Is CO_2 Mitigation Cost-Effective?

by Christopher Monckton of Brenchley

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SPPI Original Paper ♦ **May 2, 2013**

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This summary *updates Monckton of Brenchley (2013), read at the World Federation of Scientists' 2012 Seminars on Planetary Emergencies. The paper applied inter-temporal investment appraisal to mainstream IPCC climatology by comparing the cost of Australia's 10-year CO_2 tax (Parliament of Australia, 2011) with the benefit in the cost of warming-related damage the tax might avoid.*

Fraction of world CO_2 emissions abated:	Over ten years, the tax, which its inventor, Professor Garnaut, said in 2013 had failed, cannot now abate more than **5%** of predicted CO_2 emissions. Australia emits **1.2%** of world emissions (derived from Boden *et al.,* 2010ab). The tax will thus abate **5% x 1.2%** = **0.06%** of world emissions.
CO_2 concentration abated:	Without the tax, CO_2 concentration after ten years would be **410 µatm** (IPCC, 2007), up by **20 µatm** on the **390 µatm** (Conway & Tans, 2011) at the outset. With the tax, after ten years CO_2 concentration would be **410 µatm** less **0.06%** of the 20 µatm growth: i.e. **409.988 µatm.**
CO_2 forcing abated	(IPCC, 2007; Myhre, 1998), would be **5.35 ln(410/409.988)** = **0.00016 W m^{-2}.**
Ten-year climate sensitivity parameter:	IPCC (2007, p. 803, Table 10.26) says CO_2 will be **713 µatm** in 2100 against **368 µatm** in 2000. It predicts **2.8 C°** 21st-century warming, of which **0.6 C°** is pre-committed, leaving **2.2 C°,** of which 70%, or **1.54 C°,** is CO_2-driven. IPCC's implicit 100-year climate sensitivity parameter is then **1.54 C° / [5.35 ln(713/368) W m^{-2}],** or **0.44 C° W^{-1} m^2,** up by **0.13 C° W^{-1} m^2** on the instantaneous (Planck) parameter **0.31 C° W^{-1} m^2** (derived from IPCC, 2007, p. 631 fn). Since the temperature feedbacks that lift the sensitivity parameter grow with time, a fair ten-year parameter is **0.31 + 10%** of **0.13,** or **0.32 C° W^{-1} m^2.**
Global warming abated	by the tax – the ten-year parameter multiplied by the forcing abated – would be **0.33(0.00016)** = **0.00005 C°,** or **1/20,000 C°.**
No performance indicator:	Even if the tax succeeded, we could not detect that it had. **1/20,000 C°,** as a fraction of the **0.05 C°** measurement uncertainty in temperature datasets, is just **1/1000** of that uncertainty.
The cost of the tax:	The tax, as enacted in Australia's Clean Energy Act 2011, is costing **$10.1 bn/year,** plus **$1.6 bn/year** for administration (Wong, 2010, p. 5), plus **$1.3 bn/year** for renewables and other costs, a total of **$13 bn/year,** escalated under the Act at **2%/year,** and by a further **2%/year** to allow for economic growth. Conservatively, the total cost over the ten-year term will thus be **$162.3 bn.**
The mitigation cost-effectiveness	of the tax, which is the cost of abating **1 C°** warming by global measures as cost-effective as the tax, is **$162.3 bn / 0.00005 C°** = **$3.2 quadrillion per C° abated.**

Projected anthropogenic warming	over the ten-year term will be **0.17 C°** (IPCC 2007, p. 803, Table 10.26).
Discount rate:	The minimum market discount rate is 5% (Murphy *et al.*, 2008). The US Treasury's standard rate is 7%. However, in line with Stern (2006), the discount rate assumed in the present appraisal is **0%.**
The undiscounted cost	of abating **0.17 C°** warming by global measures as cost-effective as the tax is **0.17 x $3.2 quadrillion**, or **$540 trillion** in cash, which, divided by **7 bn** global population, is **$77,000 per head.** Divided by 10 years' global GDP of **$670 trillion** (World Bank, 2011), it equates to **80% of global GDP.**
The undiscounted avoided-cost benefit	of abating the **3 C°** 21st-century global warming the IPCC predicts is estimated by Stern (2006, p. vi) at **0-3%** of 21st-century global GDP: central undiscounted estimate **1.5% of GDP.**
Cost-benefit ratio:	The cost of immediate mitigation divided by that of later adaptation is **80% / 1.5%,** or **53.** Therefore, it is at least **50 times** more expensive and less cost-effective to mitigate CO_2emissions by typical measures such as Australia's carbon tax than to take no action at all today and, instead, to meet the later and far lesser cost of climate-related damage that 3 C° unabated 21st-century warming might cause.

METHOD

From the fraction of global CO_2 emissions a mitigation scheme will abate over its term, establish the fall in CO_2 concentration and hence in CO_2 forcing the scheme will achieve at the end of the term. Multiply the abated CO_2 forcing by a climate-sensitivity parameter suitable to the term to obtain the global warming the scheme will abate by the end of the term. Establish the cost of the scheme and divide it by the abated warming to obtain the scheme's mitigation cost-effectiveness per degree of warming abated. Multiply the mitigation cost-effectiveness by projected global warming over the term to obtain the cost of abating that warming by worldwide measures whose cost-effectiveness is equivalent to that of the scheme. Compare this global abatement cost with the benefit in the cost of avoiding predicted global warming over the term.

REFERENCES

Boden and Marland, 2010a. Global CO_2 Emissions from Fossil-Fuel Burning, Cement Manufacture, and Gas Flaring, 1751-2007. Carbon Dioxide Information and Analysis Center, Oak Ridge, Tennessee, USA.

Boden *et al.*, 2010b. Ranking of the world's countries by 2007 total CO_2 emissions from fossil-fuel burning, cement production, and gas flaring. Carbon Dioxide Information and Analysis Center, Oak Ridge, Tennessee, USA.

Conway, T., & P. Tans, 2011, Recent trends in globally-averaged CO_2 concentration, NOAA/ESRL, http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html#global.

Garnaut, R., 2008. The Garnaut Climate Change Review: Final Report. Cambridge University Press, Port Melbourne, Australia, 680 pp, ISBN 9780521744447.

HadCRUt3gl, 2011. Monthly global mean surface temperature anomalies, 1850-2011. http://www.cru.uea.ac.uk/cru/data/temperature/hadcrut3gl.txt.

IPCC, 2001. Climate Change 2001: The Scientific Basis: Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA.

IPCC, 2007. Climate Change 2007: the Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007 [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Avery, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA.

Monckton of Brenchley, C.W., 2013. Is CO_2 mitigation cost-effective? Proceedings of the 45th (2012) Seminars on Planetary Emergencies, World Federation of Scientists, Geneva, Switzerland, and Erice, Sicily.

Murphy, 2008. Some Simple Economics of Climate Changes. Paper presented to the MPS General Meeting, Tokyo, September 8.

Myhre *et al.*, 1998. New estimates of radiative forcing due to well mixed greenhouse gases. Geophysical Research Letters 25:14, 2715–2718, doi:10.1029/98GL01908.

Parliament of the Commonwealth of Australia, 2011, Exposure Draft of the Clean Energy Bill. http://www.climatechange.gov.au/government/submissions/clean-energy-legislative-package/~/media/ publications/clean-energy-legislation/exposure-draft-clean-energy-bill-2011-pdf.pdf.

Stern, N., 2006, The Economics of Climate Change: The Stern Review. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA.

Wong, P., 2010. Portfolio Budget Statements 2010-11: Budget-Related Paper No. 1.4. Climate Change and Energy Efficiency Portfolio, Commonwealth of Australia, Canberra, Australia.

World Bank, 2011. Gross Domestic Product 2009, in *World Development Indicators 2009.* http://siteresources.worldbank.org/DATASTATISTICS/Resources/GDP.pdf.

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