Illustrated implications of the Terrifying New Math of Meinshausen and McKibben

Colin Hunt
Honorary Fellow in Economics,
The University of Queensland,
St Lucia Campus, QLD, 4072,
Australia
(Email: c.hunt3@uq.edu.au)

Abstract: There is a limit to the quantity of greenhouse gases that may be emitted to the atmosphere if catastrophic climate change is to be avoided. The practical implication is that most of the world's fossil fuel inventory must be left in the ground and not burned. The article analyses the implications of adhering to the carbon budget in terms of the implied rate of reduction in emission intensity of the world economy. The world economy must be decarbonised by 2050. The four major emitting countries are examined for their energy and emission policies, their emissions and the trajectories of their required emission intensities derived. This shows how sharply emission intensities will need to be reduced when present policies expire, particularly in Russia and China. The postponement to concerted international action to 2020 increases the costs of action. But barriers to a comprehensive international agreement on limiting emissions still exist. It seems likely that countries will continue to be free to pursue policies for the maintenance of economic growth as a priority. The cost of renewable energy, particularly solar, continues to fall. The market, rather than regulation, may transpire to be the main driver of decarbonisation.

I. INTRODUCTION

In 2009 scientists published a seminal paper that estimated the probabilities of exceeding a 2°C temperature rise for given levels of greenhouse gas emitted between years 2000 and 2050. The paper also carried a fossil fuel inventory identifying the extent of fossil fuel reserves and the carbon dioxide emissions that would result from their combustion (Meinshausen *et al*. 2009).

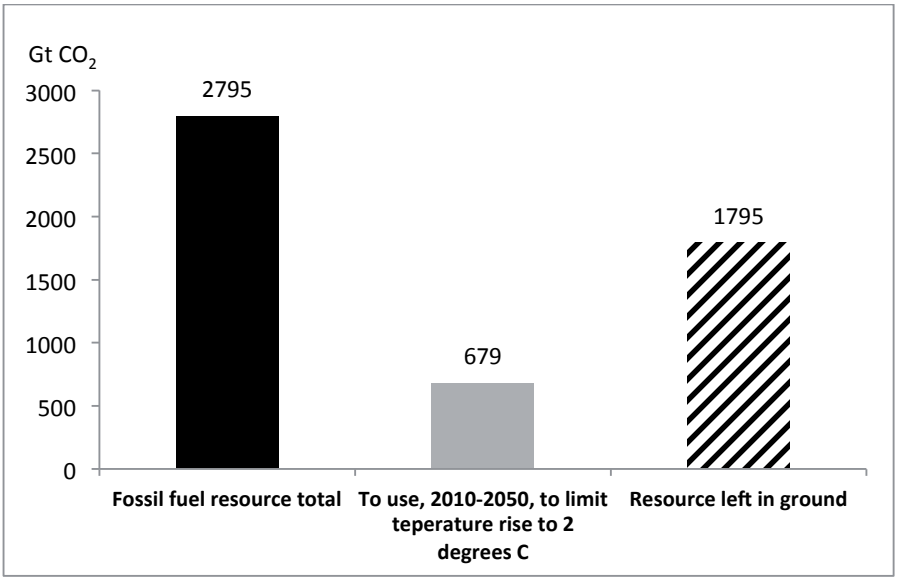
The aim of this article is to illustrate the implications of adhering to the carbon budget by modelling the implied rate of improvement of emission intensity (emissions/Gross Domestic Product) required of the world and the four major emitting countries.

II. THE CO_2 BUDGET

For a 75% probability of remaining within a 2°C temperature rise only 1000 Gt more CO_2 (the main greenhouse gas) can be emitted by year 2000. However, 321 million tonnes of CO_2

were emitted between years 2000 and 2010 (Friedlingstein *et al*. 2010). This leaves a budget of only 679 GT until 2050; that is, three quarters of the inventory must be left in the ground, see *Figure 1*.

Figure 1: The Carbon Budget with a 75% Chance of not Exceeding a 2ºC Rise in Global Temperature



Sources: IEA (2013:34); Meinshausen *et al* (2009:1169); Friedlingstein *et al*. (2010:811).

The enormity of this challenge took a while to sink in – too long for US academic Bill McKibben who published "Global warming's terrifying new math" in *Rolling Stone* (McKibben 2012) and in the same year undertook a speaking tour of the US, UK and Australia and New Zealand with the same theme. By doing the maths publicly he made the science plain that only a fraction of the fossil fuel inventory can be used if severe climate change is to be avoided.

Since then much has been written about the CO_2 budget (see for example *The Economist* (2013)), the need to stay within it to avoid the global threat and the prospects of doing so. Institutions have begun taking notice. The International Energy Agency (IEA) (2013) agreed that most fossil fuels must be left unburnt and the World Bank (2013a), another institution with a major global presence, adopted a policy of not lending for more coal-fired power plants and approving gas plants only as transitional energy sources.

In the next section the trend in global CO_2 emissions is compared with the path that needs to be taken if emissions are to be contained within the CO_2 budget. The task is then expressed in terms of rate of decarbonisation to be achieved by the world economy.