How Cheap is Energy Efficiency? 
*A Critical Analysis of the McKinsey Report*

The McKinsey consulting company has produced a number of country-specific studies of energy efficiency potential and greenhouse gas (GHG) abatement potential that have been highly influential in policy discussions in both the US and other jurisdictions. Generally speaking, these reports conclude that significant emissions reductions can be achieved at a low cost to society, and that profitable energy efficiency improvements are the reason. The results suggest that energy efficiency measures should be emphasized as a response to climate change, and that GHG emissions can be reduced substantially without implementing strong regulatory or emissions pricing policies.

The McKinsey findings are consistent with other studies conducted using a bottom-up methodology that dates back to the work of Lovins beginning in the 1970s. Research over the past two decades, however, has identified shortcomings with the conventional bottom-up approach, and this has led to the development of new analytical frameworks that are referred to as hybrid energy–economy models. Using the CIMS hybrid model housed at EMRG, Rose Murphy and Mark Jaccard conducted simulations for comparison with the McKinsey report of 2007 on GHG abatement potential in the US. (In press, *Energy Policy*, doi:10.1016/j.enpol.2011.08.033; contact M. Jaccard for more information)

Like a bottom-up model, CIMS represents specific technologies that produce and consume energy. Unlike a conventional bottom-up model, however, it is integrated, and therefore accounts for the impacts that individual actions to improve energy efficiency or reduce GHG emissions can have on each other. CIMS incorporates parameters that represent the behaviour of consumers and firms in the marketplace. Conventional bottom-up models, on the other hand, lack behavioural realism because they rely on life-cycle cost calculations that ignore risk and quality differences between technologies (they also do not take into account different circumstances and perceptions across different consumers and firms). Technologies that are available to reduce energy use or GHG emissions often have higher up-front costs and/or are new to the market, both are factors that increase the risk to the purchaser.

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Some of these technologies – efficient lighting technologies vs. incandescent bulbs, public transit vs. an SUV, etc. – are of lower quality in the eyes of the consumers meant to adopt them.

Our simulations with CIMS suggest a more modest potential to reduce greenhouse gas emissions at a given marginal cost than McKinsey, as well as a smaller contribution from energy efficiency relative to other abatement opportunities such as fuel switching and carbon capture and storage. We hypothesize that these differences are the result of the methodological innovations that were incorporated into CIMS and other hybrid energy–economy models to address problems with the conventional bottom-up approach. In particular, that CIMS accounts for preferences related to risk and quality in its technology cost calculation.

To test our hypothesis, we made a series of changes to CIMS to attempt to “undo” these innovations to the extent possible. Figure 1 presents marginal GHG abatement cost curves for 2030 for the US economy generated using CIMS alongside least-cost abatement curves based on the McKinsey report. At the positive carbon prices tested, abatement potential estimated in the modified version of CIMS is higher than in the original version, and falls roughly halfway between the McKinsey mid- and high-range cases. We also estimated contributions from different categories of abatement opportunities in the CIMS and McKinsey analyses, as illustrated in Figure 2. The share of emissions reductions from energy efficiency in the modified version of CIMS doubled relative to the original simulation, bringing it close to the share estimated for McKinsey.

Our results suggest that the low cost estimates provided by McKinsey are explained by assumptions about costs and risks that have been refuted to a considerable degree by research leading to the development of hybrid models. Bottom-up studies such as those produced by the McKinsey group may lead to decisions in the US and elsewhere in favour of policies that place too much emphasis on energy efficiency, and that are not comprehensive or stringent enough to reduce GHG emissions substantially.
As part of the B.C. carbon tax project funded by the Pacific Institute for Climate Solutions (PICS), Katya Petropavlova (Ph.D. student) and Matt Horne (Director, Pembina Institute) have been exploring public and stakeholder perspectives on British Columbia’s carbon tax policy, potential cap-and-trade, and the issue of climate change mitigation. A combination of public polling and stakeholder interviews has been used to identify the key perspectives and shape the design of B.C.’s carbon tax post 2012, when the current schedule of carbon tax increases, low-income tax credits, and personal and corporate income tax reductions come to an end.

A public poll of 830 British Columbians (reflective of B.C.’s actual regional, gender, and age composition) was conducted in April 2011 and demonstrated that the people of B.C. are concerned with global warming (69%) and think that the province should remain a leader in reducing pollution that causes global warming (70%). Although B.C. is already ahead of other jurisdictions in addressing climate change, the majority of British Columbians (52%) believe that the B.C. government’s current approach to climate change is not tough enough, with 36% of people considering it being “about right”. British Columbians feel that greenhouse gas reduction actions contribute to the economic growth (36%) in B.C. or have little or no impact on the economy (44%). In relation to B.C.’s carbon tax policy, British Columbians believe that it has had positive (33%) or neutral (41%) consequences for the province. Instead of applying the carbon tax only to fossil fuel combustion, the public feels that the carbon tax should cover all sources of pollution causing global warming (69%). Moreover, British Columbians would like some carbon tax revenue being used for government priorities, such as health care and education (56%), and greenhouse gas reducing (‘green’) projects (49%). The currently utilized revenue-recycling mechanism (i.e. returning revenues through individual and corporate income tax cuts) follows these revenue investment options and is ranked third in popularity. 71% of poll participants believe that carbon taxes are one of the three top ways for the government to collect tax revenue, with the most preferable revenue source being corporate income taxes (92%). British Columbians expressed some support (29%) for carbon tax increases after 2012, with the majority (51%) favouring no further tax increases.

To determine the main perspectives of stakeholder groups, 40 in-person and phone interviews were conducted between June and October of 2011. Some of the constituencies interviewed included large and small emitters (ranging from agriculture sectors to oil and gas extraction industries), clean technology sector, local governments, academics, institutions, public interest groups, and media experts. The interview questions were semi-structured to maximize the value of responses through open-ended questions and to benchmark some of the answers with public polling results through multiple choice questions. The questions addressed both the current and future design of the carbon tax policy and the potential cap-and-trade system as part of the Western Climate Initiative. To ensure accuracy of the results, interview notes have been recently sent to the project participants for their final review. A public report and an academic paper will be prepared to gather the range of perspectives, and ultimately help decision-makers determine the tradeoffs between different policy designs and prepare a post-2012 carbon tax policy schedule.
New Students

Jeff Rambharack - PhD Candidate

Jeff is originally from Toronto, Ontario, and obtained his B.A.Sc. in Systems Design Engineering from the University of Waterloo. Following graduation, he worked as a Program Manager for Microsoft Office at Microsoft, and many of his features can be found in the 2007 and 2010 versions of the product. He returned to school to complete an interdisciplinary M.Sc. degree in Sustainable Energy Development at the University of Calgary, seeking ways to apply his experience with technically complex problems, design, and project management to the challenging resource and environment problems facing society. He came to the EMRG group at Simon Fraser to focus specifically on energy-economy modelling and policy analysis.

Off-campus, Jeff is a classical guitarist, an avid reader, an amateur beer-brewer and winemaker, a player of German board games, and a fan of any way to spend time outdoors.

Maximilian (Maxi) Kniewasser - Masters Student

I was born in Germany and lived there for 14 years. My family and I moved back to Canada and I went to high school on Vancouver Island and in Ottawa. After a few detours I ended up at McGill University in Montreal, where I completed my B.Sc. The past few years I spent in the mountains of BC, skiing, biking and paddling. I am very excited to be in Vancouver and start a new (learning) adventure with the EMRG group.

Danette Moule - Masters Student

Originally from Nelson, BC, but having spent my school years in Calgary, I decided to move back to my beautiful home of BC at the end of 2007. In Calgary, I completed my B.A. in Applied Policy Studies, then worked for a short period of time for a local ENGO, focusing on land use and oil sands issues. Since moving to Vancouver, I have been consistently involved in the environmental field through volunteer work. I became familiar with REM and Mark Jaccard’s work while in Vancouver, and my goal became to join the EMRG team. I’m thrilled to be here, and am excited for what the next couple of years will bring. As hobbies, I thoroughly enjoy the outdoors (skiing, snowboarding, mountain biking, hiking, scrambling, and anything else), playing my piano, reading, writing, and constantly learning. I’m also extremely interested in health and nutrition.

George Kamiya - Masters Student

George Kamiya comes to REM/EMRG with experience in a range of environmental issues. He has worked for Environment Canada and the Vancouver Airport Authority on air emission reduction projects and environmental assessments/monitoring of construction projects. Most recently he worked on pesticide compliance projects with Health Canada in Ottawa. George has a Bachelor of Science in Marine Biology from UBC.

George’s interests include sports (volleyball, softball, golf, and squash), classical music, travel, food and photography. He was able to combine most of these on recent trips to Germany and Malaysia where he performed with his piano quartet.

Jeremy Moorhouse - Masters Student

I grew up in Toronto before moving to Montreal to study Mechanical Engineering. I graduated with a Bachelor’s Degree in Mechanical Engineering. For the past years I’ve been working for the Pembina Institute’s Corporate Consulting group in Calgary. My work focused on comparing commercial and emerging energy technologies and energy systems using life cycle assessment, especially in the oil sands sector. I’ve joined REM and EMRG to expand my knowledge of economic and public policy influences on energy technologies and energy systems. Outside of school I like to hike, bike, canoe, travel, cook and read.