AN ENERGY POLICY ESSAY

Revenue-Neutral Carbon Taxes in the Real World

Insights from British Columbia and Australia

by Jeremy Carl and David Fedor

Shultz-Stephenson Task Force on Energy Policy
www.hoover.org/taskforces/energy-policy

task force on energy policy

Introduction

While the scientific and economic implications of climate change remain highly contested, the idea of a net revenue-neutral tax on carbon dioxide emissions has been proposed by a number of economists from across the ideological spectrum as one possible way to help level the playing field among different sources of energy by accounting for the potential externalities of carbon emissions. At the same time other economists have criticized carbon pricing, both from the right and the left, as either a utopian scheme inappropriate to address a global problem or as a band-aid that will not fundamentally limit carbon emissions. In a revenue-neutral carbon tax regime, all revenues generated from taxes on carbon emissions would be directly returned to the taxed economy through an equivalent reduction in other existing taxes or through direct payments to taxpayers. Depending on the particular structure utilized, these may be referred to as a "revenue-neutral carbon tax" or a "carbon tax shift/swap" or a "carbon fee and dividend".

What the arguments for such a policy structure, both pro and con, have often lacked is detailed analysis of the performance and design of revenue-neutral carbon taxes in the real world. This paper attempts to address that gap. It examines the revenue-recycling carbon pricing mechanisms already enacted in British Columbia and Australia in order to assess their approach and efficacy.

Modern Carbon Tax Forays: British Columbia and Australia

The Canadian Province of British Columbia was an early adopter of a revenue-neutral carbon tax that directly recycles 100% of the revenue it generates. British Columbia now has four years of experience on carbon tax implementation and revenue distribution. Australia, after years of discussion with stakeholders from across the

HOOVER INSTITUTION
STANFORD UNIVERSITY

economy, has now designed and implemented a partially-revenue-recycling carbon tax from July 2012. Though both regions adopted broad-based taxes on greenhouse gas (GHG) emissions, they have chosen different design and implementation strategies that reflect their respective existing political, economic, and energy use characteristics.

Taken together, the British Columbian and Australian choices help to illustrate the spectrum of options, dynamics, and pitfalls that can be anticipated by other regions such as the United States that have not yet decided whether or how to value the potential negative externalities of GHG emissions. Key issues include where to apply or exempt a carbon tax within an economy, how to distribute carbon tax revenues, the relationship between carbon and other taxes, and the robustness of the carbon tax to stakeholder petitioning during design or implementation. To this last point, British Columbia presents the very rare case of a straightforward and relatively transparent revenue-neutral carbon tax that has so far managed to avoid major dilution from impacted stakeholders. Australia's proposal, on the other hand, reflects the political challenges of effectively enacting such a tax on carbon-intensive economy while upholding free-market principles. Following these investigations, we offer the case of the United States and consider at a high level how experiences abroad may or may not be relevant given the unique conditions here.

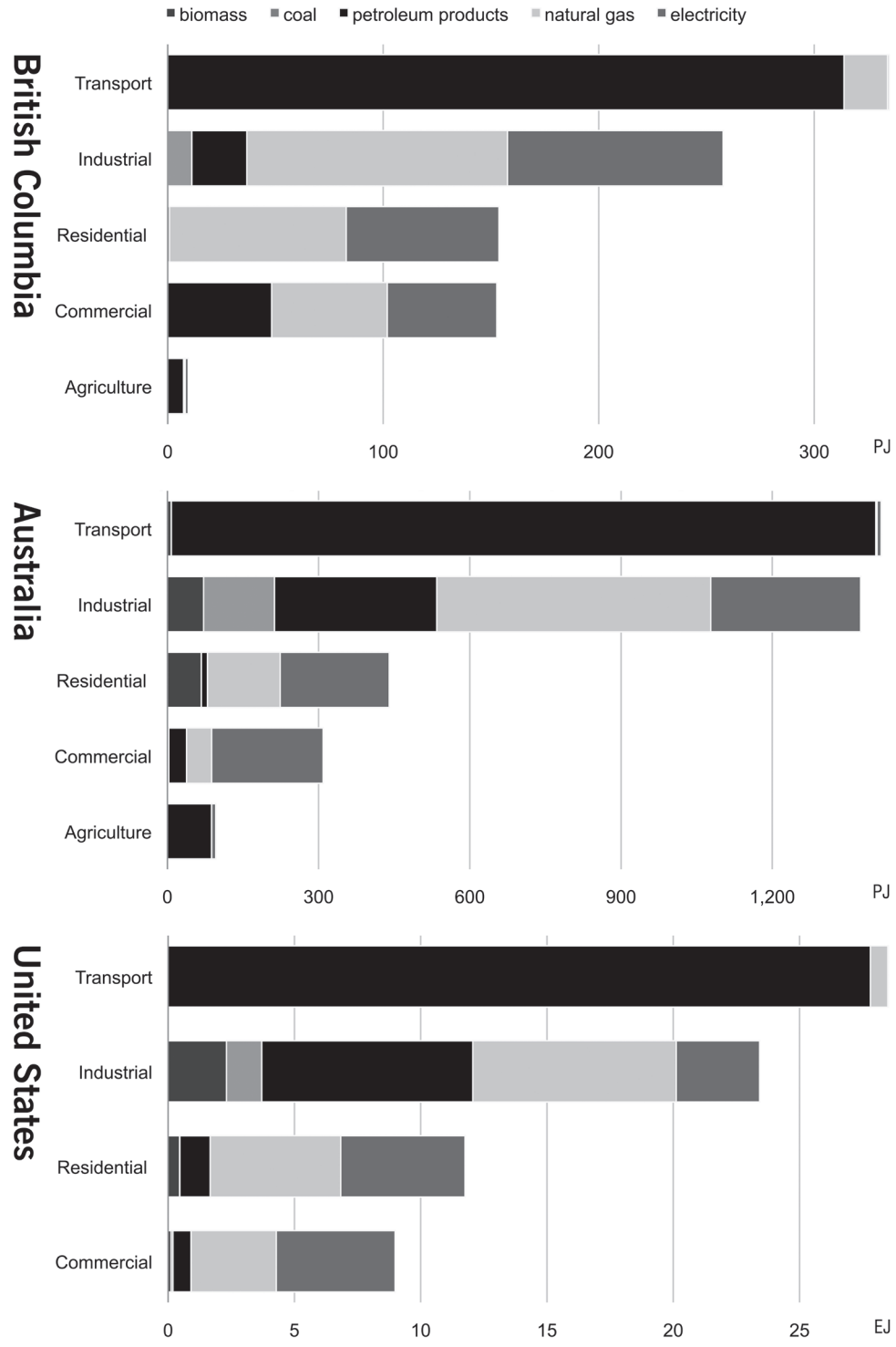
British Columbia presents the very rare case of a straightforward and relatively transparent revenue-neutral carbon tax that has so far managed to avoid major dilution from impacted stakeholders.

REGIONAL ECONOMIC, ENERGY, AND GHG EMISSION CHARACTERISTICS

	British Columbia	Australia	United States	
General				
GPD per Capita	37,200	44,600	46,000	*exchange rate, y2009 USD per person*
Primary Energy Use per Capita	0.20	0.28	0.33	*TJ per person*
Carbon Dioxide Emissions per Capita	11.3	18.8	17.7	*metric tons per person*
Carbon Intensity of Final Energy	56.4	108.1	74.7	*metric tons per TJ*
Carbon Intensity of Economy	0.305	0.406	0.384	*metric tons per 1000 y2009 USD*
Average Residential Electricity Price	0.09	0.20	0.12	*y2010 USD per KwH, not including carbon price*
Average Residential Natural Gas Price	12.50	20.10	11.80	*y2010 USD per mmBTU, not including carbon price*
Average Retail Price of Mid-Grade Gasoline	3.60	3.67	2.40	*y2009 USD per gallon, including taxes but not carbon price*
Passenger Vehicle Travel Demand	5,070	4,620	9,540	*passenger-vehicle-miles per person, data for 2007*
GHG emission inventory				
Electricity and Heat Generation	2%	38%	33%	
Transport	39%	15%	26%	
Manufacturing, Construction, Other Industrial	13%	8%	14%	*direct energy use only*
Residential, Commerical, Agricultural	12%	4%	9%	*direct energy use only*
Fossil Fuel Production and Refining	11%	4%	3%	*US figure estimated*
Non-Energy Emissions	15%	26%	13%	
Fugitive Emissions	9%	7%	6%	
Electricity supply mix				
Coal	0%	75%	44%	
Natural Gas	4%	15%	25%	
Oil + other	4%	2%	1%	
Nuclear	0%	0%	20%	
Hydro + Other Primary Renewable	90%	8%	11%	

Source: Data for 2009, compiled by the authors from national statistics and energy information bureaus; GHG data are from national inventory reports to the UNFCCC.

Sectoral Final Energy Use (2009)



Source: charts by the authors with data compiled from: Statistics Canada (2011) Report on Energy Supply and Demand in Canada, 2009 Preliminary. Catalogue #57-003-X; ABARE (2011) Energy Update 2011. Australian Government; US EIA (2010) Annual Energy Review 2009. US Department of Energy.

BRITISH COLUMBIA

Policy Design

British Columbia's carbon tax policy, originally put forward by the center-right Liberal Party of Canada, was implemented in 2008 amid broader provincial tax reforms and continues to this day. The tax, which began at CAD $10 per metric ton carbon dioxide and has since risen to CAD $30, is implemented through a fuel-specific volumetric tax applied the first point of entry or sale and is allowed to filter broadly through the economy. Carbon tax revenues offset existing provincial personal and corporate taxes and now represent about 4% of the total government budget. The tax's relatively simple structure allows very few exemptions or protected entities, and provincial economic growth has so far exceeded the Canadian average over the tax's implementation period. Public and political acceptance for the measure is generally good amid British Columbia's electorate; after five years of experience, however, some tensions have formed over the tax's future form and direction. Though the policy's impact has not been comprehensively modeled, a June 2012 report by the British Columbia government indicates that provincial carbon emissions and fuel use fell relative to historical and broader Canadian trends over the policy's early years.

The tax's relatively simple structure allows very few exemptions or protected entities, and provincial economic growth has so far exceeded the Canadian average over the tax's implementation period.

In originally introducing this so-called "carbon tax shift", the British Columbia Ministry of Finance laid out five broad implementation principles:

1. "All carbon tax revenue is recycled through tax reductions"

The policy includes a legal requirement to demonstrate how all of the carbon tax revenue is returned to provincial taxpayers. The primary mechanisms for this are broad reductions in personal and corporate income tax rates supplemented by direct annual payments to low-income households. A cautious approach toward returning carbon tax revenue has meant that the carbon tax has in fact been revenue-negative in each year for the British Columbia government; income tax reductions are set in advance of tallying annual carbon tax receipts and are calibrated based upon economic forecasts, which creates some uncertainty in the final net revenue level.[1] Nominal net tax refund in the first four years of the program exceed CAD $500 million (an equivalent, on a population basis, of a USD $35 billion refund on a nationwide carbon tax in the United States).

Specific historic carbon tax revenue receipts and recycling tax measures are described in the table below. Note the gradual growth in gross carbon tax revenue over time and

the shares of tax benefits and dividends distributed through various mechanisms to business and individuals; total business tax benefits have generally exceeded those for individuals. This has recently become a point of public discontent as some now feel that provincial businesses got too good of a "deal" with the carbon tax's corporate tax breaks. The table also indicates how tax benefits were gradually ramped up alongside the increasing carbon tax, "rewarding" British Columbians in stages as policy implementation progressed:

	FY 2008/9 @ $10/ton	**2009/10** $15/ton	**2010/11** $20/ton	**2011/12*** $25/ton
Gross Carbon Tax Revenue (million CAD)	**$306**	**$542**	**$741**	**$960**
Individual benefits				
Low income climate action tax credit	–106	–153	–165	–188
Reduction of 2% in the first two personal income tax bracket rates				
Reduction of 5% effective Jan 2009	–107	–206	–207	–218
Northern and rural homeowner payment of CAD $200			–19	–75
Individuals' share of carbon revenue	*70%*	*66%*	*53%*	*50%*
Business benefits				
General corporate income tax rate cut from 12% to 11%				
To 10.5% effect Jan 1 2010				
To 10% effective Jan 1 2011	–65	–152	–271	–381
Small business corporate tax rate cut from 4.5% to 3.5				
To 2.5% effective December 2008	–35	–164	–144	–220
Industrial property tax credits		–54	–58	–68
Farm property tax credits			–1	–2
Business' share of carbon revenue	*33%*	*68%*	*64%*	*70%*
Net Government Carbon Tax Revenue	**–$7**	**–$187**	**–$124**	**–$192**

Source: Table by authors, data compiled from yearly BC MOF budget and fiscal plans, with updates.
* Revised forecast from 2012 budget, subject to updates

2. "The tax rate started low and increased gradually"

The implementation of the carbon tax was staged over five years with the tax rising from CAD $10 to CAD $30 to allow time for British Columbians to adjust their energy use and to provide rate certainty. At its current CAD $30 rate, the tax is about CAD 25 cents per gallon of gasoline or CAD $1.58 per mmBTU natural gas.[2] As noted in the revenue chart above, tax revenue-recycling measures were also scheduled to increase alongside expected rising revenues from the carbon tax from 2008 to 2012, though the distribution of these recycling measures across different recipients changed with time. In 2010, average carbon tax payments were about CAD $200 per household, with a range of CAD $113 per household in the lowest-income 10% rising to CAD $300 in the top 10%, and CAD $617 in the top 1% of households.[3]

3. "Low-income individuals and families are protected"

Because direct energy costs make up a larger proportion of total income and spending for lower-income households, the British Columbia carbon tax policy aimed to use carbon tax revenues to compensate this population for what was otherwise considered to be a regressive tax burden with the intent that most low-income households would actually be better off under the carbon tax policy. As of July 2011, low-income households received a tax benefit of approximately CAD $115.50 per year for adults and CAD $34.50 for children, phased out above annual incomes of CAD $30,000 for individuals or $35,000 for families. This tax benefit is figured based upon previous year tax returns, and it piggy-backs on the existing Canadian federal general sales tax (GST) credit.

Other *ad hoc* compensation as part of the carbon tax policy included the introduction of a "northern and rural homeowner benefit" of CAD $200 per year to compensate these British Columbia residents who face higher annual home heating costs and a one-time initial direct "Climate Action Dividend" payment of CAD $100 to all British Columbia residents at the outset of the carbon tax policy's implementation (which was actually paid for by the previous year's general government surplus rather than carbon tax revenues).

4. "The tax has the broadest possible base"

The British Columbia carbon tax targets carbon dioxide, methane, and nitrous oxide that is created and emitted through the combustion of hydrocarbon fuels in all sectors of the economy. While not exhaustive, this gives the tax a relatively broad base, estimated to be approximately 70–75% of total provincial anthropogenic GHG emissions.[4] Emissions from biofuels, fuel sold to First Nations (Canadian indigenous) populations, fuel sold for international marine and air travel, non-energy sources (such as waste, agriculture, or industrial chemical reactions), and fugitive emissions are exempted. A fuel-specific tax, published by the government in the fuel's natural units, is applied at the wholesale level for fuel that is to be sold and combusted within the province and is administered similarly to conventional motor fuel taxes.[5] Businesses and individuals therefore both pay direct carbon taxes on fuel purchased for combustion within the province and are impacted by increased costs for intra-province embedded emissions in goods and services. Emissions which are "embedded" into a non-energy good or service produced outside of the province and imported to be sold within are not estimated or taxed, and non-energy goods or services produced inside the province for export are not refunded for the carbon tax paid to produce them. That is, in the interest of policy simplicity, there is little attempt to enact "border tax adjustments" for non-energy embedded emissions.[6]

5. "The tax will be integrated with other measures"

According to the British Columbia government, its carbon tax policy was created to help achieve previously established provincial GHG emission mitigation and climate change targets of 33% below 2007 levels by 2020 and an 80% reduction by 2050. At the

time of its introduction, however, it was noted that even at its highest scheduled level of CAD $30 per ton carbon dioxide-equivalent, the carbon tax alone would not be sufficient to meet these goals. It was therefore accompanied by a package of other targeted emission-mitigation policies and strategies, including a stated intent to join the proposed "Western Climate Initiative" cap-and-trade program with several Canadian provinces and western U.S. states at some future point.[7]

Region-specific Considerations

There are several different considerations that are unique to the British Columbia situation that are worth examining as context for its policy choices.

Extremely low-carbon electricity supply

Most importantly, 90% of British Columbia's electricity supply is generated from hydropower or other primary renewable resources that emit very little GHGs, and an even higher percentage of utility electricity distributed to individual consumers is carbon-free. This means that the British Columbia carbon tax policy essentially does not affect provincial electricity prices; most of its impact for individual households is on the price of gasoline used in private vehicles and natural gas used in home heating, and industrial or commercial electricity use is similarly unaffected in price. This variance is highly salient when attempting to extrapolate the viability of a British Columbia-style system to other regions.[8]

Moreover, on the supply side, this existing low-carbon electricity system meant that British Columbia was able to largely avoid having a concentrated carbon tax burden fall on fossil fuel-fired thermal power generators. This removed a key stumbling block that would be a policy design or political challenge elsewhere.[9]

Economic structure

British Columbia has been able to recycle carbon tax revenue to the business sector through a straight reduction in general corporate or small business income taxes. Since the 2009/10 carbon tax year, revenue recycling measures to the business sector have exceeded 50% of total revenue distributions, and in the 2011/2012 year business recycling measures were estimated to be 58% of total allocations, equal to nearly 70% of total collected carbon tax revenue.[10] Combined with a relatively non-concentrated GHG emission business profile, as described above, business acceptance of the carbon tax policy (coupled with business tax breaks) has seemed good—too good, perhaps, as corporate tax breaks have now come under popular fire as having been too generous. Exceptions are GHG-intensive export-oriented businesses, which must compete with out-of-province producers not facing British Columbia's carbon tax. In British Columbia, such industries include cement production and greenhouse growers. For the first time, in 2012, the British Columbia Ministry of Finance announced a one-time targeted relief grant of CAD $7.6 million to provincial greenhouse growers.[11]

Broader ongoing tax reforms

It is important to note that discussion around and implementation of the British Columbia carbon tax policy, attention-worthy on its own, was contemporaneous with broader dramatic tax reform within the province. In fact, considering the context, it seems unlikely that British Columbia could have accomplished its carbon pricing absent a larger tax reform that took political heat away from the carbon issue.[12]

In particular, British Columbia in the later part of the decade was party to Canadian efforts at the federal level to adjust disparate provincial sales tax systems into a more unified and consistent "harmonized sales tax" (HST) whereby taxes on goods and services at the provincial level would follow similar conventions to the existing federal "general sales tax" (GST) system. The aim of this was to simplify the tax code and reduce the compliance and bureaucratic costs of maintaining parallel systems, but it meant that tax burdens within a province would shift from the *status quo* across products and consumers. For our discussion, this is important because it meant that the carbon tax, though novel, was just one of many tax changes that British Columbians had to consider or be impacted by since 2008.[13] The HST caused substantial rifts in the ruling coalition which in many ways overshadowed the carbon tax's impact.

> Post the carbon tax, British Columbia has the lowest income tax for those making under CAD $120,000, corporate taxes that are the lowest in the G7, and small-business taxes that are the lowest in Canada.

Compared to existing motor fuel taxes

It is useful to consider British Columbia's total tax burden on gasoline and diesel in relation to the carbon tax, as motor fuel is a major incidence of the carbon tax burden and also is subject to numerous other revenue-raising taxes.[14] Given British Columbia's nearly carbon-free electricity system, motor fuels are the most salient manifestation of the carbon tax for individuals, yet even here the carbon tax's incidence is small compared to other motor fuel excise taxes and the short-term volatility in the underlying oil product price itself.

Apart from the provincial carbon tax, British Columbia motor fuels are subject to Canadian federal excise (motor fuel tax), a British Columbia Transportation Financing Authority tax, mass transit-funding taxes that vary by region within the province, and the Canadian GST. Taken together, this means that the provincial carbon tax level of CAD 8.5–25.2 cents per gallon over the 2008–2012 period has so far represented between just 6.1–12.1% of total gasoline taxes, or between 2.0–3.9% of the total price per gallon of gasoline in Vancouver.[15] This is a relatively small share of the existing motor fuel tax burden; in fact, in the Vancouver region, new increases in the local mass transit-funding excise tax on gasoline alone since the outset of the carbon tax policy nearly match the entire incidence of the gasoline carbon tax.[16]

AUSTRALIA

Policy Design

The Australian government implemented in July 2012 a broad-based tax on GHG emissions from about 350 of the country's largest GHG emitters as part of its climate change strategy. While not explicitly revenue-neutral, this tax policy stipulates that over 50% of carbon revenues will be directly returned to individual households through a combination of income tax breaks and direct payments and that 40% of carbon tax revenues will be dedicated to government spending programs intended to provide targeted assistance to particularly hard-hit business sectors. Similar to British Columbia, the Australian carbon tax has been implemented alongside a broader comprehensive multi-year tax system reform.[17]

The tax is set at AUD $23.00 per metric ton carbon dioxide-equivalent in 2012–13, rising to AUD $24.15 in 2013–14 and AUD $25.40 in 2014–2015 before a scheduled gradual transition to a market-based floating carbon price in 2015, potentially linked to an international carbon cap-and-trade system. Therefore, the set carbon tax is envisioned as just the first step of a two-stage carbon pricing policy in Australia.

Unlike the general fuel-focused British Columbia carbon tax, the Australian carbon tax is applied quite selectively throughout the economy. Only major emitters' GHG pollution is directly covered, though this coverage does include major non-energy and fugitive GHG emissions;[18] these top emitters, whose annual emissions in general exceed 25,000 metric tons per year of carbon dioxide-equivalent, represent about 60% of total Australian GHG emissions. The Australian carbon tax does not cover motor fuel used for on-road transport and also exempts the agriculture and land use sectors, though fuel used for commercial aviation, shipping, and rail services is set for inclusion.

Similar to British Columbia, the Australian carbon tax has been implemented alongside a broader comprehensive multi-year tax system reform.

Although direct final combustion of hydrocarbon fuels such as motor fuels, natural gas, or biomass by small-scale residential and commercial end-users is not directly affected by the Australian carbon tax, individual households are nevertheless expected to see increased consumer costs from higher carbon-intensive electricity rates and the embedded emissions of other goods and services produced within Australia (including, for example, domestically refined gasoline). The Australian government estimates that the consumer price index will rise by 0.7% in the first year as a result of the carbon tax. To address this, at least 50% of carbon tax revenues are allocated for "household assistance" to compensate households for these higher costs, with an average household compensation of about AUD $10.10 per week,

according to government estimates. Such household assistance includes: (1) increases in pensions, allowances, and "family payments", and; (2) income tax cuts for annual incomes less than AUD $80,000, including raising the tax-free threshold for lower income brackets.

Australian businesses do not receive a general corporate tax rate deduction funded through the carbon tax as in British Columbia, but 40% of carbon tax revenues have been allocated help major industries reduce emissions, especially those emission-intensive businesses that compete against untaxed foreign competitors.[19] This laundry list of sectoral carve-outs and targeted benefits is extensive, with the coal-fired power and metallurgic industries receiving a significant share of total benefits. These six spending categories, along with estimates of their fiscal impact, are enumerated in the table below. Note that, similar to the British Columbia case, the Australian government expects the entire carbon-tax program to actually be significantly revenue-negative (i.e. a tax cut):

	FY 2011/12	2012/13	2013/14	2014/15
Gross Carbon Tax Revenue (million AUD)		**$8,600**	**$9,080**	**$9,580**
Household Benefits				
Tax reforms		–3,350	–2,370	–2,320
Direct transfer payments (pensions, family payments, veterans, elderly)	–1,470	–746	–2,301	–2,380
Other (low carbon communities, household efficieny, household assistance)	–63	–100	–132	–125
Households' share of carbon revenue	*56%**	*49%*	*53%*	*50%*
Business Benefits				
"Jobs and competitiveness program"		–2,851	–3,059	–3,312
"Clean technology program"	–19	–142	–245	–312
Increased small business instant asset write-off			–100	–100
Regional subsidies		–10	–50	–30
Other business energy efficiency measures	–7	–15	–21	–19
Business' share of carbon revenue	*1%**	*35%*	*38%*	*39%*
"Transitional" Measures				
Carbon tax credits for coal-fired power producers				
Negotiated government buyouts of inefficient coal-fired power plants	–1,009	–1	–1,003	–1,042
"Clean Energy Finance Corp."				
Financing to deploy renewable, low-carbon, and efficiency infrastructure + Subsidies to manufactureres of renewable energy equipment	–2	–21	–467	–455
Land and Carbon Sink Measures				
"Carbon Farming Initiative" + "Biodiversity Fund" + Other carbon sink land management subsidy programs	–69	–131	–506	–489
Governance				
Establishment of a "Clean Energy Regulator" and other adminstrative costs	–78	–90	–106	–107
Net Government Carbon Tax Revenue	**–$2,716**	**$1,144**	**–$1,279**	**–$1,110**

Source: Table by authors from data published in the "Clean Future Final Plan", Australian Government 2011.
* Share of total payments as no carbon revenues are collected in FY 2011/12.

Region-specific Considerations

The form of the Australian carbon tax policy is practically the reverse of British Columbia's. While both aim to apply a fixed carbon price across a broad swath of economy-wide GHG emissions, Australia has chosen to focus on all GHG emissions from only the largest emitting businesses, whereas British Columbia chose a carbon dioxide-focused fuel tax evenly applied across all end-users, including individual direct combustion for vehicles and home heating (two areas specifically exempted in Australia). And though both policies aim to recycle carbon tax revenues similarly for individual households, they take an opposite approach toward compensating businesses.

Extremely carbon-intensive electricity sector

One explanation for this different policy strategy is the nature of the two regions' electricity systems; whereas British Columbian electricity relies on hydropower and is nearly carbon-free, nearly 75% of the Australian electricity system is supplied by carbon-intensive coal and only 8% by low-carbon renewables such as hydropower. The Australian government estimates that electricity price rate increases will represent about one-third of the total carbon tax costs borne by households, or about 10% higher electricity costs. Taken together with higher embedded emission costs from other goods and services produced in Australia's particularly carbon-intensive economy, this means that individual households in Australia will face cost-of-living increases that are similar to (or slightly less than) the increases seen in British Columbia at a comparable carbon price—even with Australian household end-use exemptions on motor fuel.[20]

The carbon-intensive nature of the Australian electricity sector also helps explain why the government has chosen to direct carbon tax revenues to sector-specific business assistance rather than the broad tax breaks adopted in British Columbia. Industry is the largest user of electricity in Australia, and carbon costs will be particularly concentrated in electricity-intensive sectors such as aluminum and mining. Moreover, the coal-fired electric generators themselves, as major GHG emitters, face a heavy carbon tax burden the prospect of uneconomic stranded investments.

Industry focus

Because of its natural resource and export-heavy economic structure and coal-dependent fuel profile, GHG emissions in Australia are relatively concentrated in singular large emitters. For example, when accounting for indirect GHG emissions from purchased electricity, the Australian manufacturing and mining sectors together account for 39% of total GHG emissions. Adding GHG emissions from the waste sector, fugitive emissions such as those from energy production, and commercial transport services means that about 60% of total GHG emissions can be accounted for simply by focusing on about 350 of the country's largest emitters out of an estimated 2 million registered Australian businesses.[21] Though embedded carbon emission costs do certainly affect the broader economy, such a targeted approach is thought to

potentially lower bureaucratic and compliance costs of implementing the policy, as well as reduce the number of direct stakeholders. Like the comprehensive carbon cap-and-trade bills attempted in the United States, however, this approach opens the political process to significant opportunities for gaming and regulatory capture by organized business interests.[22]

Like the comprehensive carbon cap-and-trade bills attempted in the United States, however, this approach opens the political process to significant opportunities for gaming and regulatory capture by organized business interests.

THE UNITED STATES

What can the experiences of British Columbia and Australia teach the U.S.?

Though the United States has not implemented a revenue-neutral carbon tax, the debate regarding carbon pricing, both for and against, has recently been attracting considerable public attention for the diversity of its participants.[23] In the wake of failed attempts to pass an ambitious and complex economy-wide cap-and-trade bill, as an alternative to potential court-ordered direct regulation of carbon emissions by the EPA through the Clean Air Act, and with an eye toward comprehensive federal tax reforms, politicians and economists have once again tabled revenue-neutral carbon taxes as one policy option among the many to be considered. And while the carbon tax experiences of British Columbia and Australia to date do illustrate valuable real-world dynamics and design choices, the energy and economic differences between them and the United States limit their direct relevance.

In the wake of failed attempts to pass an ambitious and complex economy-wide cap-and-trade bill, as an alternative to potential court-ordered direct regulation of carbon emissions by the EPA through the Clean Air Act, and with an eye toward comprehensive federal tax reforms, politicians and economists have once again tabled revenue-neutral carbon taxes as one policy option among the many to be considered.

Region-specific Considerations

At first look, the United States—though much larger than British Columbia or Australia—is not so dissimilar to these two carbon-taxing regions. With a diverse mix of both high-carbon and low-carbon electricity generation capacity, average United States electric system carbon intensity falls between coal-reliant Australia and hydro-rich British Columbia. Existing United States electricity rates are closer to relatively higher Australian rates but natural gas rates closer to relatively lower British Columbia rates. Per capita energy use in the United States easily exceeds that of both British Columbia and Australia, but per capita carbon dioxide emissions and the carbon dioxide emission intensity of economic activity fall between the two other regions.

But the situations quickly begin to diverge. For example, the GHG-economic structure of the United States is relatively diverse. The United States does have concentrated emission-intensive or emission-linked industries (such as coal fired power generation or oil refining) that would face steep costs from a carbon price, but its economy-wide emissions are not dominated by these sources as they are in Australia. For example, about 5,500 reporting facilities in the United States meet the Australian annual 25,000 ton GHG emission threshold; to attain 60% coverage of United States GHG emissions by focusing on final fuel consumers, as achieved by the top-350 emitter

industry-focused carbon tax scheme in Australia, would require coverage closer to 5,000 facilities.[24]

One particularly exceptional characteristic of the United States energy and emission profile is its transport sector: Americans drive significantly more than those in British Columbia[25] and Australia but existing gasoline prices are significantly lower. So while overall household expenditure on gasoline may be similar across all three regions, a price on carbon would raise annual costs to American drivers by both a higher absolute level and a higher relative proportion of volumetric price. In short, it would be more noticeable.

Another important consideration for the United States is its regional diversity—a potentially key design barrier for any sort of carbon price. Given its large size, the average United States energy-economic characteristics described above are actually the result of significant regional heterogeneity.[26] It would be important then to also consider the geographic in addition to the socioeconomic distributional effects of pricing carbon and recycling that revenue in the United States. For example, unlike in British Columbia, a straight carbon tax in the United States would result in customers in states with highly coal-dependent electricity generation portfolios being impacted more than residents in less carbon-intensive states.[27]

DISCUSSION

The British Columbia and Australia cases highlight key carbon tax design and implementation issues. These choices and experiences are explored below.

What is the goal of the revenue-neutral carbon tax?

The British Columbian and Australian governments both described their carbon taxes in terms of reducing GHG emissions within their economies so as to help mitigate anthropogenic climate change.[28] Neither government expected that the carbon tax alone would be sufficient to achieve various GHG emission-reduction or technology development goals and so presented the carbon tax alongside other programs and measures. Neither policy explicitly determined prior to implementation how the carbon tax would be evaluated or if it would be adjusted based on its impact or lack thereof on GHG-emitting behavior.

A different option for framing the goals of a carbon tax—not explicitly adopted by British Columbia or Australia—would be in terms of fairness, competition, and efficiency. Namely, because current markets generally do not price the potentially negative impacts of GHG emissions, emission-intensive activities are privileged relative to non-intensive options; this distorts technology development, capital deployment, and fuel choice or other behaviors. Applying a tax to carbon to internalize this distortion could therefore be framed as one step towards "level the playing field" for the supply and demand of energy. Alongside reform of other distortionary energy taxes, subsidies, and mandates, the explicit goal of pricing carbon would then be to achieve fairer competition and efficiency in the energy market.[29] Such a "means-based" (i.e. market function) rather than "ends-based" (i.e. aggregate emissions reduction or climate change mitigation) framing would also have the advantage of being easier to directly evaluate.[30]

How are carbon tax revenues returned to the economy?

A revenue-neutral carbon tax directly returns all tax receipts to the economy, though this return of revenue is redistributive by nature; the carbon price signal faced by GHG emitters is therefore independent of any compensation received, even if net emitter costs from the carbon tax are near zero. Drawing from the British Columbia and Australia cases, revenue recipients can be divided into the following general categories:

(1) Individuals (further stratified by income level, with additional special classes including low income, vulnerable, or particularly emission-intensive groups), and;

(2) Businesses (with divisions for small businesses, export-oriented or trade-vulnerable sectors, or particularly emission-intensive sectors).

A revenue-recycling policy could arguably identify any number of these categories to receive a portion of total revenue benefits; as such, this "outflow" element of policy design is subject to stakeholder capture just as the tax incidence itself is on the "intake" side of the policy.

A basic approach to revenue distribution, illustrated in British Columbia, is to apply a simple benefit scheme to both businesses and individuals, but to attempt to correct for the regressive nature of a carbon tax on the individual side by calibrating benefits to the average share of income impacted by the carbon tax for different tax brackets, with further special benefits for particularly impacted individuals.[31] Somewhat surprisingly, however, British Columbia was largely able to avoid similarly segregating revenue benefits to business recipients.

Australia, on the other hand, while adopting a similar benefit scheme for individuals, has chosen to also make business benefits extremely targeted on export-oriented or emission intensive sectors. Furthermore, it has supplemented business benefits through government-managed spending programs to the extent that the policy may not truly be considered revenue neutral. In addition to these demographic and sectoral design considerations, were the United States to adopt a similar simple revenue-neutral carbon tax, the regional distribution of tax or dividend beneficiaries might also have to be considered given heterogeneity in regional energy system carbon intensity.

Apart from the question of who receives how much revenue benefit, there is the issue of the benefit's form. The revenue benefit's form is important in determining a government's control over revenue distributions over time as well as stakeholder support or political feasibility of the overall policy. For example, British Columbia has chosen to recycle most carbon tax revenues through reductions in personal income or general business tax rates. Particularly impacted low-income or emission-intensive households are further compensated by tax credits or the proverbial "check in the mail" akin to the State of Alaska's mineral royalty "Permanent Fund Dividends" paid annually in an equal proportion to each resident.

Direct "check in the mail" payments to individuals can be a politically appealing choice because of the high degree of salience and accountability it provides regarding the revenue-neutrality of the carbon tax. Such flat dividend payments, however, can potentially become vehicles for significantly progressive wealth redistribution: high income, high consumption households who contribute more payments under a carbon tax would likely be refunded far less than their total tax payments under a flat dividend, even if such individuals adopt strong carbon emission-mitigating choices. Similarly, a flat dividend under a very steep carbon tax could become a significant new entitlement to low income households.[32] This distribution represents both a significant political and policy challenge.

In contrast, tax offsets have been chosen to distribute the bulk of revenue benefits to individuals for both the British Columbia and Australia cases. The British Columbia "tax-shift" choice, in particular, can be seen as using a carbon tax to "fund" a desired tax cut on an existing distortionary tax such as a payroll, personal income, or corporate taxes (i.e., taxes on working or earning profits—neither of which are activities that a government likely wishes to discourage through taxation but does anyway because of funding needs and historical precedent).[33] More specifically, the use of corporate tax breaks can be an appealing option to encourage business buy-in for a revenue neutral carbon tax, but begins to create the hazard of regulatory capture as demonstrated very clearly in the Australia case. To this end, it is worth noting that the British Columbia "tax-shift" was designed and enacted by the provincial Ministry of Finance rather than an environmental or energy agency.

The British Columbia "tax-shift" was designed and enacted by the provincial Ministry of Finance rather than an environmental or energy agency.

In addition to affecting political feasibility, the form of benefit distribution can also have important operational implications.[34] One substantial operational concern is balancing the need for true revenue neutrality with a desire to ensure fiscal health. The British Columbia experience illustrates this tension:

(1) The revenue-recycling benefit mechanism is generally set in advance as part of an implicit contract that emphasizes predictability in what is otherwise a novel taxation system; this can make it difficult or legally impossible to update if problems arise during implementation.

(2) Revenue expectations from a carbon tax are based on estimates of future fuel consumption or GHG emissions and so are uncertain; likewise, non-discrete revenue benefit measures such as general tax rate reductions depend on estimates of future economic activity in particular sectors and are also uncertain. Net accounts of the carbon tax system, which might be politically significant, are therefore shifting at both ends.

(3) Similarly, the net distributional impacts of a revenue-neutral carbon tax are subject to numerous additional layers of uncertainty. For example, one sector of the economy may face unanticipated high costs from a carbon tax (such as an external need to switch fuels) while another sector may benefit from an unexpected windfall from revenue-recycling tax breaks.

As described above, the result of such operational uncertainty in British Columbia has meant that the "carbon-shift" has actually been revenue-negative for the government and the distribution of revenue benefits between individuals and business has diverged

from initial expectations. Because the policy design largely tied the government's hands for the first five years of implementation, the government had to assume revenue and benefit payment risks that might have become significant. It is possible, however, that a different design might have been more robust to uncertainty without compromising social acceptance; a direct payment system with a proportional benefit amount determined by that year's estimated tax revenue, for example, would disaggregate the benefit payment risk by transferring it from the government to recipients.

Another notable aspect of the British Columbia carbon tax was its structuring in such a way that seemed to "call" for emissions growth to balance revenues with expenses, as is highlighted in the numbers below from the British Columbia Government. As a result, the British Columbia budget has become more dependent on carbon tax revenue than any jurisdiction on earth, with a forecasted 10% jump in emissions over the initial five year period being necessary to hit revenue targets, as outlined in the table below:[35]

Fiscal Year	Carbon Tax Rate	Est. Carbon Tax Revenues	Inferred Carbon Tax Base	Emissions Growth Requirement
2010/11	CAD $20/t CO2e	CAD $741 million	37.1 million tons CO2e/y	
2011/12	CAD $25/t CO2e	CAD $960 million	38.4 million tons CO2e/y	3.5%
2012/13	CAD $30/t CO2e	CAD $1,166 million	38.9 million tons CO2e/y	1.3%
2013/14	CAD $30/t CO2e	CAD $1,232 million	41.1 million tons CO2e/y	5.7%

Source: Table by authors; data compiled from BC MOF Budgets and author calculations.

Of course, these are significant revenues, especially in the context of British Columbia's total budget of just CAD $43 Billion. One problem with the carbon tax is that having already committed this future revenue stream to finance the corporate and personal income tax rate cuts that it enacted, British Columbia is potentially in a difficult fiscal position of not really wanting carbon dioxide to fall too much in the near future, seemingly defeating the emissions reduction purpose of the tax in the first place.[36]

How is the integrity of the tax and revenue-returning measures ensured?

Once implemented, a revenue-neutral carbon tax is potentially subject to both new exemptions on the taxation side and appropriation of revenues by stakeholders or the government itself on the benefits side. Potential adjustments range from small "tweaking" in response to unanticipated tax burdens that befall certain stakeholders to an outright policy overhaul given a changed economic or political environment. In British Columbia, for example, a "Northern and rural homeowner benefit" payment was established in the third year of policy implementation to compensate this energy-intensive stakeholder group for the higher cost they faced from home heating through the carbon tax. This new benefit amounted to 2.6% of collected third year carbon tax revenue and 7.8% of fourth year tax revenue.

These adjustments were enacted through the benefit payout rather than tax intake side—the tax base remained relatively stable. This is in stark contrast to the Australian case where targeted tax base exemptions are central to policy design from the very outset. And though the British Columbia carbon tax appears to enjoy generally solid public support,[37] anecdotally, popular calls for exemptions or even a redirection of revenues towards "green" government spending do remain present, especially in urban areas.

Moreover, it is unclear if this latest target relief grant to the provincial greenhouse agricultural industry, described above, represents a new approach by the Ministry of Finance toward implementation of the policy and if it will now be successfully followed by further stakeholder requests.

Designing a Lockbox—The Alaska Permanent Fund Dividend

The question of how to create a "lockbox" around the revenues of any new carbon tax, especially in times of government deficits and across political or economic cycles, is central in assuring the key principle of revenue-neutrality. Returning to United States precedent and the Alaska Permanent Fund Dividend, first paid out to residents in 1982 and uninterrupted through today, it is interesting to note that the constitutional amendment creating the fund specifically granted the state legislature broad flexibility in determining how fund earnings could be spent [Austermann 1999]. The dividend, however, has nevertheless been consistently and successfully distributed since.

The most significant challenge to the dividend came in 1999 when oil prices (and fund principal deposits) were very low; a governor's proposal to redirect some fund earnings towards general budgetary spending was rejected by popular vote by an overwhelming margin. The dividend continued despite persistent government account deficits in Alaska and it has been suggested that officials today are so anathema to be seen as interfering with the annual dividend that they hesitate to even commission research studies on its operation or effect [Goldsmith 2002]. The only "lockbox" for this case then is virtual; historical precedent, alongside a once non-existent but now significant public constituency (supported by the dividend policy's extreme simplicity and visibility), has preserved continuity.

It is also interesting to note that, unlike the "shared" tax breaks seen in the British Columbia carbon tax case, business entities in Alaska are not directly involved at all on the receiving side of the permanent fund; dividends are returned only to individuals, and to every individual. The simplicity and transparency of this has likely contributed to the robustness of the Alaska Permanent Fund Dividend over time.

Though this model is robust it is not without critique. In particular, many point out that a flat dividend can become a vehicle for cross-subsidy across income and consumption groups, especially as payouts rise beyond compensation for any incurred direct costs.

Designing a Lockbox—Using a Carbon Tax to Eliminate an Existing Tax
Another sensible approach to dealing with revenues while ensuring integrity is to explicitly substitute new revenues for an existing revenue stream. Such a 1-for-1 trade would be a true "tax swap", completely eliminating—and not just marginally reducing—an existing tax.

To illustrate how this could work we can look at the example of a carbon tax in the United States. The easily measurable carbon dioxide emissions of major energy producers in the United States have been roughly 5 billion metric tons in recent years [US EPA 2012, see below]. Therefore, a carbon tax of USD $30 per ton would yield about USD $150 billion in government revenues. Unlike many other federal taxes, however, which grow alongside broader economic activity, carbon tax revenues could be expected to gradually fall over time as the economy becomes less carbon intensive. So what does USD $150 billion buy from federal government revenues today?

Curent Federal Tax	**Typical Revenues**
Gasoline	$25 billion
Diesel	$8–9 billion
Other Manufacturer / Fuels	$2–3 billion
Air Travel / Freight + Phone	$11–12 billion
Highway Trust Fund Supplement	$8 billion
Capital Gains	$40–140 billion
Capital Gains, income <100k/200k	$10–15 billion
Estate and Gift	$20–30 billion
AMT for individuals	$5–25 billion

Excise and consumption taxes are one potential target and they are similar in form, though narrower, than a carbon tax. In particular, displacing the federal gasoline and diesel taxes would significantly offset a major consumer and small business pain point. Fuel and transport tax eliminations (~USD $55 billion) could be paired with elimination of capital gains taxes for medium income households, elimination of the estate and gift taxes, and elimination of the AMT for individuals. Or, instead, the capital gains tax could be completely eliminated. As one reference point, the Romney tax cuts would have "cost" about USD $215 billion (in static terms). With such a tax-swap model, there are a wide variety of potential tax elimination options that might be both politically salient and reasonably transparent enough to mitigate the risk of future tampering.

Where is the Tax Applied?

Setting the ideal carbon tax base is a tradeoff between making coverage as broad as possible (to maximize emission mitigation potential, flexibility, and fairness across the economy) and narrowing the number of directly liable entities or events (to minimize administrative costs, policy complexity, and gaming). The varied British Columbia and Australian approaches to both aspects illustrate that potential strategies are the result of both energy-economic structure and political choice.

Namely, British Columbia chose to apply its tax largely upstream and let it filter broadly through the economy while Australia is focusing more downstream at the

major consumer level and at the point of consumption. Australia's approach allows it to better exempt certain protected sectors like personal transport. Moreover, its entity-based approach—seen more commonly in carbon cap-and-trade schemes[38]—sets Australia up for its intended conversion to an internationally-linked cap-and-trade after 2015. But whereas Australia's downstream carbon tax covers just 60% of the country's total GHG emissions (and must include fugitive emissions to achieve even that), British Columbia's upstream energy-focused tax can ultimately operate more efficiently with its 70–75% coverage of total GHG emissions. British Columbia also notes that its volumetric approach was able to use existing fuel tax administration infrastructure, allowing for simpler implementation.

For comparison, in the United States, the carbon dioxide emissions from fossil fuel combustion alone are about 79% of total greenhouse gas emissions.[39] An upstream and midstream-focused energy-only carbon tax with incidence only on oil refiners, coal producers, and natural gas processors could realistically be expected to cover about 70–75% of total United States greenhouse gas emissions from under just 2,500 total liable entities.[40]

Border Considerations

Many proposed carbon pricing policy designs have struggled with the question of border adjustments—that is, how to penalize imports produced in out-of-jurisdiction regions that do not face a similar carbon price, how to compensate domestic exporters for their carbon tax payments, or how to avoid leakage of economic activities across jurisdictional borders. Politically, such competitiveness-related concerns have even been cited as a primary justification for legislative inaction on carbon pricing. It is interesting to note then that in British Columbia's pioneering revenue-neutral carbon tax efforts, the issue of border adjustments was deemed not to be a showstopper: relatively simple provisions were enacted to address the first-order issue of fuel imports and exports, while the second-order issue of embedded emissions within traded products or services was essentially left aside to be evaluated over time as actual (and not simply anticipated) business impacts were observed.[41]

And while the pragmatic spirit of British Columbia's approach is imitable, it may not be sufficient for trade-heavy countries such as the United States. For example, as described above, emission-intensive trade-exposed industries such as refineries, chemicals, metals, cement, paper, or even agriculture in countries like Australia (or the United States) could reasonably be expected to face negative economic impacts from a relative drop in domestic and international competitiveness against untaxed foreign embedded emissions. For its part, Australia is planning to devote significant tax revenues towards compensating such industries domestically in the early years of its carbon tax with the hope that enough of its trade partners will adopt similar or even harmonized carbon pricing policies into the future to mitigate the problem. Presumably, over time, such border adjustments might be rendered unnecessary as trade partners adopt their own commensurate carbon pricing mechanisms.[42]

The Politics of a Carbon Tax

In addition to the policy aspects of carbon pricing, experiences abroad also have important lessons about the politics of carbon pricing.

In British Columbia, the major left-wing party were very concerned about the effects on working class incomes of such a tax, causing them to initially oppose it. Despite the opposition of these traditional left-wing proponents of environmental regulations, however, the centrist Liberal party achieved re-election after its advocacy of the tax.[43]

Perhaps most interestingly, the carbon tax proposal was designed by the Liberals explicitly to pull environmentally-minded voters from more left-wing parties to the Liberal party, effectively splitting those parties.[44] One observer commented that "The New Democrats, led by Carol James, fiercely opposed the carbon tax, arguing that it especially hurt rural residents. But the party's opposition to the tax cost them the support of almost all environmental organizations, which sided with Campbell solely on the issue," while the nonpartisan Conservation Council launched a campaign telling voters to choose "anybody but James."[45]

Even before the results came in, some commentators began to speculate on the likely electoral effect of the tax. For the *Globe and Mail*, Dirk Meissner reported on suggestions that the NDP's stance on the carbon tax might hurt it on election day. In particular, he emphasized the views of Harris Decima's Senior VP Jeff Walker who suggested that "traditional soft environment voters in British Columbia who usually go into every election vowing to vote Green, but end up going with the NDP are now considering staying Green to punish the NDP."[46]

Yet despite carbon pricing's reasonably favorable reception by the British Columbia public and the intriguing politics outlined above, by 2011, "The three major provincial parties in Ontario—the governing Liberals, the Conservatives and the NDP—[had] explicitly vowed not to introduce a carbon tax in that province if they win the upcoming provincial election."[47] Stéphane Dion, of the Liberals, who ran on a similar "Green Shift" in taxation at the national level in 2008, was resoundingly defeated after being opposed by both Canada's conservatives, under Stephen Harper and the liberal NDP, both of whom criticized his carbon tax proposal, modeled after British Columbia's.[48] Looking at the British Columbia case, the evidence for the political feasibility of a revenue-neutral carbon tax could be best described as mixed. It seems most likely to occur in the context of a broader overall tax reform, as occurred in Australia and British Columbia.

Looking at the British Columbia case, the evidence for the political feasibility of a revenue-neutral carbon tax could be best described as mixed.

CONCLUSION

In this paper we have described the real-world design choices and policy experience to date of the most significant major new global forays into revenue-neutral carbon taxes—that is, those carbon taxes that return substantially all of their revenue collected through tax benefits and direct payments to individuals. Interestingly, one of the few things shared between the British Columbian and Australian approaches is that they both enacted their carbon taxes in the context of a comprehensive tax reform process. Policy details such as tax incidence, sectoral coverage, GHG coverage, business revenue benefits, and the schedule of policy implementation are actually all quite different. And time will tell how public and political support for Australian scheme fares in comparison to the British Columbian experience over the past five years.

For example, it is highly salient that the only largely successful revenue-neutral carbon tax enacted worldwide—in British Columbia—was one that essentially exempted the electricity sector. We argued that the reasons for such divergent approaches are due in part to political choices, but they are also grounded in the quite different energy and economic systems of the two regions. One lesson we might draw then is that the path of even something as seemingly straightforward as a revenue-neutral carbon tax—from economic theory, through the political process, to real-world implementation—is in fact long and winding.[49]

The path of even something as seemingly straightforward as a revenue-neutral carbon tax—from economic theory, through the political process, to real-world implementation—is in fact long and winding.

Moreover, having considered the British Columbia and Australian efforts, it is clear to us that a revenue-neutral carbon tax cannot be considered simply from the perspective of climate change mitigation. Because a carbon tax is ultimately an energy tax (albeit a differentiated one), it, like any fundamental energy system reform, should instead be framed more broadly: by how it affects a country's *environment*, by how it affects *energy security*, and by how it affects the broader *economy*.

The first measure—the *environment*—is the natural domain of a revenue-neutral carbon tax and so one could expect it to score well in that regard. As we have noted above, however, many now expect that a price instrument alone may not be sufficient (or efficient) to meet climate change mitigation goals. For example, the United States and other countries continue to suffer from a persistent underinvestment by both public and private sectors in early-stage, long-term energy R&D. Ultimately, significant climate goals require not just marginal shifting but also groundbreaking new technologies, and there are good reasons why a carbon price alone would not support

enough R&D to deliver these. At the same time, a revenue-neutral carbon tax must also explicitly demonstrate how it can help improve not just global but also the local environmental conditions that remain top-of-mind for average citizens.

The *energy security* impacts of a revenue-neutral carbon tax remain particularly unexamined. Neither British Columbia nor Australia explicitly invoked energy security in their program formulation—both Canada and Australia have very low energy import dependency—but it would be a key consideration in the United States. A revenue-neutral carbon tax would affect national energy security on both the consumption and domestic production sides of the energy equation, and in terms of both volume and form. Because of its pervasiveness, a carbon tax could very well become, *de facto*, the most significant energy security policy in an energy import-dependent market economy—positive or negative. We leave this important issue to further consideration.

Finally, the *economy*. A revenue-neutral carbon tax's impact on a region's economy is likely to be the main debate both politically and in terms of policy design. This was certainly the case in British Columbia and Australia and would be for the United States as well. But while much of that discussion turns on projected impacts to particular industrial sectors, household budgets, employment, or even fiscal health, to consider a carbon tax is also an ideal time to consider the *existing* web of taxes and subsidies that our governments enact throughout the energy system today.

Just as in other countries, the modern United States energy policy offers an often mystifying web of production tax credits, investment tax credits, depletion allowances, domestic manufacturing tax deductions, accelerated depreciation schedules, loan guarantees, and portfolio standards. Built up piecemeal, over time and across industries, these affect costs and prices in both directions for most every form of energy such that it becomes unclear just what market distortions do or do not exist for a revenue-neutral carbon tax to try to fix. Whatever the theoretical merits of a revenue-neutral carbon tax in improving energy market function, to add one on top of our current patchwork of energy market manipulations would clearly add to this complexity. For this reason, rationalizing the United States energy market by creating a level playing field and eliminating energy subsidies should be a necessary part of any carbon tax policy discussion. Ultimately, when the negotiation begins over America's energy and fiscal futures, every chip needs to be on the table.

ANNEX

Carbon tax shares of fuel tax and total fuel price for gasoline and diesel in the British Columbia "Translink" (Vancouver-area) motor fuel taxation region, for both constant hypothetical fuel prices and actual historical provincial fuel price averages over the carbon tax policy implementation period:

[Note: The Translink service area in 2010 was ~2.3 million people, approximately half of the total British Columbia population; calculations for other British Columbia regions available on request]

BC – Translink Area Gasoline for personal vehicles	*hypothetical fuel price, cents per liter*	Jan. 1 2008	July 1 2008	July 1 2009	Jan. 1 2010	July 1 2010	July 1 2011	April 1 2012	(expected) July 1 2012	(expected) April 1 2013	(expected) July 1 2013
Federal Excise Tax		10	10	10	10	10	10	10	10	10	10
Provincial Excise Tax		8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Local Excise Tax		12	12	12	15	15	15	17	17	17	17
Carbon Tax		0	2.34	3.51	3.33	4.45	5.56	5.56	6.67	6.67	6.67
total excise tax		***30.5***	***32.84***	***34.01***	***36.83***	***37.95***	***39.06***	***41.06***	***42.17***	***42.17***	***42.17***
GST		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Provincial element of HST		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PST		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
total sales tax		***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***
Total tax on fuel @:	*50*	34.53	36.98	38.21	41.17	42.35	43.51	45.61	46.78	46.78	46.78
Total fuel + tax bill @:	*50*	84.53	86.98	88.21	91.17	92.35	93.51	95.61	96.78	96.78	96.78
Tax percentage of fuel bill @:	*50*	40.85%	42.52%	43.32%	45.16%	45.86%	46.53%	47.71%	48.34%	48.34%	48.34%
Carbon tax percentage of total tax on fuel @:	*50*	*0.00%*	*6.33%*	*9.19%*	*8.09%*	*10.51%*	*12.78%*	*12.19%*	*14.26%*	*14.26%*	*14.26%*
Carbon tax percentage of fuel bill @:	*50*	*0.00%*	*2.69%*	*3.98%*	*3.65%*	*4.82%*	*5.95%*	*5.82%*	*6.89%*	*6.89%*	*6.89%*
Total tax on fuel @:	*75*	35.78	38.23	39.46	42.42	43.60	44.76	46.86	48.03	48.03	48.03
Total fuel + tax bill @:	*75*	110.78	113.23	114.46	117.42	118.60	119.76	121.86	123.03	123.03	123.03
Tax percentage of fuel bill @:	*75*	32.30%	33.76%	34.48%	36.13%	36.76%	37.38%	38.46%	39.04%	39.04%	39.04%
Carbon tax percentage of total tax on fuel @:	*75*	*0.00%*	*6.12%*	*8.89%*	*7.85%*	*10.21%*	*12.42%*	*11.86%*	*13.89%*	*13.89%*	*13.89%*
Carbon tax percentage of fuel bill @:	*75*	*0.00%*	*2.07%*	*3.07%*	*2.84%*	*3.75%*	*4.64%*	*4.56%*	*5.42%*	*5.42%*	*5.42%*
Total tax on fuel @:	*100*	37.03	39.48	40.71	43.67	44.85	46.01	48.11	49.28	49.28	49.28
Total fuel + tax bill @:	*100*	137.03	139.48	140.71	143.67	144.85	146.01	148.11	149.28	149.28	149.28
Tax percentage of fuel bill @:	*100*	27.02%	28.31%	28.93%	30.40%	30.96%	31.51%	32.48%	33.01%	33.01%	33.01%
Carbon tax percentage of total tax on fuel @:	*100*	*0.00%*	*5.93%*	*8.62%*	*7.63%*	*9.92%*	*12.08%*	*11.56%*	*13.54%*	*13.54%*	*13.54%*
Carbon tax percentage of fuel bill @:	*100*	*0.00%*	*1.68%*	*2.49%*	*2.32%*	*3.07%*	*3.81%*	*3.75%*	*4.47%*	*4.47%*	*4.47%*
Actual average fuel price less taxes for period beginning:		92.95	78.12	75.17	77.78	87.53	95.79	102.20			
Total tax on fuel @:		36.67	38.39	39.47	42.56	44.22	45.80	48.22			
Total fuel + tax bill @:		129.63	116.51	114.64	120.34	131.75	141.59	150.42			
Tax percentage of fuel bill @:		28.29%	32.95%	34.43%	35.37%	33.57%	32.35%	32.06%			
Carbon tax percentage of total tax on fuel @:		0.00%	6.10%	8.89%	7.82%	10.06%	12.14%	11.53%			
Carbon tax percentage of fuel bill @:		0.00%	2.01%	3.06%	2.77%	3.38%	3.93%	3.70%			

BC – Translink Area Diesel for personal vehicles	*hypothetical fuel price, cents per liter*	Jan. 1 2008	July 1 2008	July 1 2009	Jan. 1 2010	July 1 2010	July 1 2011	April 1 2012	(expected) July 1 2012	(expected) April 1 2013	(expected) July 1 2013
Federal Excise Tax		4	4	4	4	4	4	4	4	4	4
Provincial Excise Tax		9	9	9	9	9	9	9	9	9	9
Local Excise Tax		12	12	12	15	15	15	17	17	17	17
Carbon Tax		0	2.69	4.04	3.84	5.11	6.39	7.67	7.67	7.67	7.67
total excise tax		***25***	***27.69***	***29.04***	***31.84***	***33.11***	***34.39***	***37.67***	***37.67***	***37.67***	***37.67***
GST		5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Provincial element of HST		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
PST		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
total sales tax		***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***	***5%***
Total tax on fuel @:	*50*	28.75	31.57	32.99	35.93	37.27	38.61	42.05	42.05	42.05	42.05
Total fuel + tax bill @:	*50*	78.75	81.57	82.99	85.93	87.27	88.61	92.05	92.05	92.05	92.05
Tax percentage of fuel bill @:	*50*	36.51%	38.71%	39.75%	41.81%	42.70%	43.57%	45.68%	45.68%	45.68%	45.68%
Carbon tax percentage of total tax on fuel @:	*50*	*0.00%*	*8.52%*	*12.25%*	*10.69%*	*13.71%*	*16.55%*	*18.24%*	*18.24%*	*18.24%*	*18.24%*
Carbon tax percentage of fuel bill @:	*50*	*0.00%*	*3.30%*	*4.87%*	*4.47%*	*5.86%*	*7.21%*	*8.33%*	*8.33%*	*8.33%*	*8.33%*
Total tax on fuel @:	*75*	30.00	32.82	34.24	37.18	38.52	39.86	43.30	43.30	43.30	43.30
Total fuel + tax bill @:	*75*	105.00	107.82	109.24	112.18	113.52	114.86	118.30	118.30	118.30	118.30
Tax percentage of fuel bill @:	*75*	28.57%	30.44%	31.35%	33.14%	33.93%	34.70%	36.60%	36.60%	36.60%	36.60%
Carbon tax percentage of total tax on fuel @:	*75*	*0.00%*	*8.20%*	*11.80%*	*10.33%*	*13.27%*	*16.03%*	*17.71%*	*17.71%*	*17.71%*	*17.71%*
Carbon tax percentage of fuel bill @:	*75*	*0.00%*	*2.49%*	*3.70%*	*3.42%*	*4.50%*	*5.56%*	*6.48%*	*6.48%*	*6.48%*	*6.48%*
Total tax on fuel @:	*100*	31.25	34.07	35.49	38.43	39.77	41.11	44.55	44.55	44.55	44.55
Total fuel + tax bill @:	*100*	131.25	134.07	135.49	138.43	139.77	141.11	144.55	144.55	144.55	144.55
Tax percentage of fuel bill @:	*100*	23.81%	25.41%	26.19%	27.76%	28.45%	29.13%	30.82%	30.82%	30.82%	30.82%
Carbon tax percentage of total tax on fuel @:	*100*	*0.00%*	*7.89%*	*11.38%*	*9.99%*	*12.85%*	*15.54%*	*17.22%*	*17.22%*	*17.22%*	*17.22%*
Carbon tax percentage of fuel bill @:	*100*	*0.00%*	*2.01%*	*2.98%*	*2.77%*	*3.66%*	*4.53%*	*5.31%*	*5.31%*	*5.31%*	*5.31%*
Actual average fuel price less taxes for period beginning:		98.57	77.74	65.82	71.01	83.21	95.48	105.63			
Total tax on fuel @:		31.18	32.96	33.78	36.98	38.93	40.88	44.84			
Total fuel + tax bill @:		129.75	110.70	99.61	107.99	122.13	136.36	150.47			
Tax percentage of fuel bill @:		24.03%	29.78%	33.92%	34.24%	31.87%	29.98%	29.80%			
Carbon tax percentage of total tax on fuel @:		0.00%	8.16%	11.96%	10.38%	13.13%	15.63%	17.11%			
Carbon tax percentage of fuel bill @:		0.00%	2.43%	4.06%	3.56%	4.18%	4.69%	5.10%			

Notes

1 Moreover, the carbon tax policy actually stipulates a salary penalty for the minister of finance if annual carbon revenues exceed payouts.

2 This results in an annual natural gas bill increase for home and water heating of about CAD $120 for the typical British Columbia household according to government estimates.

3 Marc Lee, February 2012 Sierra Club Study.

4 Canada National Inventory Report to the UNFCCC 2011.

5 Sellers who pay a security to the government equal the tax amount are reimbursed when they collect final consumer tax payments at the retail level. The natural gas carbon tax is collected at the retail level.

6 The carbon tax liability is considered at the point of sale/purchase (as opposed to production) or, where applicable, following self-consumption. This makes border adjustments for fuels relatively transparent: fuels imported from outside the province are subject to the carbon tax when sold for use inside the province; similarly, fuels produced within the province for consumption outside the province are not taxed as part of that transaction (or taxes paid can be refunded).

7 No such linkage program is in effect as of 2012.

8 Therefore, in British Columbia, much of government guidance on how individuals can reduce their carbon tax burden (and therefore GHG emissions) has focused on efforts such as driving less, switching to a more fuel-efficient vehicle, improving home insulation, or upgrading gas furnaces [BC MOF Budget 2008], rather than the discussions on improving lighting efficiency or reducing home appliance use that figure prominently in the U.S. or other regions with typically carbon-intensive power systems.

9 Oil refineries are another major source of industrial GHG emissions that may face particularly large burdens from a carbon tax and therefore demand special policy attention. British Columbia, however, has only two relatively small oil refineries, with a combined capacity of about 65,000 barrels/day representing about 12% of the province's total carbon dioxide emissions (California, for comparison, has about 20 refineries with a combined capacity that exceeds 2 million barrels/day) [refinery capacity date from Oil and Gas Journal 2009].

10 BC MOF 2011.

11 This "Carve out" creep is notable, because of the lack of carve-outs in the initial proposal, and because the lack of a greenhouse carve-out was specifically mentioned by BC's finance minister at the time (source: conversation with the minister). This shows the political difficulty of maintaining any carbon tax system without favoritism over time.

12 It is also notable that, post the carbon tax, British Columbia has the lowest income tax in Canada for those making under CAD 120,000, corporate taxes that are the lowest in the G7, and small-business taxes that are the lowest in Canada ["Tax Cuts Funded by the Carbon Tax" BC MOF 2012].

13 British Columbia implemented such a HST system in July 2010, but ultimately, despite strong support from the provincial government, the HST was defeated in a 2011 ballot referendum and efforts are underway to return to the previous provincial sales tax system by April 2013.

14 British Columbia's experiment with the HST did not directly influence motor fuel or home energy use prices; both categories were exempted by both tax systems, though this is not true elsewhere in Canada.

15 Specifically, the Vancouver "Translink" region.

16 See the annex for a detailed accounting of the carbon tax shares for gasoline and diesel in the Vancouver, British Columbia motor fuel taxation regions for both constant hypothetical fuel prices and actual historical provincial fuel price averages over the policy implementation period.

17 Known as the "Australia Future Tax System Review", which began in 2008. One of the more notable and controversial parallel tax reforms has been the simultaneous introduction of a "minerals resources rent tax" which uses revenues from a new windfall tax on iron and coal miners to reduce corporate and small business tax rates and invest in regional infrastructure.

18 Including carbon dioxide, methane, nitrous oxide, and perfluorocarbon emissions.

19 Major initiatives designed to do this include a "Jobs and Competitiveness Program" to assist industry (largely steel and aluminum producers); an "Energy Security Fund" to allocate free carbon units and cash payments to coal-fired power generators who publish "Clean Energy Investment Plans", also used to negotiate the closure of (i.e. buy out) about 2GW of the most inefficient coal facilities by 2020; and a "Clean Energy Finance Corporation" to help fund renewable electricity projects. Other related spending programs include: a "Coal Sector Jobs Package" focused on mines impacted by the reduction in projected coal use; a sectorally-targeted "Clean Technology Program" to encourage low carbon manufacturing and technology innovation; a "Steel Transformation Plan"; and a land use and "Carbon Farming Initiative" offset scheme.

20 BC and Australian government estimates.

21 Australian government calculations. Originally, the Australian government estimated that 500 businesses would exceed the 25,000 ton per year emission threshold; of those, approximately 130 were primarily in the waste sector, 100 were in mining, 60 were electricity generators, 40 were natural gas retailers, and 50 operated in other fossil fuel-intensive sectors.

22 It is interesting to note that the commercial sector in Australia receives no targeted benefit as a result of the carbon tax. In British Columbia, the commercial sector (along with industries) received general corporate tax rate breaks and small business tax breaks as part of the revenue-neutral carbon tax program. In Australia, even if commercial-sector entities are generally not directly taxed for their own emissions, they will still face higher electricity costs, which is typically the majority of their energy use. It can be argued that this demonstrates the relative strength of major industries in the Australian carbon tax development process.

23 The American Enterprise Institute has since 2011 held a series of ad-hoc left-right workshops around a revenue-neutral carbon tax. One held in July 2012 and titled "Price Carbon Campaign / Lame Duck Initiative: A Carbon Pollution Tax in Fiscal and Tax Reform" prompted vigorous discussion within the conservative think tank community. See "Left-right climate group quietly weighing proposals for carbon tax" (July 12 2012) from The Hill's E2-Wire (online) and a response from the Competitive Enterprise Institute's Marlo Lewis, "AEI Hosts Fifth Secret Meeting to Promote Carbon Tax" (July 11 2012).

24 see EPA facility level GHG reporting data, 2012.

25 (which is dominated by low average vehicle-mile per year urban residents in its primate city Vancouver; see region summary statistics compiled from respective government sources).

26 For example, just three states (Texas, Louisiana, and California) represent over half of United States refining capacity. Wyoming alone produces 40% of US coal. Hydroelectric power accounts for 75% of Washington state electricity supply, while coal supplies 90% of electric power in Ohio. Because of fuel price disparity, infrastructure, and policy differences, average retail electricity prices are 17.4 cents per KwH in Connecticut but just 6.7 cents in Kentucky. South Carolina per capita expenditures on gasoline are nearly twice that of New York. Per capita energy consumption in California is half that of Texas [all figures US EIA, 2010 data].

27 Recent studies have attempted to quantify the extend and nature of regional heterogeneity in impacts on household incomes from a flat revenue-neutral carbon tax. See, for example, CBO (July 2009) "Two Recent Studies of Regional

Differences in the Effects of Policies That Would Price Carbon Dioxide Emissions" letter from Douglas W. Elmendorf to James Inhofe. Interestingly, they find that though regional disparities exist, the impact is likely less then anticipated.

28 Australia also emphasized the role of the carbon tax in encouraging a broader shift toward a "clean" economy with potential growth opportunities from the adoption of new technologies.

29 The 2012 Joint Committee on Taxation valued total United States energy sector "tax expenditures" at about $39.3 billion over the 5 years 2011–2015, or about $6 billion annually ["Estimates Of Federal Tax Expenditures For Fiscal Years 2011–2015" January 17 2012.] Note that estimates of federal government subsidies or tax preferences in the energy industry vary widely, in part because of different ways to conceptualize what should count as a subsidy or tax preference; a 2011 review by the US DOE's EIA, for example, pegged the *annual* cost of energy sector tax expenditures much higher, at $16.3 billion, and included a more expansive valuation of "direct federal financial interventions and subsidies" at $37.2 billion annually (up from $11.5 billion and $17.9 billion, respectively in 2007 before ARRA implementation) ["Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2010" July 2011].

30 Even after a few years of experience in pricing carbon, it is difficult for British Columbia to offer robust analytical support of how the carbon tax is impacting provincial emissions. A recent British Columbia government report ["Making progress on B.C.'s climate action plan" 2012] points out that provincial emissions have fallen over the carbon tax period (by 4.5% from 2007–2010) and that fuel sale declines have exceeded the national average trend, while population and GRP growth has exceeded the national average; though a host of other uncontrolled variables (weather, macroeconomic structural shifts, demographics, other tax changes, etc.) make it difficult to argue with certainty how much of that change was due to the carbon tax, this data has nonetheless helped underpin public support for the carbon tax in recent months.

31 This approach can, however, have the problem of potentially reducing some behavioral effects of the tax. Even though benefits are the same within a recipient class regardless of energy usage (which preserves the behavioral affect), it does effectively insulate entire classes that might in fact have the most potential to reduce energy consumption by shifting classes. For example, the British Columbia special tax benefit for rural or northern homeowners might still incent them to improve the energy efficiency of their homes, but it would not necessary encourage them to move to the city and reduce energy use even further as they would lose the special tax benefit in doing so.

32 For example, in the United States, a 2009 Congressional testimony from the CBO estimated that a carbon cap-and-trade program that returned permit auction revenues (similar in function to a carbon tax) as a flat divided on a per household basis would impact after-tax real household income by +1.8%, +0.7%, -0.1%, -0.6%, and -0.7% for the lowest to highest income quintiles, respectively [Congressional Budget Office (May 7 2009) Distribution of Revenues from a Cap-and-Trade Program for CO2 Emissions. Statement of Douglas W Elmendorf before the United States Senate Committee on Finance.].

33 To the extent that such existing taxes are distortionary within an economy, their displacement by a revenue-generating carbon tax can be an attractive option from a economic efficiency standpoint because it reduces deadweight loss. Aggregate macroeconomic gain achieved through such a pigouvian tax shift (under certain conditions) is referred to as a "double dividend". See Lawrence Goulder (1995) "Environmental Taxation and the Double Dividend: a reader's guide" Tax and Public Finance, 2:157–183.

34 A significant operational issue is the potential "fence-post" problem with enacting a new carbon tax: to the extent that there exists a time interval between carbon tax payment and revenue dispersal, there is a float generated on the balance of funds. In the British Columbia case, this balance remains with the treasury (mitigated by the accuracy of estimated tax withholdings) and so some taxpayers will see net-negative cash-flow on account of the carbon tax until compensated by end of year tax refunds or more frequent direct payments. The balance can be virtually flipped from the government to the taxpayer over any given time period, however, by distributing benefits in advance of and equal to anticipated tax receipts, though this incurs a temporary but persistent funding deficit to the government.

35 Aldyen Donnelly: British Columbia's carbon tax quagmire.

36 As noted above, actual British Columbia provincial emissions fell by 4.5% over 2007–2010 on reduced fuel sales.

37 Pembina Institute 2011, Duff 2008.

38 (with entity liability thresholds almost identical to those in cap and trade systems recently announced in California, South Korea, and China's Guangdong Province).

39 US EPA 2012 GHG Emission Inventory, data for 2010.

40 See, for example, the tax liability scheme outlined in Metcalf and Weisbach, 2009, "The Design of a Carbon Tax", Harvard Environmental Law Review Vol 33. Note that this discussion has dealt with tax obligation and not tax incidence—tax incidence will likely spread across each fuel's value chain according to existing market forces. A number of studies have attempted to model price impacts of carbon pricing across various economic subsectors. In the United States, see, for example, the CBO's June 2010 working paper "Input-Output Model Analysis: Pricing Carbon Dioxide Emissions", Kevin Perese.

41 This approach has not been without complaint, as witnessed by the protestations of the British Columbia cement industry, for example, as described above. One small border tax perk in British Columbia, however, has been the net positive capture of carbon tax revenues paid by tourists or other non-provincial travellers through fuel and other energy purchases which are subsequently refunded to British Columbians.

42 To that end, the Australian government fastidiously promulgates news of carbon pricing scheme adoption by trading partners on its program website. See, for example, "South Korea passes ETS legislation", May 3 2012, Australian Government Clean Energy Future website.

43 BC Voters Stand By Carbon Tax, http://www.carbontax.org/blogarchives/2009/05/13/bc-voters-stand-by-carbon-tax.

44 The Tyee.

45 British Columbia re-elects Liberals (May 12) AFP.

46 "Canadians cool on carbon tax: poll" May 10 2009, The Canadian Press.

47 Jock Finlayson, spokesman for the Business Council of B.C, in "Three years in, B.C. still on its own with carbon tax" June 30 2011, The Canadian Press.

48 The Globe and Mail. September 11 2008. "Layton Lays in Green Shift". http://www.theglobeandmail.com/news/politics/layton-lays-into-green-shift/article1061159.

49 That there is actually flexibility in the design of a revenue-neutral carbon tax may dismay supporters who see it as a relatively simple alternative to complex cap-and-trade mechanisms. This flexibility, however, is also an asset, as it means that what a revenue-neutral carbon tax can be, and what goals it can fulfill, should not be considered pre-defined. A United State revenue-neutral carbon tax, if ever implemented, may not be recognizable from the British Columbian perspective, the Australian perspective, by today's domestic carbon tax opponents—or even today's carbon tax supporters.

Jeremy Carl
Jeremy Carl is a research fellow at the Hoover Institution and director of research for the Shultz-Stephenson Task Force on Energy Policy. His work focuses on energy and environmental policy, with an emphasis on energy security, climate policy, and global fossil fuel markets. In addition, he writes extensively from his experience on US-India relations and Indian politics. He holds degrees in history and public policy from Yale and Harvard Universities.

David Fedor
David Fedor is a research analyst for the Hoover Institution's Shultz-Stephenson Task Force on Energy Policy. He has worked in energy and the environment across China, Japan, and the United States. Formerly at APEC's Asia Pacific Energy Research Center, Fedor has also consulted for WWF China, the Asian Development Bank, and the Korea Energy Economics Institute. He holds degrees in earth systems from Stanford University.

Shultz-Stephenson Task Force on Energy Policy

The Hoover Institution's Shultz-Stephenson Task Force on Energy Policy addresses energy policy in the United States and its effects on our domestic and international political priorities, particularly our national security.

As a result of volatile and rising energy prices and increasing global concern about climate change, two related and compelling issues—threats to national security and adverse effects of energy usage on global climate—have emerged as key adjuncts to America's energy policy; the task force will explore these subjects in detail. The task force's goals are to gather comprehensive information on current scientific and technological developments, survey the contingent policy actions, and offer a range of prescriptive policies to address our varied energy challenges. The task force will focus on public policy at all levels, from individual to global. It will then recommend policy initiatives, large and small, that can be undertaken to the advantage of both private enterprises and governments acting individually and in concert.

For more information about this Hoover Institution Task Force, please visit us online at www.hoover.org/taskforces/energy-policy.

HOOVER INSTITUTION
STANFORD UNIVERSITY