THE IMPACTS OF THE CARBON TAX ON VEHICLE FUELS IN METRO VANCOUVER

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ABSTRACT

In July 2014, the Globe and Mail published an article entitled "The Shocking Truth About BC's Carbon Tax: It Works" which argued that BC's carbon tax has been a huge success in reducing fossil fuel usage in the province. The argument essentially correlates a 16% decline in fossil fuel use between 2007 and 2012 with the introduction of the carbon tax in July 2008 as proof of the effectiveness of the carbon tax. A related paper by one of the authors uses the same Statistics Canada data to argue in the same fashion that vehicular fuel usage has fallen 7%-8% in direct response to the carbon tax.

While the Globe and Mail article focused on the province as a whole, one would expect to see similar outcomes for the Metro Vancouver region. In this paper we examine vehicular fuel usage in Metro Vancouver using more current data (2014) and ask two questions: first, did the carbon tax reduce vehicular fuel usage; and second, if the tax did impact fuel usage, by how much.

The analysis finds that the carbon tax does work –just. The present 6.7 cent tax on gasoline and 7.7 cents on diesel reduced overall GHG emissions in Metro Vancouver by 0.8% in 2014. That is, if there had not been a carbon tax, vehicular GHG emissions would have been less than 1% higher in 2014 than they actually were. Looked at in another way, the carbon tax would need to exceed $2.00 a litre to reduce vehicle emissions by the stated provincial goal of 30%. Hardly a ringing endorsement of the carbon tax.

Although the analysis suggests that the carbon tax is relatively ineffective for directly reducing vehicular GHG emissions, it is estimated that the carbon tax generates $175 to $200 million in revenues in Metro Vancouver, a sum that, if invested in fuel-saving ventures, would improve the efficacy of the tax.

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In July last year, the Globe and Mail published an article entitled "The Shocking Truth About BC's Carbon Tax: It Works".[1] The authors, Ross Beaty; Richard Lipsey and Stewart Elgie, claim victory for BC's carbon tax, first introduced in July 2008, by citing Statistics Canada data indicating that BC's total fossil fuel use dropped 16% between the period ending March 2008 and March 2013. In a related paper, Stewart Elgie claims similar success for the carbon tax for reducing provincial vehicle fuel usage by some 7% - 8% over the same period.[2]

The analysis by Beaty, Lipsey and Elgie examines trends in fossil fuel usage in the province as a whole, but one should expect that the trends in Metro Vancouver would follow roughly the same pattern and that the conclusion would be similar: that the carbon tax works. Further, that as more current data become available, the trends ought to continue. So the question we ask in this paper is straight-forward: given that we have good fuel usage data up to 2014, has the carbon tax actually resulted in lower vehicular fuel usage in Metro Vancouver. A corollary question also comes to mind: if it is true that the carbon tax has reduced fuel usage by vehicles, by how much did the carbon tax reduce this fuel usage, a question not answered in the Globe and Mail article.[3] To these questions we now turn.

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[1] http://www.theglobeandmail.com/globe-debate/the-insidious-truth-about-bcs-carbon-tax-it-works/article19512237/

[2] http://www.sustainableprosperity.ca/blogpost97

[3] A central criticism of the Globe and Mail article (and Elgie's related paper) is that the authors seem to suggest that the carbon tax is the prime agent ("major driver") in the reduction of vehicle fuel usage. There is no mention, for example, that the regional transit tax in Metro Vancouver increased by 5 cents between 2008 q1 and 2013 q1 and the GST by another 1 cent, the sum being almost as much as the carbon tax itself. Similarly, constant dollar per capita median income in Canada increased by 4% between 2007 and 2012 while in BC real per capita incomes flat lined. As outlined in our earlier paper, other influencing factors on vehicle fuel usage was the opening of the Canada Line in 2009, an increase in bus service hours, and an increase in transit fares. One important factor touched upon by Elgie in his paper but discounted as being responsible only for a "small fraction" of the decline in fuel usage, is the issue of cross-border fuel purchases. We beg to differ. The increase between 2007 and 2013 of Canadian vehicles crossing back to the Lower Mainland from the US was over 4 million. At a (reasonable) average fill-up of 50 litres (a Honda Civic has a capacity of ~50 litres; a Cadillac CTS ~90 litres, a Ford F150 pickup ~100 litres), this represents roughly 200 million litres of additional fuel purchased in the US or 10% of fuel usage by passenger and medium-duty vehicles in Metro Vancouver in 2013. Clearly, not all vehicles crossing back into the Lower Mainland were resident in Metro Vancouver, but even if only half were Metro Vancouver vehicles, this would lower fuel sales in Metro Vancouver by 5% compared to fuel usage. And it is fuel usage that is the proper indicator of GHG emissions.

In July, 2008 the government of British Columbia implemented a "carbon tax" on fuels across BC. A carbon tax, according to the BC Ministry of Finance "*is usually defined as a tax based on greenhouse gas emissions (GHG) generated from burning fuels. It puts a price on each tonne of GHG emitted, sending a price signal that will, over time, elicit a powerful market response across the entire economy, resulting in reduced emissions*".[4] The rationale for a carbon tax is fourfold:

- to encourage individuals, businesses, industry and others to use less fossil fuel and reduce their greenhouse gas emissions;
- to send a consistent price signal;
- to ensure those who produce emissions pay for them; and
- to make clean energy alternatives more attractive.

In addition, the BC carbon tax has the feature of being revenue-neutral, that is, the government promised that every dollar generated by the carbon tax would be returned to citizens via reductions in income taxes.

In an earlier paper[5], we used our VKT/GHG Forecasting Model to examine the trends in vehicular GHG emissions in Metro Vancouver between 2007 and 2014. The analysis found that emissions increased to 2009 and then began falling, only to begin rising again starting in the middle of 2012 and has continued to increase through to the end of 2014. The paper examined in detail the three factors that contribute directly to changes in GHG emissions: changes in the vehicle stock, changes in the average fuel efficiency, and, most important for this analysis, changes in the average number of vehicle kilometres travelled (VKT).

A detailed look at the factors influencing average VKT found that, along with elements such as average per capita incomes, transit service hours, access, and fare costs, population density and distances that vehicles are based from town centres, the largest influence on driving behaviour are (lagged[6]) fuel prices. And, of course, fuel prices are partially determined by the level of the carbon tax.

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[4] http://www.fin.gov.bc.ca/tbs/tp/climate/carbon_tax.htm

[5] This paper can be found on the web site: http://pacificanalytics.ca

[6] The regression equations for estimating VKT employ 4 quarter lagged fuel prices in order to account for the fact that the response to a change in fuel price is not immediate. Rather, people adjust their driving habits over time (for example, for many people only after a price change is perceived to be permanent, will they switch to taking transit).

In this paper, we again employ our VKT/GHG Forecasting Model to re-estimate the average VKT for each vehicle group – the Model estimates average VKTs for each of 14 vehicle classes (e.g., Small Cars, SUVs, Pickups, Medium-Duty Vans, etc.), for each fuel type (gasoline, diesel, hybrids, other, and electric) for each license type (licenced for Pleasure only or for and to/from Work) and for each vehicle model year 1990 to 2015.[7] In brief, the equations generating the estimates for VKT follow the general structure:

$$\log(kms) = \alpha + \beta_1*q1 + \beta_2*q2 + \beta_3*q3 + \beta_4*\log(Fuel) + \beta_5*\log(Income) + \beta_6*\log(Model\ Age) + \beta_7*Sex + \beta_8*Age16 + \beta_9*Age65 + \beta_{10}*Dum\_2010q1 + \beta_{11}*CBD + \beta_{12}*RTC + \beta_{13}*Access + \beta_{14}*Bus\ Hours + \beta_{15}*Sky\ Hours + \beta_{16}*Density + \beta_{17}*Employ\ Ratio + \beta_{18}*Fares + \beta_{19}*\log(Gas\_15to9) + \beta_{20}*Exch$$

The econometric equations estimating VKT for each vehicle group use the correct historical data; that is, the actual real fuel prices, real per capita incomes, location from the Central Business District (CBD) and the Regional Town Centre (RTC), transit access values, bus and SkyTrain service hours, population densities, employment ratios, transit fares, exchange rates, etc. The estimated coefficients are then integrated into the Model and the historical values for all exogenous variables are used to determine average VKT for each vehicle group over time (2001 q1 to 2014 q4).

For estimating the impacts of the carbon tax, the only change we make is that, while all other components of gasoline and diesel pump prices (crude oil price, refinery margin, wholesale and retain mark-ups, and other fuel taxes such as the federal excise tax, the regional transit levy) remain at their historically valid values, the carbon tax is removed, resulting in slightly lower historical time series for fuel prices.

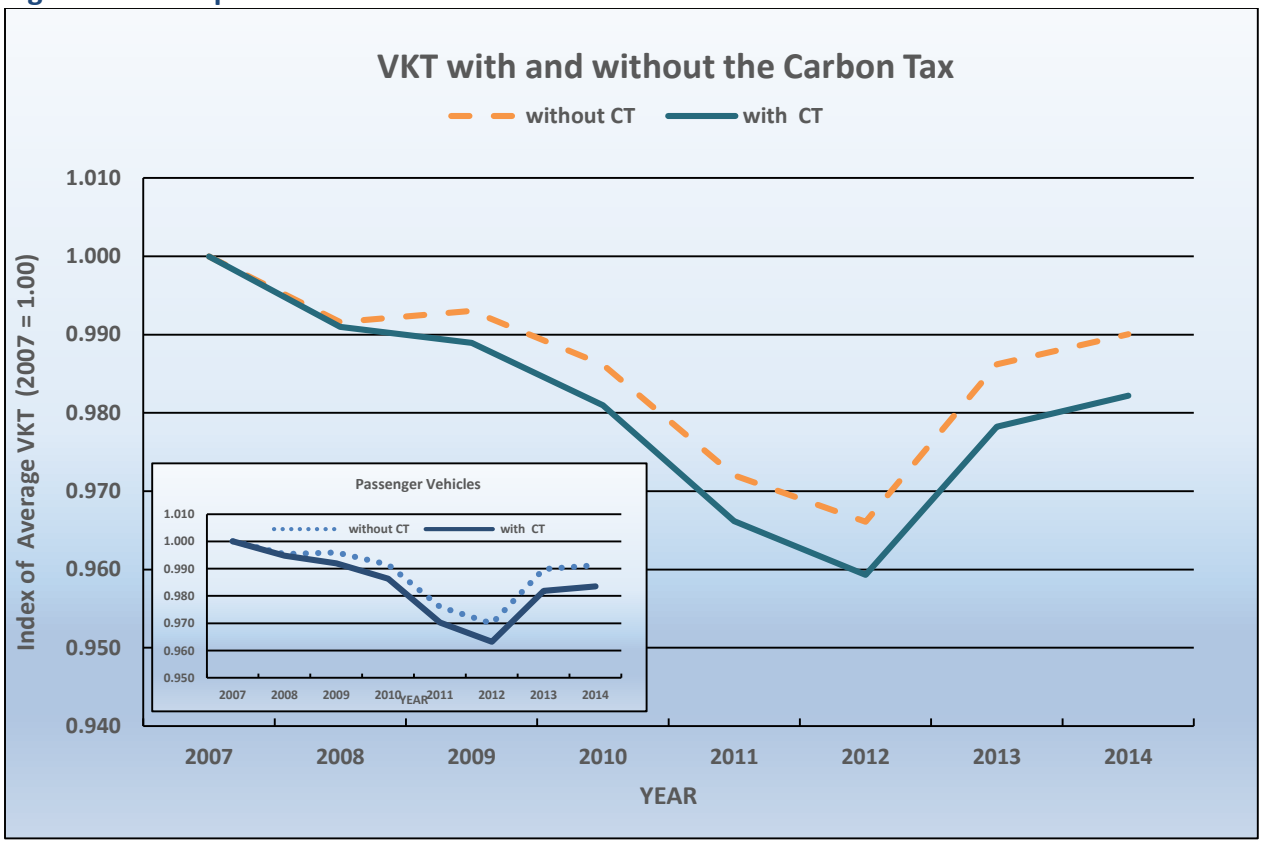
The Model estimates VKT by the disaggregated vehicle groups and therefore it is possible to examine the impacts on each of these groups. However, for the purposes of this report, we will examine only overall impacts, with some comments on the impacts on passenger vehicles.

Figure 1 below highlights the overall impacts on average VKT for all vehicles in Metro Vancouver, using the year 2007 as the base year (index 2007 = 1.00). The graph highlights the trend in historical VKT for all vehicles with the carbon tax and without the carbon tax as well as the equivalent data for passenger vehicles (see inset).

[7] A complete description of the VKT/GHG Forecasting Model along with all data sources can be found at http://pacificanalytics.ca.

Historical average VKT reached its lowest point in 2012 and then has trended upward through 2013 and 2014. This trend profile would not have changed if the carbon tax had not been in place, but, as displayed in the chart, overall VKT would have been higher.

Figure 1: A Comparison of VKT With and Without the Carbon Tax

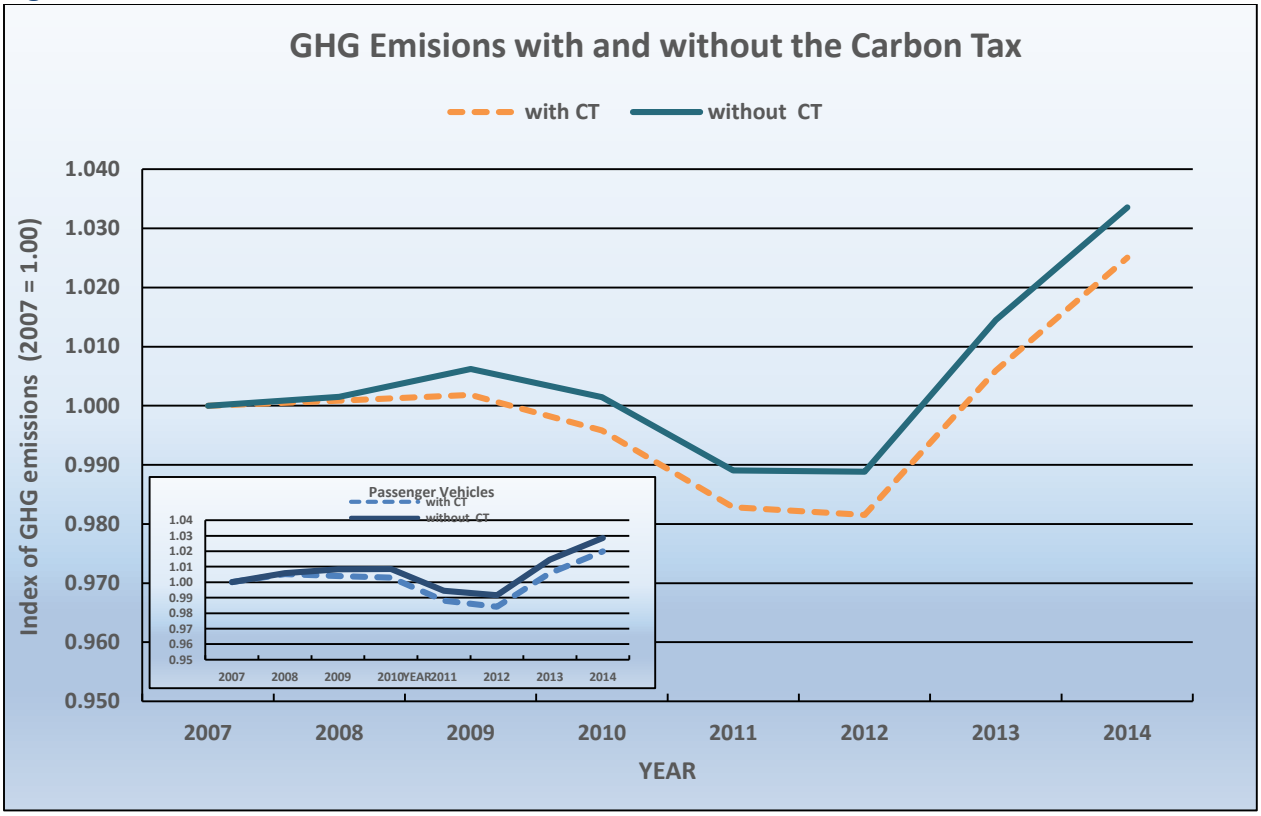


By 2014, implementation of the carbon tax reduced average VKT for all vehicles by an estimated 115 kms/year (passenger vehicles recorded a slightly lower reduction, around 108 kms/year, while the remaining vehicle groups recorded somewhat larger reductions).

Since the reduction the VKT has an immediate and direct impact on fuel consumption (Fuel Consumption = Stock*VKT*Fuel Consumption Rate/100), it also has a direct impact on GHG emissions.[8] **Figure 2** below highlights the impacts on emissions over time.

[8] Fuel consumption and GHG emissions are closely linked but not quite exactly. A litre of gasoline burned will always produce 2,289 grams of CO_2 while burning a litre of diesel produces 2,263 grams and propane 1,510 grams. Consequently, a small difference may occur if the proportion of diesel-to-gasoline-to-propane vehicles changes over time or, obviously, if electric vehicles become a greater proportion of the stock. At the same time, newer vehicles generally emit much less CH_4 and N_2O emissions and therefore as the vehicle stock renews itself, emissions will fall.

Figure 2: GHG Emissions with and without the Carbon Tax



Emissions dropped between 2009 and 2012 just as the Statistics Canada data for the province suggested. But since then emissions have trended upward. Without the carbon tax, the profile would have been similar, except of course overall emissions would have been higher. For the year 2014, total GHG emissions would have been almost 55,000 tonnes equivalent larger (or roughly 0.8% of total vehicle emissions in Metro Vancouver) if there had not been a carbon tax.

Between the time the carbon tax was implemented (July 2008) and the end of 2014 total GHG emissions would have been almost 265,000 tonnes equivalent in total higher than if the carbon tax had not been implemented. **Figure 3** below displays the cumulative trend in emissions over the time period for all vehicles in Metro Vancouver and for passenger vehicles only.

Perhaps a more illuminating visual is to chart out the decline in GHG emissions as a percentage of total vehicular emissions. **Figure 4** on the following page displays this trend in emissions over time.

Figure 3: Cumulative Change in GHG Emissions since July 2008

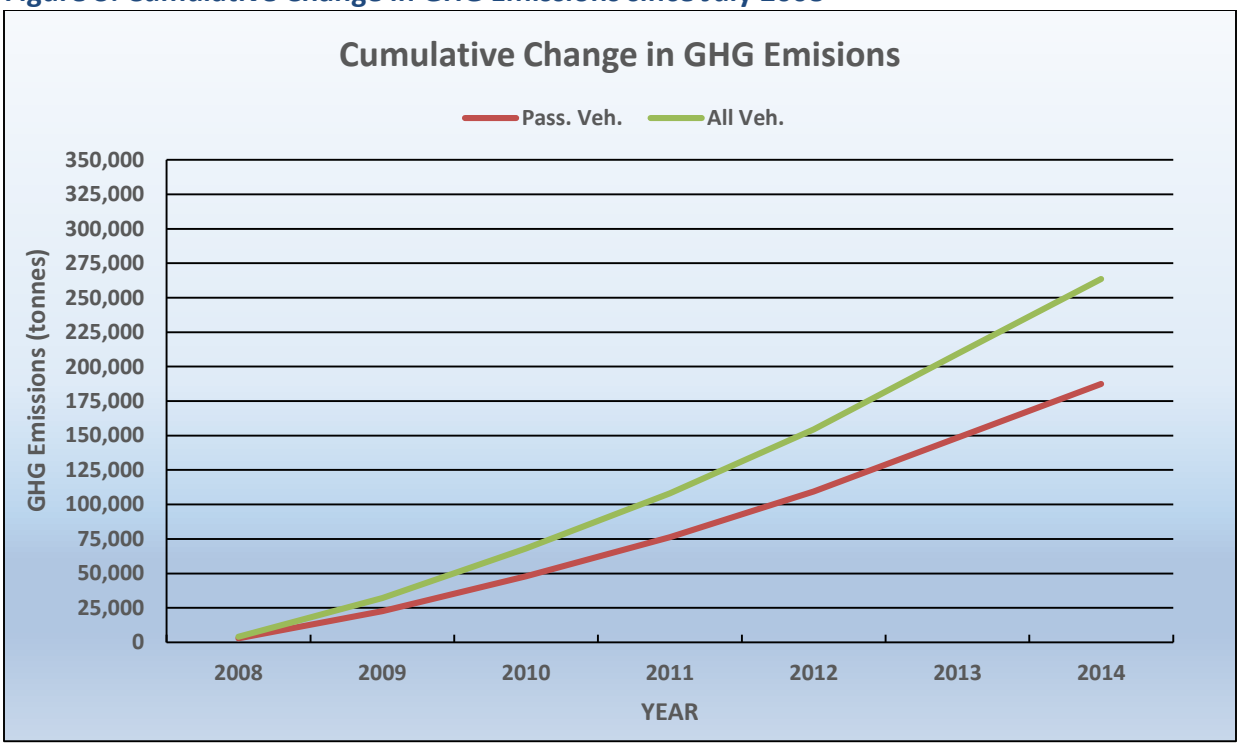
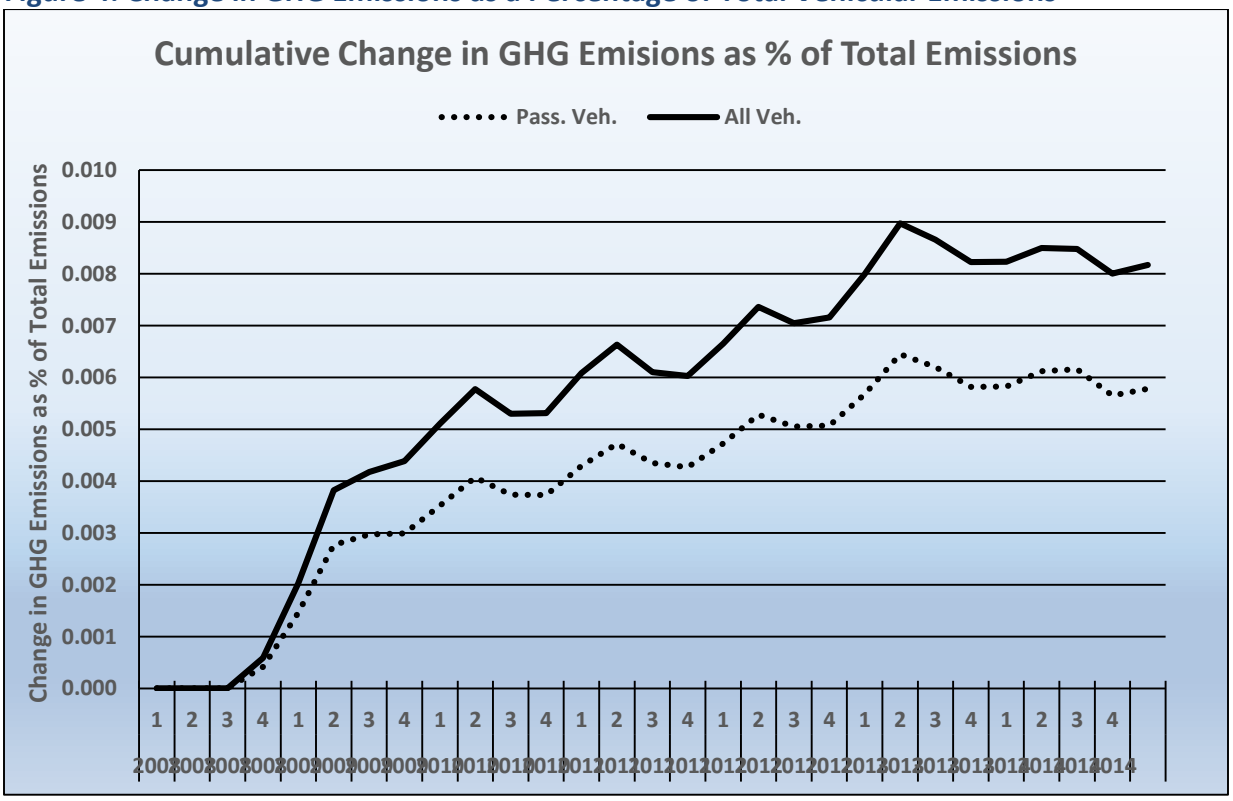


Figure 4: Change in GHG Emissions as a Percentage of Total Vehicular Emissions



Beginning in July 2008, the carbon tax for both gasoline and diesel increased each July at a specified rate, reaching 6.7 cents in July 2012 for gasoline and 7.7 cents for diesel. Prior to the July, 2013 rate increase the government froze the carbon tax, and the rates remain the same today as the rates in 2012. As a result, and as displayed in Figure 4 above, the emissions impacts began levelling off and over the 2014 period, the impacts were fairly stable at just over 0.8% of total emissions. That is, a 6.7 cent tax on gasoline and a 7.7 cent tax on diesel results in an annual reduction of 0.8% in vehicular GHG emissions.

That answers our first question posed in this paper: the carbon tax does work –just. It also answers the corollary question: the carbon tax at present reduces annual GHG emissions by just under 1%.[9] To put that into context in order to reduce vehicular emissions by the provincial goal of 30% would require a carbon tax over $2.00 per litre.[10] That is hardly a ringing endorsement of the carbon tax.

The critical reader will note that we have not rebutted the argument presented in the Globe and Mail article that the carbon tax is primarily responsible for the drop in overall fossil fuel consumption in the province, and it may be that the carbon tax is a very effective tool for lowering non-vehicular fuel emissions (although a much more comprehensive analysis ought to be undertaken to confirm such a statement). Nevertheless, this paper has provided data-based evidence that the carbon tax is only marginally effective in reducing vehicular GHG emissions in Metro Vancouver, a finding likely to be true for the province as a whole.

Given the results of this paper, another question arises: should the fact that the carbon tax is not a major determinant in reducing vehicular fuel usage exclude the carbon tax as an important tool in the arsenal to counter GHG emissions? Many organisations champion the carbon tax[11] as an economically efficient tax that can lead to lower emissions, help reduce market failures, improve congestion, etc. But most important, the carbon tax is an efficient method for raising revenues that can then be used to implement market incentives for energy conservation purposes, for encouraging fuel-saving technologies or for promoting sustainable energy projects.

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[9] It is likely that the impact on emissions would be slightly greater than 0.8% since the tax may have incentivised some people to purchase more fuel efficient vehicles – but at a value of 6.7 cents for gasoline (7.7 cents for diesel), it is unlikely the tax would have had much influence on vehicle purchase decisions.

[10] Actually, it would likely require a an even higher carbon tax, since a $2.00 increase in fuel would send a much larger number of people heading south toward the low-gas cost paradise of the US.

[11] The Brookings Institute is one of many: http://www.brookings.edu/research/opinions/2013/03/12-taxing-carbon-gale

The carbon tax today raises between $175 million and $200 million from vehicular fuel usage in Metro Vancouver depending on how much net fuel is purchased south of the border. When the carbon tax was first implemented, it was marketed as a "revenue-neutral" carbon tax, and thus all revenues raised are returned to general revenues, ostensibly to reduce income taxes. The trade-off of higher fuel taxes, then, was lower income taxes, although one doubts that anyone in Metro Vancouver would remember that their lower income taxes are due to the carbon tax. An argument could be made that the promise of revenue neutrality was a mistake, and that the real power behind a carbon tax is not how a carbon tax can directly reduce emissions, but how the revenues collected from a carbon tax can be used to promote a low carbon economy.

The danger of the Globe and Mail article is that it can generate a sense of complacency. If a carbon tax as low a BC's present tax (6.7 cents for gasoline; 7.7 cents for diesel) resulted in a 16% decline in GHG emissions, then getting emissions down by 30% ought to be a fairly simple task. But as we've seen, the carbon tax had nowhere near that impact (at least on vehicular emissions).

Two conclusions can be reached from this analysis. First, if reducing vehicular GHG emissions is an appropriate objective (and some will argue it isn't), the carbon tax, while part of a solution, is woefully insufficient. Second, any jurisdiction considering implementing a carbon tax should understand that investing the revenues earned from such a carbon tax on emissions-lowering technologies or incentivising energy conservation represents an integral part of why carbon taxes can help reduce an economy's dependency on fossil fuels. And doubtless in Metro Vancouver, there are people who could identify where $200 million could be invested to encourage fuel saving behaviour.

A copy of this report can be downloaded from the website: http://pacificanalytics.ca