

## Green Technology for Disaster Risk Reduction

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**Abstract**— Malaysia launched the National Green Technology Policy in 2009 that emphasised for Malaysia to go green for entrepreneurs, industrialists, inventors and consumers, citing global concerns to adopt and embrace sustainable and renewable best practices. The green technology strategy would achieve the objective of reducing total carbon emissions by 15% and total emissions per GDP by 40% by the year 2020 compared to 2005 levels and catalyzing Malaysia's capability and capacity for innovation in green technology development. The paper highlights an overview of national green technology policy and disaster risk reduction. It also attempts to provide a connection of green technology (energy efficient and renewable energy) strategy as well as disaster risk reduction and the extent that green technologies can offer risk management benefits for insurance industry to expand their involvement in the green technology marketplaces. However, the systemic promotion of green technologies need to be encouraged as an element of a new insurance paradigm based on sustainable development and the prevention of losses from disasters. With the potentials of business and innovation opportunity of green technology development, Malaysia could be a regional player in the green investment market.

**Keywords**— *Green technology; disaster risk reduction; Investment; insurance industry*

### I. INTRODUCTION

There has been an increasing trend in the occurrence of natural disasters and it is expected that climate change will aggravate the devastating impacts of disasters. Several effective strategies particularly through the application of green technologies could be used to strength resilience for both of disaster and climate change. In July 2009, Prime Minister of Malaysia, Dato' Sri Mohd Najib Bin Haji Abdul Razak launched National Green Technology Policy (NGTP) under the new ministry, Ministry of Energy, Green Technology and Water which replaced the former Ministry of Energy, Water and Communications. In his launched speech, Dato' Sri Najib emphasised for Malaysia to go green for entrepreneurs, industrialists, inventors and consumers, citing global concerns to adopt and embrace sustainable and renewable best practices. He has also given more importance to facilitate the growth of the green technology industry that was named as one of the key drivers that would contribute to the national economy. This strategy would achieve the objective of reducing total carbon emissions by 15% and reducing total emissions per GDP by 40% by 2020

compared to 2005 levels and catalyzing Malaysia's capability and capacity for innovation in green technology development. The paper highlights an overview of national green technology policy and disaster risk reduction. It also attempts to provide a connection of green technology (energy efficient and renewable energy) strategy as well as disaster risk reduction and the extent that green technologies can offer risk management benefits for insurance industry to expand their involvement in the green technology marketplaces. The subject matter of this article is in line with the overarching theme of the forthcoming Fourth Asian Ministerial Conference on Disaster Risk Reduction hosted by the Government of the Republic of Korea in October, 2010. The conference will be delineating "Disaster Risk Reduction for Climate Change Adaptation", with a particular focuses on 1) the convergence of DRR and climate change adaptation and 2) available information technology and green technology. The authors look forward to the conference deliberations that will collectively find ways and means to reduce disaster risks through applications of green technology strategies.

### II. NATIONAL GREEN TECHNOLOGY POLICY

According to the NGTP, green technology is the development and application of products, equipment, and systems used to conserve the natural environment and resources, which minimises and reduces the negative impact of human activities [1]. Green Technology refers to products, equipment, or systems which satisfy the following criteria such as i) it minimises the degradation of the environment; ii) it has a zero or low greenhouse gas (GHG) emission; iii) it is safe for use and promotes healthy and improved environment for all forms of life; iv) it conserves the use of energy and natural resources; and v) it promotes the use of renewable resources. The national goals of the Green Technology Policy is to provide direction and motivation for Malaysians to continuously enjoy good quality living and a healthy environment. To achieve the national goals of green technology policy, NGTV manifested significant progress and major improvements in the four key areas as shown in Table 1. The NGTP is a way forward to a sustainable environment to ensure better quality of life and to create the right business culture for continued economic growth of the nation. Details information about the NGTP can be obtained

from the Ministry of Energy, Green Technology and Water, Malaysia.

TABLE 1 NGTP: SIGNIFICANT PROGRESS AND MAJOR IMPROVEMENTS

Key areas	Significant progress and major improvements
<i>Energy Sector</i> Energy supply sector: Energy utilisation sector:	Application of Green Technology in power generation and in the energy supply side management, including co-generation by the industrial and commercial sectors; and Application of Green Technology in all energy utilisation sectors and in demand side management programmes.
<i>Buildings Sector</i>	Adoption of Green Technology in the construction management, maintenance and demolition of buildings.
<i>Water and Waste Management Sector</i>	Technology in the management and utilisation of water resources, waste water treatment, solid waste and sanitary landfill;
<i>Transportation Sector</i>	Incorporation of Green Technology in the transportation infrastructure and vehicles, in particular, biofuels and public road transport.

### III. DISASTER RISK REDUCTION

According to the Centre for Research on the Epidemiology of Disasters (CRED), a disaster defines as a situation or event which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering. For a disaster to be entered into CRED's database (EM-DAT) at least one of the following criteria must be fulfilled: 10 or more people reported killed; 100 or more people reported affected; declaration of a state of emergency; call for international assistance. Table 2 shows the definitions of natural disaster subgroups and their main types.

In 2009, 335 natural disasters (excluded biological disaster) were reported worldwide that killed 10 655 persons, affected more than 119 million others and caused over US\$ 41.3 billion economic damages. Asia experienced the largest share in reported 40.3% of natural disaster occurrence, accounted for 89.1% of global reported natural disaster victims and 38.5% of total reported economic damages from natural disasters [2]. Malaysia also experienced several natural disasters such as the landslides, mudslides, and floods and man-made disasters for example transportation accidents, technological disasters, public places failures, and production failure which cause enormous property damage involving both direct and indirect costs [3]. Landslides in Malaysia are mainly triggered by tropical rainfall and flash floods causing failure of the rock surface along fracture, joint and cleavage planes [4]. Shaluf and Ahmadun (2006) classified disasters into natural and man-made disasters. Natural disasters are catastrophic events resulting from natural causes such as

floods, landslides, mudslides, etc. where man-made disasters can be sudden or long term [5] also known as socio-technical disasters. Table 3 shows number and types of disasters in Malaysia since 1968 to 2004, among them technological disasters are the most common disasters accounting for 56%, followed by 32% flood occurrences.

TABLE 2 DEFINITION AND MAIN TYPES OF NATURAL DISASTER

Disaster Subgroup	Definition	Disaster Main Type
<b>Geophysical</b>	Events originating from solid earth	Earthquake, Volcano, Mass Movement (dry)
<b>Meteorological</b>	Events caused by short-lived/small to meso scale atmospheric processes (in the spectrum from minutes to days)	Storm
<b>Hydrological</b>	Events caused by deviations in the normal water cycle and/or overflow of bodies of water caused by wind set-up	Flood, Mass Movement (wet)
<b>Climatological</b>	Events caused by long-lived/meso to macro scale processes (in the spectrum from intra-seasonal to multi-decadal climate variability)	Extreme Temperature, Drought, Wildfire
<b>Biological</b>	Disaster caused by the exposure of living organisms to germs and toxic substances	Epidemic, Insect Infestation, Animal Stampede

Source: Vos et al., 2010 [2]

TABLE 3 NUMBER AND TYPE OF DISASTERS IN MALAYSIA 1968-2004

Disaster	Type of disastrous event						Total
	<i>Landslides</i>	<i>Mudslides</i>	<i>Storms</i>	<i>Epidemics</i>	<i>Floods</i>	<i>Tsunami</i>	
<i>Natural</i>							
Number	5	1	3	3	6	1	19
Total percentage	26	5	16	16	32	5	49
<i>Man-made</i>		<i>Technological</i>	<i>Places failure</i>	<i>Transport</i>	<i>Production failure</i>		
Number		10	5	2	1		18
Total percentage		56	28	11	5		46
<i>Subsequent</i>			<i>Haze</i>				
Number			2				2
Total percentage							5
Total number of disaster							39

Source: Shaluf and Ahmadun, 2006

Increased population densities, rapid urbanization and industrialization, environmental degradation, and global warming make the impacts of natural disasters worse. However, the consequences and impacts of natural disasters can be prevented through effective disaster risk reduction initiatives. Governments around the world have adopted the Hyogo Framework for Action (2005-2015) to reduce disaster risk, and vulnerabilities to natural hazards [6]. Malaysia is indeed committed to DRR and continues its efforts towards implementing the priority areas of the Hyogo Framework for Action (HFA) to build resilience of nations and communities and cope better with the disasters that threaten development goals.

DRR represents an important development in both disaster management and sustainable development paradigms. Primarily, disaster managers focused attention on the delivery of emergency relief after catastrophes, today increasing attention is given to DRR and preparedness.

Several studies revealed the expected benefits of a disaster risk reduction measure by exceedance probability curves. With available information or more funding to invest in estimating hazard probabilities, an exceedance probability curve can be obtained to estimate the probability of occurrence of different intensities of the hazard at a given location. A vulnerability assessment of the resilience of assets or livelihoods that would be given some protection by DRR measures should then be undertaken, both with and without that measure. Finally, the vulnerability and exceedance probability curves should be combined to generate the loss-probability curves, indicating the probability of differing levels of loss with and without the disaster risk reduction measure. The area under each loss-probability curve represents average annual expected losses. Average annual expected benefits of a disaster risk reduction measure are represented by the area between the two loss-probability curves as shown in Fig. 1. Therefore, the benefits of DRR and preparedness are equivalent to the savings of the damages that would be incurred in the event of a future disaster. Consequently, insurance and risk management industries can take advantage by promoting products and services of green technologies in the benefits of DRR.

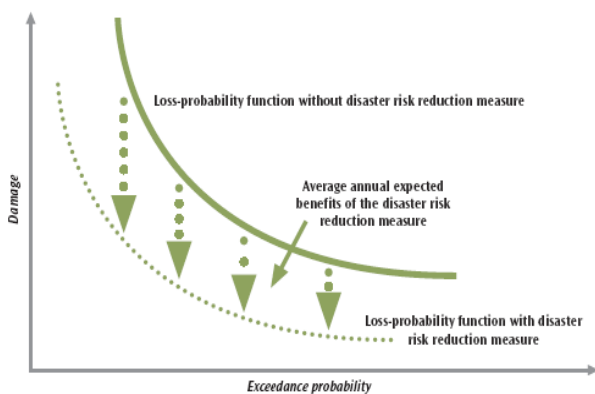


Fig. 1 Expected benefits of DRR measure Source: IFCRCS, 2007; Mechler, 2005; Parker et al. 1987

#### IV. GREEN TECHNOLOGY FOR RISK REDUCTION

Typically, insurance and risk management industries have little interests in products and services of green technologies eg. energy efficient and renewable energy. Historically these industries involved loss-prevention technologies eg. automobile air bags, fire prevention systems, anti-theft devices, etc. With increasing number of natural, climatic and technological disasters, green technology is also starting to become a reputational and strategic issue for insurance and risk management industries. In recent years, involving green technology in risk management are receiving greater attention and recognition, with investors and other stakeholders in the business or private sector. Mills (2003) drove the following three factors that make interest in energy efficiency and renewable energy by the insurance and risk management industries:

- Offer loss-prevention benefits (such as improved fire safety);
- Insurance industry (particularly life insurance) plays a major role in real estate markets (commercial building owners and landlords), as interest in facility of green technology management grows, insurance industry can benefit directly to be engaged in it; and
- Increased competitive pressures to motivate insurance and risk management industries to develop new products and services related to green technology (e.g. energy efficiency) that differentiate from their competitors and offer new ways to touch customers.

Mills (2003) and Vine et al. (1998) demonstrated an inventory of energy efficiency and renewable energy technologies revealed 78 specific examples that offered risk management and loss prevention benefits, a few examples of them includes efficient refrigeration, energy efficient windows, insulated water pipes, fuel-switching from electric to gas cooking and building commissioning. Table 4 provides an example of what kind of physical perils and insurance coverage can be addressed by EE and RE technologies and strategies [7], [8] which are mapped to the relevant insurance lines. It should be noted that green technology strategies need to be mapped according to the relevant insurance lines, as various types of insurance company have very different technical and market priorities.

To the extent that green technologies offer risk management benefits such as reduction of ice damming risks or elimination of pilot lights, insurance companies could expand their involvement in the EE and RE dimension of buildings and its performance and standards. On the other hand, insurance industry and its subsidiary companies also find new profit opportunities by the risk-management benefits of green technology strategies. The challenges facing insurance industry are growing risks associated with electricity reliability which can be addressed through energy efficiency and distributed renewable energy supply solutions. Notwithstanding, green technologies could contribute to enhance the ability of insurance companies to process claims during disaster recovery operations. For instance, Gordes (2000) revealed that American Modern Insurance Group tested a mobile office powered with photovoltaic system to process claims in disaster areas without power (for demonstration purposes) [9].

Literature shows that there is a limited study on identification and articulation of the ways and opportunities in which green technologies can moderate or prevent insurance losses, and to make the businesses for how these technologies can improve the competitive advantage of insurance and risk management companies. Nevertheless, the systemic promotion of green technologies need to be encouraged as an element of a new insurance paradigm based on sustainable development and the prevention of losses from disasters.

TABLE 4 EXAMPLES OF PHYSICAL PERILS AND INSURANCE COVERAGE BY EE AND RE TECHNOLOGIES AND STRATEGIES

	Number of measures offering benefit <sup>a</sup>
<i>Physical perils</i>	
Extreme temperature episodes	16
Fire & wind damage	38
Home or workplace indoor air quality hazards	38
Home or workplace safety hazards	21
Ice & water damage	17
Outdoor pollution or other environmental hazard	17 <sup>b</sup>
Power failures	35
Theft and burglary	6
<i>Insurance coverage—commercial lines</i>	
Boiler & machinery	15
Builder's risk	4
Business interruption	21
Commercial property insurance	36
Completed operations liability	14
Comprehensive general liability	45
Contractors liability	14
Environmental liability	12
Health/life insurance	39
Product liability	5
Professional liability	19
Service interruption	21
Workers' compensation	35
<i>Insurance coverage—personal lines</i>	
Health/life insurance	35
Homeowners insurance	26

<sup>a</sup>The numbers in this column refer to unique technologies and cover all technologies in Table 4 of Vine et al. (1998) cited in Mills (2003).

<sup>b</sup>The environmental benefits of improving the outdoor air quality and reducing greenhouse gases are cross-cutting and thus are not included in this table.

## V. CONCLUSION

The paper shows that there are well connections and linkages between green technology strategies, DRR benefits and insurance and risk management industries. This linkage provides a multiple achievement by reducing disaster vulnerability and impacts, tackling climate change by reducing GHG emissions and safeguarding economic growth and development. Insurance and risk management industry could contribute to promote green technologies that would reduce GHG emissions and at the same time would reduce the risk of weather-related natural disasters. Examples also showed ways and opportunities in which insurance and risk management industries have already or can be involved in the green technology marketplaces. For the case of Malaysian insurance and risk management industries, there is a great prospect and lot of rooms to be involved in the development and promotion of green technologies which would give an opportunity for reducing vulnerabilities from disaster as well as accelerating green and energy related policy objectives and market transformation. The National Green Technology Policy is not only providing a way to build a greener and more sustainable future but also showing a way to be more

economical and profitable. It offers a positive impact on the investment decisions of entrepreneurs, corporations and investors trading locally and regionally. With the potentials of business and innovation opportunity in green technology including low price of manufacturing and services, and traditional knowledge and processes, Malaysia could be a regional player in developing green investment market.

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