

## **SLOWING, THEN REDUCING, GREENHOUSE GAS EMISSIONS IS IMPORTANT BUT WILL NOT BE EASY**

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**C**limate change is an important, long-term issue of public policy — arguably a dominating and defining one for the twenty-first century. Given what we are learning about the science of climate change, we can anticipate that the issue will be of increasing public concern and a thorn in the side of those charged with creating Canadian public policy. Presently, all five federal parties (including the Green Party) rank climate change high on their political agendas.

Unfortunately, Canadian public policy has failed to come to terms with the fact that stabilizing climate is a truly daunting, long-term energy technology problem. The blind adherence of the previous Liberal government to Kyoto targets — which were both unachievable and, in climate change terms, essentially meaningless — has continued to infect climate change debate.

These opening remarks reflect what I bring to an assessment of “Canadian Policies for Deep Greenhouse Gas Reductions,” Mark Jaccard and Nic Rivers’ contribution to this volume. I will argue that the package of proposals vetted by the authors, while not without its faults, is one of the more sensible — and, in some respects, novel — to be suggested in the Canadian context. But I will also argue that although these proposals, if enacted, would undoubtedly make a huge dent in emissions from a correctly specified emissions baseline, it is important not to overstate what they can actually do to reduce emissions from current levels.

### **CRITERIA AND INSTRUMENTS**

**A**fter offering a brief introduction to the climate change issue, Jaccard and Rivers set out criteria for choosing among climate change policies and several possible instruments for implementing policy actions. The criteria include the usual suspects: effectiveness, efficiency, acceptability and administrative feasibility. But the authors wisely warn that other considerations must not be overlooked, including Canada’s

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multiple jurisdictions over the environment and the need to account for decision-making with uncertainty.

With regard to policy instruments, the authors' list amounts to the regular litany: command-and-control regulations, emissions cap and permit trading, greenhouse gas (GHG) taxes, subsidies and voluntarism. For all the right reasons, Jaccard and Rivers rule out subsidies (a costly method of accomplishing very little, or even doing the wrong thing) and voluntarism (we've tried that, and it doesn't work). As they make clear, we need a positive price for carbon, not a neutral (voluntarism) or negative (subsidies) one. However, I would have liked the authors to explain that their discussion of subsidies really applies to production subsidies. The emphasis on these types of subsidies (for example, to wind power and ethanol production) is as opportunistic — and scandalous — as the subsidies themselves are popular. In contrast, certain subsidies may be justified on the grounds that they promote a traditional public good or externality: subsidies to basic research and development for new energy technologies and sources; subsidies to the development of enabling technologies, such as storage for intermittent wind and solar energies, and smart grids to handle variable supplies as well as demands for electricity; and even some capital subsidies.

One novel inclusion in Jaccard and Rivers' list of instruments is a system of obligation and certificate trading (OCT). Although superficially similar to the emissions cap and tradable permit (ECTP) system, the two are quite different. Jaccard and Rivers point out that whereas ECTP "regulates a maximum amount of an undesirable product (emissions)," OCT "requires a minimum amount of a desirable product or process" (83) (presumably emissions reduction). Avoiding the highly controversial and inevitably political issue of how to allocate permits to produce a "bad," OCT instead grants certificates to firms when they produce a "good." But OCT does not wholly avoid the high costs of administration, monitoring and enforcement to which ECTP is subject. These costs would increase as the number of units with obligations rises. The discussion of this issue is not an idle one: Jaccard and Rivers propose to employ OCT as an integral part of two of their emissions-reducing initiatives. In my view, an initially low, gradually escalating carbon tax, combined with a research and development energy technology policy, would surpass by a wide margin either ECTP or OCT.

### POLICY ACTIONS

**J**accard and Rivers propose three policies to reduce GHG emissions by 2050: a carbon management standard for fossil fuel producers and importers; a vehicle

emission standard; and strengthened appliance and building standards. Before discussing these, I would like to register my support for the approach the authors have taken. With its focus on important potential undertakings, it stands in contrast to Canadian climate policy through 2005. The focus of that policy was on hard, near-term, quantitative emissions reduction targets — a legacy of our obsession with Kyoto. That obsession with targets led us to make commitments that Thomas C. Schelling has described as not generally “credible” (1992, 2005). At the same time, for all intents and purposes we have ruled out price-based instruments (for example, carbon taxes) as opposed to quantity-based instruments (emission permits, tradable or not). In contrast, Jaccard and Rivers suggest policy actions — commitments that may be credible in Schelling’s terms and that could have important emissions-reducing impacts over time (although they would not likely meet hard, near-term targets).

#### A carbon management standard

Jaccard and Rivers would require fossil fuel producers and importers to “ensure that a growing fraction of the carbon they extract from the earth’s crust does not reach the atmosphere” (92). To achieve this goal, the authors would employ an OCT system. Instead of allocating permits to firms, government would collect from firms certificates that matched their emissions reduction obligations. Those obligations would be measured in terms of a percentage of carbon fuels, rather than in absolute terms, thus relaxing the emissions constraint somewhat if consumption of fossil fuels grows (as it will). Firms that failed to comply would be subject to stiff penalties, but a safety valve would be added in the form of government-issued certificates sold at a pre-determined price if the fossil fuel growth rate was faster than anticipated, or if abatement costs were significantly higher than expected.

The authors’ approach to implementing a carbon management standard is novel, and it would seem to be a workable means of inducing carbon capture and storage (CCS) at electricity generating plants and fossil fuel production sites such as the Alberta oil sands. But it is less easy to discern how it could be applied to fossil fuel producers who sell (mainly oil and natural gas) downstream to final energy users — homes, buildings and factories — that employ these energy sources for heating, transportation and various industrial functions. One may reasonably ask how upstream producers and importers can be held responsible for the downstream use of their fuels. To be sure, the authors appear to be mainly considering CCS at power plants and plants in energy-intensive industries, and the capture of fugitive emissions from coal mines, oil and gas wells and natural gas pipelines. But then why do they include importers, and

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why do they limit certification to fossil fuel producers and ignore those whose activities directly generate fossil fuel emissions? In some cases, it would make more sense to move certification responsibility downstream to the power plant and pipeline levels.

### A zero-emission vehicle standard for vehicle manufacturers

The second initiative that Jaccard and Rivers suggest is a vehicle emission standard (VES) that “requires vehicle manufacturers and importers to sell a minimum number of zero-emission vehicles by a target date as a percentage of total vehicle sales” (95). Again, the instrument of choice is obligation and certificate trading. The minimum market share of zero-emission vehicles (ZEVs) would rise over time. The authors argue that the VES “accelerates the process of developing, commercializing and disseminating low-emission vehicles” (95), and they cite the VES policies of California as a model.

Jaccard and Rivers make a strong case that we need to tackle the transportation vehicle sector if we are to see significant emissions reductions by 2050. Nevertheless, I have some reservations about their approach. The most important of these is that “zero-emission vehicle” is a misnomer if we consider the life-cycle, or well-to-wheels, analysis. Electric cars or plug-in hybrids require recharging, which would increase emissions if the electric power was generated by fossil-fuel-fired plants. If the authors are assuming that the generating-plant emissions would be subject to CCS, then they should make it clear that their ZEV proposal depends heavily on the viability of their proposed carbon management system and its unlimited capacity to scale up.

Moreover, if the ZEV proposal is based on ethanol and other biofuel usage, or on hydrogen, then life-cycle analysis takes on added importance. In the case of biofuels, a great deal of energy is needed to produce the inputs that go into ethanol and bio-diesel and then to convert these into liquid fuels. Some evidence suggests that the energy required to produce ethanol (including the energy used in the production of the input — corn) actually exceeds the energy content of the ethanol, resulting in negative net energy (Pimentel and Patzek 2005), while others have found slightly positive net energy (Farrell et al. 2006; Tilman, Hill, and Lehman 2006). In any case, if fossil fuels are used in the life-cycle biofuel production process, then the resulting emissions must be taken into account, or else somehow captured. If the fuel of choice is hydrogen, it is important to consider how the hydrogen is produced. If it is produced by reforming natural gas or by a process that gasifies coal, then emissions will be created unless the CO<sub>2</sub> (carbon dioxide) is captured. Thus, a ZEV is much better described as a low-, or lower-, emission vehicle.

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Frankly, I would place greater emphasis on enhanced vehicle fuel efficiency standards. Presumably, Jaccard and Rivers have, like almost all economists, rejected fuel efficiency standards because they do not focus on emissions reduction and create a rebound effect — by increasing fuel efficiency, they lower the cost of vehicle use and increase kilometres driven, thus cutting into the emissions reduction effect. While this is quite true, a fuel efficiency standard (such as the US Corporate Average Fuel Economy, or CAFE) has legs: it is more easily administered and enforced than a VES (assuming the light-truck loophole in CAFE is closed); and it can largely preclude the rebound effect if accompanied by a low, but increasing, carbon tax.

### Building and appliance standards

The third set of policies that Jaccard and Rivers propose are residential and commercial building codes and appliance and equipment standards. The authors argue that the “most cost-effective way to lower GHG emissions in the building stock (through energy efficiency and fuel choice) is by means of design and construction” (97). Their assumption is that design and construction influence the amount of energy used in heating and air conditioning, lighting, water heating and the like. I believe they are right, and a corollary to this (which they do not mention) is that it is much more cost-effective, and probably more energy-effective, to apply building standards when constructing new buildings, just as setting standards for new appliances and equipment is much more cost-effective than retrofitting existing ones.

As my final comment regarding the VES proposal suggests, I support the use of efficiency standards, including those for new buildings and appliances. Jaccard and Rivers note that although “Canada has relatively strong efficiency standards for some equipment” (98), there is still much room for improvement. Let me highlight two initiatives that the authors do not mention. One involves washing machines. Currently, most washing machines are top-loaders, although a growing number are front-loaders. Front-loaders are more energy-efficient because they use 30 to 40 percent less hot water. If Canada simply legislated that after, say, 2009, no top-loading washers could be sold in Canada, a small but important improvement would be made in the energy efficiency of household appliance use. The second initiative would be to require that when new buildings are under construction, pipes be sunk into the ground to facilitate geothermal means of climate control (heating in winter, cooling in summer). Of course, neither initiative allows us to predict emissions reduction over the short term, which is one reason why such obvious contributors to long-term emissions reduction get short shrift now that the pressure is on to achieve Kyoto-type targets.

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**RESULTS**

In the final pages of their chapter, Jaccard and Rivers project the impact of their proposed policies. They detail their results in table 5 and summarize them in figure 3 — in both cases dealing exclusively with energy-related emissions. In the table and the figure, the authors make comparisons for both business-as-usual (BAU) and policy-related GHG emissions for 2050, using 2010 as a base year. The projected reductions are large, regardless of base or baseline. Table 5 indicates that the authors believe that especially large reductions can be achieved in the sectors of electricity generation, oil and gas production, energy-intensive industry and transportation. The estimated reductions are great enough to suggest the possibility of overstatement. Setting this concern aside, I nevertheless have reservations about the way in which Jaccard and Rivers calculated the BAU 2050 emissions level in their policy scenario.

According to the authors, emissions in 2010 will be 713 megatonnes of CO<sub>2</sub> equivalent, which implies an average annual growth rate in energy-related emissions of 2 percent from 1990 to 2010. They estimate that BAU emissions will be 1,157 megatonnes in 2050. That implies a 1.2 percent average annual rate of GHG emissions growth from 2010 to 2050 (using the authors' base of 713 megatonnes in 2010). What is not clear is why the no-policy growth rate of energy-related GHG emissions is so much lower for 2010-50 than the 2 percent rate for 1990-2010, a rate that would have raised energy-related emissions to around 1,574 megatonnes in 2050 as compared with Jaccard and Rivers' 1,157 megatonnes.

The authors imply that their policies can reduce energy-related GHG emissions in Canada to 357 megatonnes by 2050 — that is, by 356 megatonnes from their 2010 base of 713, and by 800 megatonnes from their 2050 BAU baseline of 1,157. Even assuming that their policy actions are capable of reducing GHG emissions by 800 megatonnes from baseline in 2050, the foregoing analysis suggests that there is plenty of room for doubt that energy-related emissions will be reduced to 357 megatonnes by that time.

Since Jaccard and Rivers are attempting to estimate the emissions reductions that flow directly or indirectly from energy technology changes, they would have done better to employ a "frozen technology" baseline (Edmonds and Smith 2006) — that is, a baseline that indicates emissions in the absence of energy technology change. A frozen technology BAU emission baseline for 2050 also avoids inadvertent double-counting of technologies (once in the baseline, and once in the policy emissions scenario). By using such a baseline, we would see emissions grow roughly at the rate of GDP. (I say "roughly," because changes

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in industry structure can alter somewhat the energy intensity of the economy. Calculations suggest that, on a trend basis, the structural factor constitutes 10 to 30 percent of trend energy intensity decline.) If the trend rate of GDP for the period 2010 to 2050 were 2.5 percent, and frozen technology emissions grew at a rate of 2 percent (allowing for structural factors to contribute 20 percent of the differential between GDP and GHG emissions growth), BAU emissions in 2050 would be 1,567 megatonnes. An 800-megatonne reduction (if achievable) from a 1,567-megatonne baseline would imply energy-related emissions in 2050 of 767 megatonnes — almost 24 percent higher than the 2004 level of 620 megatonnes, and more than double the 357-megatonne level that the authors say their policies can achieve.

### CONCLUSION

Jaccard and Rivers have provided us with a useful set of policies with which to tackle a very important long-term problem. I think that their focus on appropriate policy actions rather than targets is a breath of fresh air. While I have raised some concerns with aspects of two of their policy actions, I think their determinations of where Canada can make important contributions to GHG reduction are good ones. However, I believe that their projections of where GHG emissions will be in 2050 are rather optimistic. Be that as it may, climate change deserves a high rank in the Canadian Priorities Agenda, and the policy actions presented by Jaccard and Rivers, with some modifications at the margin, could put us on a path to GHG emissions reduction.

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