Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/envsci

Prioritizing climate change mitigation: An assessment using Malaysia to reduce carbon emissions in future

Abul Quasem Al-Amin [a], *Rajah Rasiah* [b,*], *Santha Chenayah* [c]

[a] *International Business School (IBS), Universiti Teknologi Malaysia (UTM), 54100 Kuala Lumpur, Malaysia*
[b] *Department of Development Studies, University of Malaya, 50603 Kuala Lumpur, Malaysia*
[c] *Department of Economics, University of Malaya, 50603 Kuala Lumpur, Malaysia*

ARTICLE INFO

Article history:
Available online 21 February 2015

Keywords:
Climate change
Carbon emission projections
Mitigation policy

ABSTRACT

This study examines empirically climate change related vulnerability impacts, and remedial options as an optimal and applicable strategy by prioritizing needs in climate change mitigation over 95 years. An Empirical Downscaling Dynamic Integrated model of Climate and the Economy (EDDICE) is deployed using an optimal scenario for Malaysia against a baseline scenario of existing conditions following the top-down disaggregation strategy recommended by other studies. The model takes account of various climatic variables, including, temperature, carbon cycle, carbon emission, climatic damage, carbon control, and carbon concentration, which was adapted from observational records of climatic changes caused by global warming from 2010 to 2105. The results are interesting in prioritizing climate change mitigation for the future. Whereas the cumulative cost of climatic damage over the period 2010–2105 will amount to MYR40,128.1 billion under the present climatic regime in Malaysia, it will fall to MYR5263.7 billion under the optimal regime. In addition, the government would have collected revenue from carbon taxes amounting to MYR9535.4 billion over the 95 years.

1. Introduction

It is now acknowledged that the projected increase in atmospheric concentrations of climate related greenhouse gases (GHGs) would change the scale of seasonal variations in temperatures in many parts of the world (IPCC, 2007, 2011), which is expected to increase the danger facing human civilization in years to come. Several works have emerged detailing the causes of rising atmospheric temperatures, which primarily point to human activities of economic development. While contestations have continued on the models, approaches and projections made on climate change there is increasing consensus that the earth is increasingly becoming vulnerable to climatic damage (Aldy et al., 2003; Beckerman and Hepburn, 2007; Carter et al., 2006; Füssel et al., 2003; JRC, 2013). For example, the Intergovernmental Panel on Climate Change (IPCC), and other related studies reported that the world is increasingly facing climatic risks (Hansen et al., 2006; IPCC, 2007; Nordhaus, 2008; Stern, 2007). While climate science, especially the future pace and extent of global warming, remains a contested field as climatic consequences are affected by time, events and country specific developments (Keith, 2000; Kelly and Kolstad, 1999; Schimmelpfennig,

* *Corresponding author*. Tel.: +60 3 7967 3606; fax: +60 3 7967 7252.
E-mail address: rajah@um.edu.my (R. Rasiah).
http://dx.doi.org/10.1016/j.envsci.2015.02.002
1462-9011/

1996), recent scientific evidence of vulnerability facing the world is indisputable (Bonfils et al., 2008; McKibbin and Wilcoxen, 2002; Nordhaus, 2001; Oreskes, 2004). Global warming is intensifying and climate change related impacts on natural and human systems have already caused potential distractions to economic activities and the livelihood of people (IPCC, 2007; Stern, 2007). Recognizing the dangers of climate damage and the uncertainty associated with long-term projections other studies call for mitigation through direct interventions that call for the introduction of transition policies without relying on quantitative projections (Rosen and Guenther, 2015; Van den Bergh et al., 2011). This is especially so when the expected utility derived from decision making under uncertainty may offer little realistic solutions to address climate damage (Heal and Millner, 2014; Kunreuther et al., 2013).

Although long-term quantitative projections are often characterized by information problems, there is evidence to show that the world is experiencing a major series of geophysical changes that is unprecedented (Byatt et al., 2006; Carter et al., 2006; Nordhaus, 2007, 2008; Pizer, 1999; Tol, 2003; Weitzman, 2007). The recent report from IPCC (2011) indicates that the global mean surface temperature would rise sharply in the next century and beyond if existing patterns of human activity are left unchecked. Worldwide the atmospheric concentrations and emissions are rising and there are signs of rapidly increasing average surface temperatures in recent decades (IPCC, 2007; Nordhaus, 2008; Ozdogan, 2011; Stern, 2007). The scientific community has become increasingly concerned with how to deal with the recent upheavals associated with atmospheric concentrations, temperature increases and emissions rather than on disputes and disagreements on scientific facts (Nordhaus, 2008; Stern, 2007). The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) gives the best estimate of increases in global temperatures over the next century, which ranged from 1.8 to 4.0 °C. Although this seems like a small change, it is much more rapid than any changes that have occurred in the past 10,000 years (Nordhaus, 2008). Thus, it is obvious and acknowledged by the scientific community that temperatures would increase over the coming century up to 3.0–4.0 °C, which is certain to raise peoples vulnerability to climatic catastrophes (Carter et al., 2006; IPCC, 2007; Nordhaus, 2008; Weitzman, 2007).

The direct vulnerability impact of temperature increases and global warming related climate change include, the degradation of natural resources, damage to infrastructure and environment, health hazards facing humans, and destruction to the global economy. In addition, there will be indirect damages, which are expected to be serious as well (Al-Amin and Leal Filho, 2014). Recent projections of climate change and global warming recognize the importance of environmental quality and sustainable economic development, which has prompted efforts to establish a balance between environmental quality and economic development. The failure to adopt strategies that take account of the introduction of efficient and effective renewable sources of energy will cause harmful environmental damage that will eventually make economic development unsustainable. Unless governments accept this fact and value the environment in formulating their development strategies, global economic progress cannot be sustained over the long term as reported by the Fourth Assessment Report of the Intergovernmental Panel on Climate Change IPCC (2007). Following the evidence compiled by the IPCC (2007, 2011), Nordhaus (2008)[1] and Stern (2007) many policymakers have reviewed the deleterious consequences of climate change more carefully, and hence, have started to include environment-friendly strategies in their development policies. In fact, since the Stern (2007) report, some countries have started to reduce the use of fossil fuels and focus on carbon reduction options in the production process, renewable sources of energy, such as solar, wind and water current. Also, several countries have made commitments to reduce carbon emissions. Thus, regardless of the contestable findings from climatic change, research communities, governments, and non-governmental organizations (NGOs) are increasingly working together to find a solution through prioritizing their needs to mitigate climate change.

However, many countries are struggling to establish a healthy balance between environmental quality and sustainable economic development. Especially the developing countries lack specific optimal strategic options. Many do not even have the institutional resources to undertake vulnerability analysis and assessment of remedial measures to introduce mitigation alternatives (Al-Amin and Leal Filho, 2014). These countries particularly lack the instruments of economic analysis that are required to visualize, plan, apply and compare alternative methods taking account of their country specificities (Nordhaus, 2008; Stern, 2007).[2] Hence, developing countries are lagging behind environmentally sustainable thresholds, and hence, have not managed to pursue effectively sustainable development strategies, which include carbon reduction, renewable sources of energy, abatement technologies. Malaysia, an upper middle income country is no exception here. Thus, this study aims to explore the vulnerabilities and negative impacts, and remedial options available for Malaysia over the 95 years since 2010. Notably, this study seeks to find an optimal climate change strategy for Malaysia by focusing on priority needs to mitigate climatic damage.

2. Methods

Climatic change is a typical example of a good that entails the global common whereby the externalities created in one country are often also borne by other countries. Nevertheless, like any public good any effort to reduce climate damage in one country will also bring benefits to other countries. Hence, the projections on Malaysia that we make in this study will inevitably be affected by what happens in the neighboring countries of Brunei, Indonesia, the Philippines, Singapore and Thailand. Fortunately, we can make the assumption for this study that all these countries will continue to reduce carbon

[1] Reducing GHGs, particularly if they are sharp, will require taking costly steps to reduce CO_2 emissions (Nordhaus, 2008).

[2] There are two major economics of climate change projections available, though they are both based on global options (Nordhaus, 2008; Stern, 2007).