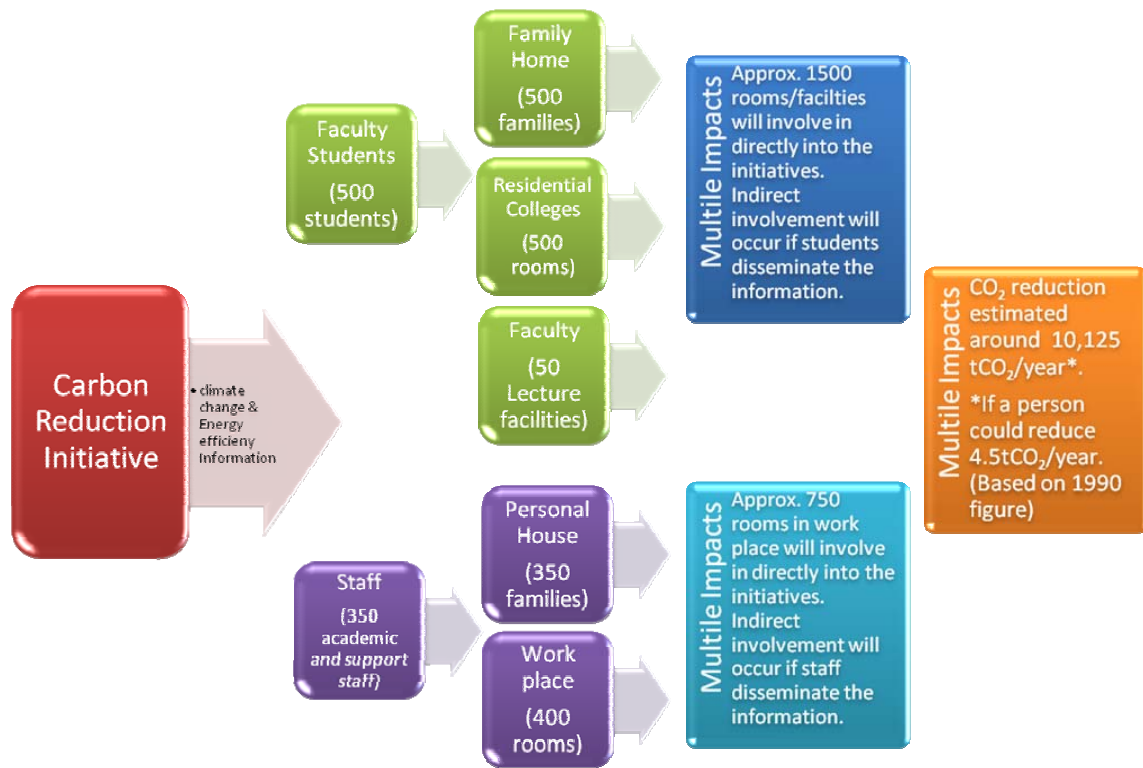
Figure 1: Framework for Carbon Reduction Initiatives



Source: Modified from DEFRA Diagrammatic Representation 4E Model (DEFRA, 2008)

This pilot project was implemented in education institution, thus engaging students and staff will presumably give *multiple impacts* beyond expectation (Figure 2).

Figure 2: Multiple impacts scenario from the implementation of carbon reduction initiative (scenario in faculty with 850 population).



A campus with estimated population of 30,000 will generate 225,000 tCO₂/year (estimated from UNDP figure for Malaysia - 7.5 tCO₂/year/person). If the university need to reduce carbon generation based on 1990 figure, 60% of carbon generation or 135,000 tCO₂ need to be eliminated yearly. This can be achieve through energy efficiency program, reforestation and behavioural changes.

CRed@UKM has set a target to reduce 60% of carbon emission by 2015 through various strategies especially that related to energy efficiency programs and possible changes in university purchasing policy (Kadaruddin et al. 2008). This project can be implemented through phases (Table 2).

Table 2: Carbon reduction implementation stages.

Phases	Program	Objective
1	<ul style="list-style-type: none"> • Compiling baseline data • Awareness campaign on energy efficiency • Monthly energy monitoring 	Concentration on faculty and students' residential colleges (2 colleges). Priority is on awareness building
2	<ul style="list-style-type: none"> • Energy efficiency awareness program in all students' residential colleges • Energy reporting 	Reducing energy consumption by 10%. Championing program created
3	<ul style="list-style-type: none"> • Energy efficiency awareness program in all university facilities (faculties institutes etc) • Energy reporting 	Reducing energy consumption by 10% Championing program created
4	<ul style="list-style-type: none"> • Other CO₂ reduction program (waste, transport, reforestation) 	30% CO ₂ reduction
5	<ul style="list-style-type: none"> • Pursuing changes in purchasing policy • University energy and development planning policy • Consideration for alternative energy 	60% CO ₂ reduction Purchasing less energy appliances Solar powered building

Source: Kadaruddin et al. 2008

This program has created a long term planning strategies in effort to reduce carbon generation and contribute to the process of mitigating climate change. Using DEFRA Diagrammatic Representation Model, we have strategized the program to benefit all the stakeholders. However, the success of this program needs commitment from all stakeholders from university top management to students and staff. Even though the real intention for this program is to mitigate climate change, the use economic/monetary factors to gains attention are highly advisable. At present, electricity costs for a university with 30,000 population is between RM 1million to RM1.5 million per month. The program are targeting only 10% reduction which is around RM100,000 per month. If this could be achieve through Phase 1-3, an investment could be made to new technologies or alternative energy. Furthermore, the saving can be returned back to university community through students' program and staff development program or any climate change mitigation strategies.

7. Conclusion

Climate change will gave an impacts to everybody therefore it is everybody responsibility to try to mitigate in whatever ways they can. Carbon reduction initiative will provide information and strategies that suited everybody from simple energy awareness or efficiency to alternative energy. The most important aspect for this initiative is consumers satisfactory; environmentally and financially. It is a long journey but we must start now.

Acknowledgement

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