

## IS THERE A FUTURE FOR ENVIRONMENTAL TAXES IN NEW ZEALAND?

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*Emissions intensity as a proportion of population in New Zealand is among the highest in developed countries. The key tool in the strategy to address climate change is the introduction of an emissions trading scheme that has yet to show results. There have been no deliberate attempts to use the tax system to influence behaviours that may reduce emissions. This study questions whether the tax system could, or should, be used to influence individual choices, with particular reference to vehicle selection.*

*The objective of the study is to highlight potential tax options that may be used to influence vehicle choice and to encourage debate on issues related to climate change in New Zealand. The study outlines the policy tools available for taxing vehicles, together with the literature that has examined the efficacy of using financial and non-financial incentives to encourage adoption of low-emission vehicles. The study also investigates current practice in a range of European countries to explore possible options for influencing vehicle purchasing behaviour through the tax system. The literature and practice suggests that behavioural shifts are likely to result when financial incentives are provided for electric vehicles or when financial penalties are applied to purchases of high-emission vehicles.*

*The study is critical of New Zealand's current approach to climate change. A coherent whole-of-government strategy is absent. The Ministry for the Environment has published outcomes for meeting climate change obligations, but the strategy to achieve this is not cohesive and does not directly target the two sectors that make the greatest contribution to New Zealand's greenhouse gas emissions.*

### 1 INTRODUCTION

Climate change has consequences for 'all spheres of existence on our planet'.<sup>1</sup> Climate change impacts on a range of societal issues including poverty, population growth, and economic development, among others. However, climate change is not inevitable, and sufficient actions undertaken on a timely basis can still mitigate the most extreme damage predicted from climate change. In particular, and as noted by the United Nations, 'at the very heart of the response to climate change...lies the need to reduce emissions'.<sup>2</sup> In New Zealand, emissions intensity by population is 'amongst the highest for developed countries'.<sup>3</sup>

New Zealand is in a unique situation. It is vulnerable to climate change due to its significant coastal borders that are susceptible to rising sea levels. Moreover, it is highly reliant on agriculture, which is an industry frequently criticised for its contribution to the emissions problem. However, New

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<sup>1</sup> United Nations Framework Convention on Climate Change (UNFCCC). *Background on the UNFCCC: The international response to climate change*. Retrieved from: [http://unfccc.int/essential\\_background/items/6031.php](http://unfccc.int/essential_background/items/6031.php), accessed 15 October 2015.

<sup>2</sup> UNFCCC, Above, n.1.

<sup>3</sup> Ministry for the Environment. (2015) *Report of the Ministry for the Environment for the year ended 30 June 2015*, Retrieved from: <http://www.mfe.govt.nz/sites/default/files/media/About/annual-report-2015.pdf>, Accessed 4 November 2015, 57.

Zealand also presents with some positive characteristics, such as a large proportion of electricity generated from renewable sources.

This study examines the options available to reduce emissions in New Zealand, with a specific focus on vehicles. The first research question addressed in this study is: what can New Zealand learn from approaches adopted in European countries in relation to reducing emissions through tax incentives on vehicles? This is addressed with reference to the academic literature as well as practice in a range of European countries.

There are reasons other than climate change for why reducing emissions are desirable, for example, some health conditions are exacerbated with increased air pollution resulting from vehicle emissions.<sup>4</sup> To date there has been little action from New Zealand to target specific sectors for encouragement or discouragement. Thus, the second research question considered is what should New Zealand do to address what is currently a lack of action towards reducing road transport emissions in New Zealand.

In this study the literature relating to the price-elasticity of demand for vehicles, along with the literature on tax incentives for vehicles and taxes on fuel prices, are canvassed. This literature is largely in agreement that tax subsidies are an effective instrument to encourage all-electric vehicle adoption. The study investigates the policy tools adopted in Norway, Ireland and the United Kingdom, as these countries have adopted a range of economic instruments with the aim of increasing the uptake of low-emission vehicles. Policy tools adopted by other European Union Member States are also outlined. Based on the literature and actions undertaken in a range of European countries, the argument is made that New Zealand could, and should, be taking stronger action against climate change and using the tax system to encourage greater uptake of electric vehicles.

While New Zealand has historically been reluctant to use the tax system to change behaviour, there are strong arguments to be made that reducing emissions through adoption of electric vehicles warrants consideration. Justification for government involvement in supporting the uptake of low-emissions vehicles is provided by Beresteanu and Li when they write that it is '*grounded on environmental externalities of motor gasoline consumption, national energy interests, as well as information spillovers among consumers and firms often present in the diffusion process of new technologies*'.<sup>5</sup> Electric vehicles remain a relatively new technology and retain a price premium. There are not the same range of makes and models of vehicles and the vehicles do not have the benefit of the economies of scale of vehicles that have been in production for many years. Accordingly, many countries recognise the high initial purchase price for an electric vehicle and provide financial incentives to encourage their adoption. Moreover, the behavioural shift associated with increasing the price of high emission vehicles has been established and many countries have introduced financial penalties for new vehicle purchases that have high CO<sub>2</sub> emissions.

The article commences in section two, which provides the context to New Zealand's climate change policy. This section also discusses the current environmental policies adopted in New Zealand. Section three covers a range of the literature relating to behavioural taxes. While the literature on

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<sup>4</sup> It was reported in October 2015 that the death rate in the United Kingdom is four per cent higher due to nitrogen dioxide pollution, or around 23,500 extra deaths per year. Gary Fuller, *Putting a price on NOx health impacts*, The Guardian, 4 October 2015.

<sup>5</sup> Beresteanu, Arie and Li, Shanjin. (2011) "Gasoline Prices, Government Support, and the Demand for Hybrid Vehicles in the United States", *International Economic Review*, 52(1):161-182, 161.

electric vehicles is outlined, this is a relatively new area of research. The literature on elasticities of fuel prices is also examined, together with non-financial incentives. Section three concludes with a brief discussion on the price elasticity of demand. Section four provides three short case studies of European countries that have used the tax system to either encourage the uptake of low-emissions vehicles or discourage purchases of high-emissions vehicles. The countries selected are Ireland, the United Kingdom and Norway. Section four also provides a brief outline of the policies adopted in other European countries and the United States of America, in order to fully cover a wide range of possible policy tools. Section five considers the literature and approaches adopted in other countries and suggests that New Zealand's use of the tax system to improve our emissions from the transport sector is weak when compared to almost every other OECD country.

## **2 BACKGROUND**

This section commences with a discussion on the global position on climate change before discussing the issues that are specific to New Zealand. New Zealand's Emission Trading Scheme is outlined, together with international treaties such as the Kyoto Protocol. A brief outline of electric vehicles is included at the end of this section.

### **2.1 The Issue**

The concentration of CO<sub>2</sub> equivalent at the moment, as reported by the United Nations, is 398.58 parts per million.<sup>6</sup> The concentration that this figure must stay at or under to maintain the 'two degrees Celsius goal' is 450 parts per million.<sup>7</sup> The two degrees Celsius goal is the highest rise possible to incur a 50 per cent chance of avoiding the worst effects of climate change.<sup>8</sup> This is viewed as the upper level of tolerance.

The relevant industry group for this study is the energy sector. Figure 1 shows the percentage change in energy sector greenhouse gas emissions since 1990. A selection of countries is shown here including Australia with a 44 per cent increase (the highest) and New Zealand with a 36 per cent increase (the second highest). The United Kingdom has the lowest, with a 21 per cent decrease, with the 28 countries of the European Union measured as the second lowest, with a 17 per cent decrease.

Emissions per capita are shown in Figure 2. Figure 2 shows that from 1990 to 2012 Australia increased their energy sector emissions per capita. In 1990, Australia was ranked as third worst performing country from the 16 countries shown. By 2012, Australia had moved to be the worst country. The United States of America, which was the worst performing country in 1990, had reduced their energy sector emissions per capita, but as most other countries also had declining energy sector emissions, they have only moved to the second worst position. New Zealand is ranked at the same position in both time periods: 10<sup>th</sup>. Of the 16 countries, only five had increased their energy sector emissions over the period from 1990 to 2012: New Zealand, Australia, Japan, Portugal and Spain.

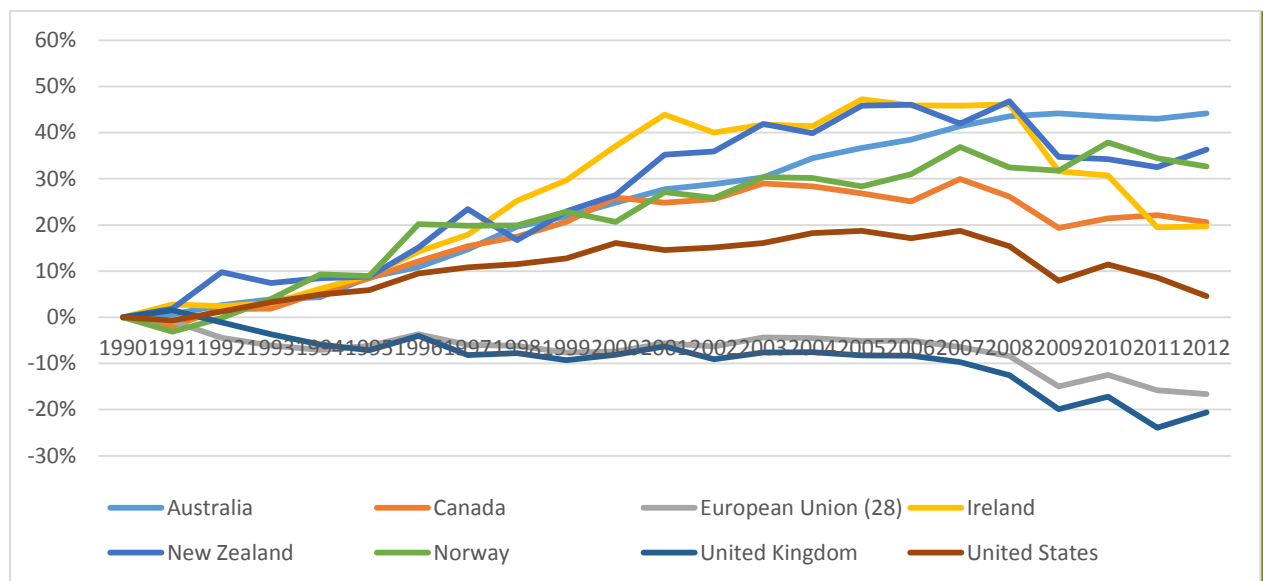
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<sup>6</sup> UNFCCC, Above, n.1.

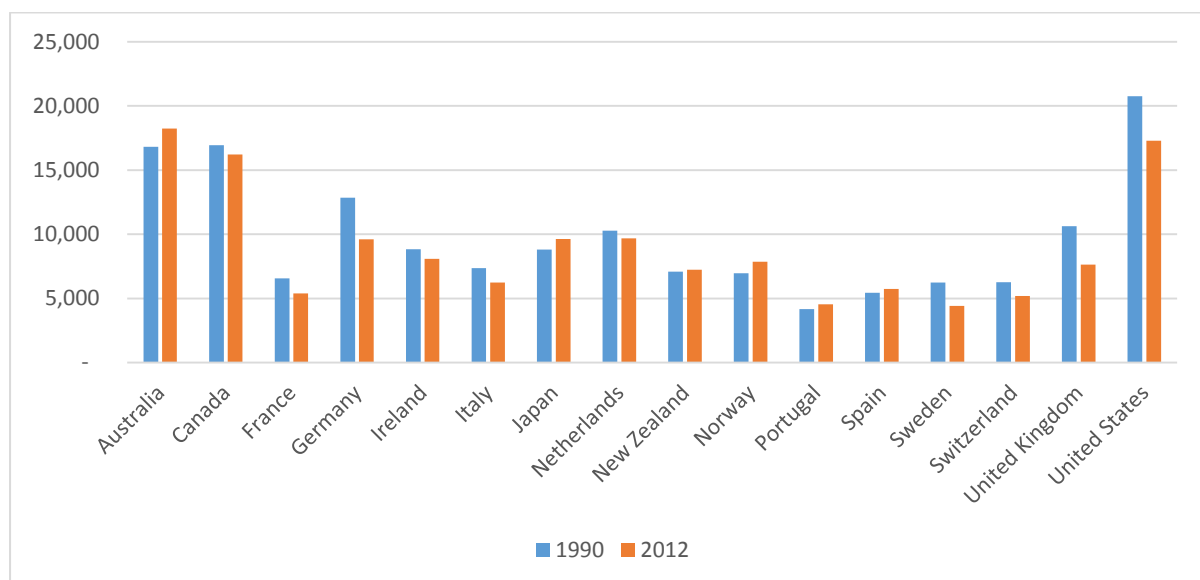
<sup>7</sup> UNFCCC, Above, n.1.

<sup>8</sup> UNFCCC, Above, n.1.

**Figure 1: Changes in Energy Sector Greenhouse Gas Emissions Since 1990<sup>9</sup>**



**Figure 2: Energy Sector Emissions Per Capita (Kilotonnes carbon dioxide equivalent per person)<sup>10</sup>**



## 2.2 Possible Solutions through the Tax System

Using the tax system to achieve environmental policy objectives results in adjusting relative prices ‘with a view to influencing producer or consumer behaviour in favour of goods or services that are considered to be environmentally beneficial’.<sup>11</sup> However, a recent study from the OECD on environmental taxes notes that tax preferences are often used inappropriately.<sup>12</sup> Specifically, the tax system may be used to address negative externalities, where there is no market incentive for firms

<sup>9</sup> Ministry of Business Innovation and Employment. *Energy GHG Emissions Webtables*, International Comparisons. Available at: <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/greenhouse-gas-emissions>, Retrieved 3 November 2015.

<sup>10</sup> Ministry of Business Innovation and Employment, Above, n.9.

<sup>11</sup> Greene, J., and Braathen, N.A. (2012) “Tax Preferences for Environmental Goals: Use, Limitations and Preferred Practices”, *OECD Environment Working papers*, No.71, OECD Publishing.

<sup>12</sup> Greene and Braathen, Above, n.11.

or individuals to control pollution and the environmental impact affects people other than the polluter. Instead, environmental taxes are preferred as they can internalise the costs of pollution and generate an incentive for consumers to choose more environmentally beneficial alternatives. The aim is to internalise the environmental costs. It is noted that it may be difficult to achieve this without resulting in a regressive outcome.

There are limitations with using the tax system for environmental policy purposes: they do not internalise negative externalities into prices; they may create windfall gains or free-riding behaviour; and they can be costly.<sup>13</sup> It is typically cost that is raised as the primary barrier. As with all government expenditure, there is an opportunity cost and any expenditure invested in attaining certain environmental policies is at the cost of foregone expenditure in other areas.

### 2.3 The New Zealand Context

A number of unique characteristics of New Zealand means that some emissions reduction opportunities available to other countries are less able to be exploited in the New Zealand environment.<sup>14</sup> For example, in 2012, 73 per cent of electricity generation was from renewable sources (hydro, geothermal and wind generation).<sup>15</sup> While this is forecast to increase to 90 per cent by 2025 many of the possible gains in this area have already been made.<sup>16</sup>

The two largest represented sectors in the New Zealand emissions profile are agriculture and energy, producing 48 per cent and 39 per cent of New Zealand's total greenhouse gas emissions, respectively.<sup>17</sup> Within the energy sector, road transportation contributed 40.2 per cent of emissions, an increase of 31.9 per cent above the 1990 level.<sup>18</sup> Opportunities for gains through increased public transport are restricted due to the low population density in the country.<sup>19</sup> However, as New Zealand's unique profile suggests that some of the common tools are less applicable, this points to the suggestion that we could and/or should consider other tools to reduce our greenhouse emissions.

It was the energy sector that experienced the largest increase in emissions in the 1990-2008 period, increasing two and a half times as much as emissions generated in the agriculture sector.<sup>20</sup> However, in more recently periods (2009-2011) emissions have declined in the energy sector.<sup>21</sup> This

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<sup>13</sup> Greene and Braathen, Above, n.11, 18.

<sup>14</sup> Ministry for the Environment. (2013) *New Zealand's Sixth National Communication under the United Nations Framework Convention on Climate Change and the Kyoto Protocol*. Retrieved from: <http://www.mfe.govt.nz/publications/climate-change/new-zealands-sixth-national-communication-under-united-nations-framework>, accessed 27 October 2015.

<sup>15</sup> Ministry for the Environment, Above, n.14, 30. Renewable energy contributed 37 per cent of total primary energy supply.

<sup>16</sup> Ministry for the Environment, Above, n.14, 12.

<sup>17</sup> Ministry for the Environment. *New Zealand's Greenhouse Gas Inventory 1990-2013*. Fulfilling reporting requirements under the United Nations Framework Convention on Climate Change and the Kyoto Protocol. Submitted to the United Nations Framework Convention on Climate Change, 10 April 2015. Wellington: Ministry for the Environment.

<sup>18</sup> Ministry for the Environment, Above, n.17, ix-x.

<sup>19</sup> Ministry for the Environment, Above, n.14.

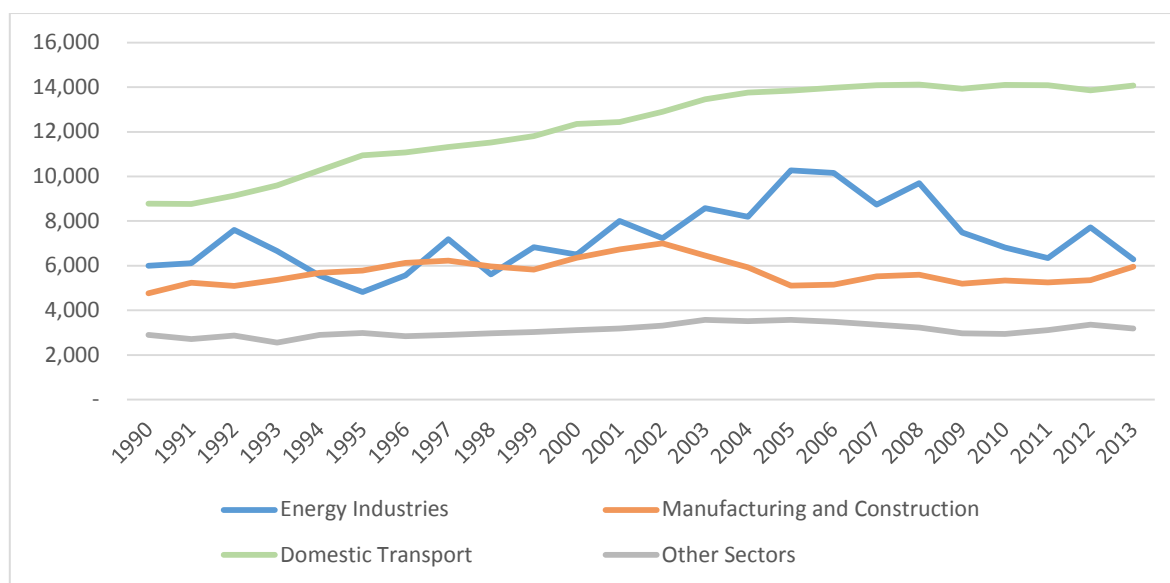
<sup>20</sup> Ministry for the Environment, Above, n.17, vii.

<sup>21</sup> Ministry for the Environment, Above, n.17, vii.

is attributed to the global recession, the closure of coal mines and greater investment in renewable energy sources.<sup>22</sup>

Figure 3 shows the trend of greenhouse gas emissions in the energy industries, domestic transport, manufacturing and construction, and other sectors over the period from 1990 to 2013. This shows the increase in domestic transport, when compared to the other sectors.

**Figure 3: Greenhouse Gas Emissions in NZ: Kilotonnes carbon dioxide equivalent<sup>23</sup>**



Three sectors account for the largest component of total energy emissions: national transport, electricity generation and manufacturing.<sup>24</sup> Of these, national transport is the largest. The transport system in New Zealand is distinguishable with its reliance on road transport. This road transport is 'almost universally powered by petrol and diesel'.<sup>25</sup> New Zealand has one of the highest rates of vehicle ownership among OECD member countries.<sup>26</sup> Compounding the transport issue is: a relatively old passenger vehicle fleet in the country; high use of trucks, rather than trains for freight; and a population that is widely spread.<sup>27</sup> New Zealand is heavily reliant on road transport: 86 per cent of New Zealanders use private road transport to get to work; and 70 per cent of domestic freight is carried by road.<sup>28</sup>

The transport sector in New Zealand is highly reliant on fossil fuels, with 84 per cent of light vehicles powered by petrol and 16 per cent powered by diesel.<sup>29</sup> Transport accounted for 19 per cent of New

<sup>22</sup> Ministry for the Environment, Above, n.17, vii.

<sup>23</sup> Ministry of Business Innovation and Employment, Above, n.9.

<sup>24</sup> Ministry of Business, Innovation and Employment. *Greenhouse Gas Emissions*. Retrieved from: <http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-data-modelling/statistics/greenhouse-gas-emissions>, Accessed 22 September 2015.

<sup>25</sup> Ministry of Transport. *Briefing to the Incoming Associate Minister of Transport: Part two: Introduction to the New Zealand Transport system and related issues*, January 2013. Retrieved from: <http://www.transport.govt.nz/assets/Import/Documents/BIM-2013-20Part-Two-Introduction-to-transport-system.pdf>, Accessed 22 September 2015, 33.

<sup>26</sup> Ministry for the Environment, Above, n.17, 43.

<sup>27</sup> Ministry for the Environment, Above, n.17, 43.

<sup>28</sup> Ministry for the Environment, Above, n.14, 35.

<sup>29</sup> Ministry for the Environment, Above, n.14, 34/35.

Zealand’s greenhouse gas emissions in 2011.<sup>30</sup> Within the transport sector, 91 per cent of emissions are attributable to road transport, of which 65.5 per cent of emissions are due to light passenger vehicles.<sup>31</sup> Despite a decrease in transport demand in recent times, greenhouse gas emissions from transport in New Zealand increased by more than 60 per cent in the period from 1990 to 2013.<sup>32</sup>

Figure 4 shows the number of new vehicle registrations in New Zealand over the past 20 years. Numbers peaked in 2005 at 230,313 new vehicle registrations, after which time they steeply decreased for four years. However, since 2009, which was the lowest point over the 20-year period, they have again been steadily increasing.

**Figure 4: Annual Registration of New Vehicles (1994-2013)**<sup>33</sup>

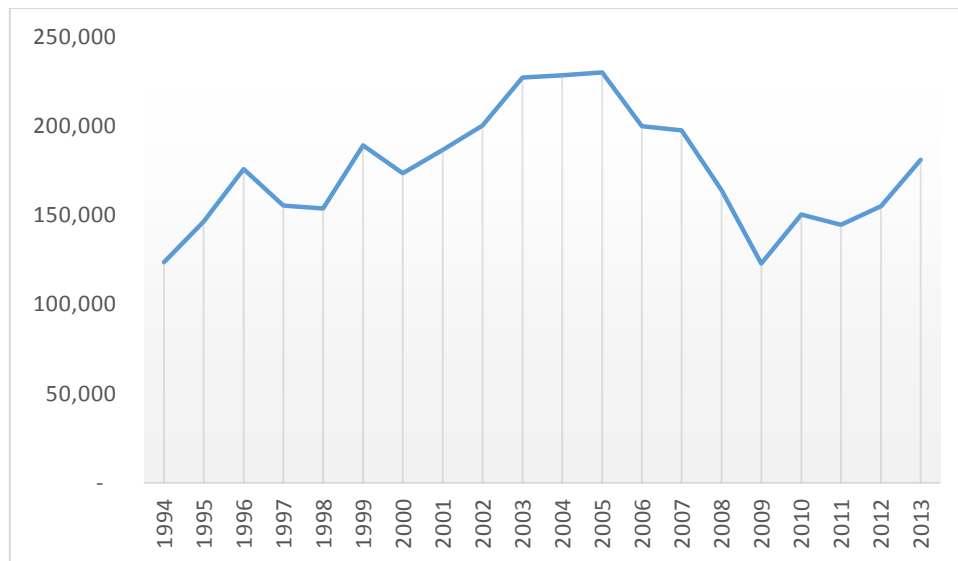


Table 5 outlines new vehicle registrations by cc ratings. The most popular range of vehicles is in the mid-high range: 1801-2000 and 2000-2500. These two ratings measures accounted for 40 per cent of annual vehicle registrations in New Zealand in 2013.

The transport sector is one of the areas where significant gains may be made. There have been considerable technological advances made in recent years, particularly in relation to electric vehicles. However, these electric vehicles have two key factors that are inhibiting greater uptake: their price and their current limited driving range. Work is ongoing in an attempt to address the latter issue. However, in the absence of specific interventions, the first issue is likely to remain at least in the short- to medium-term.

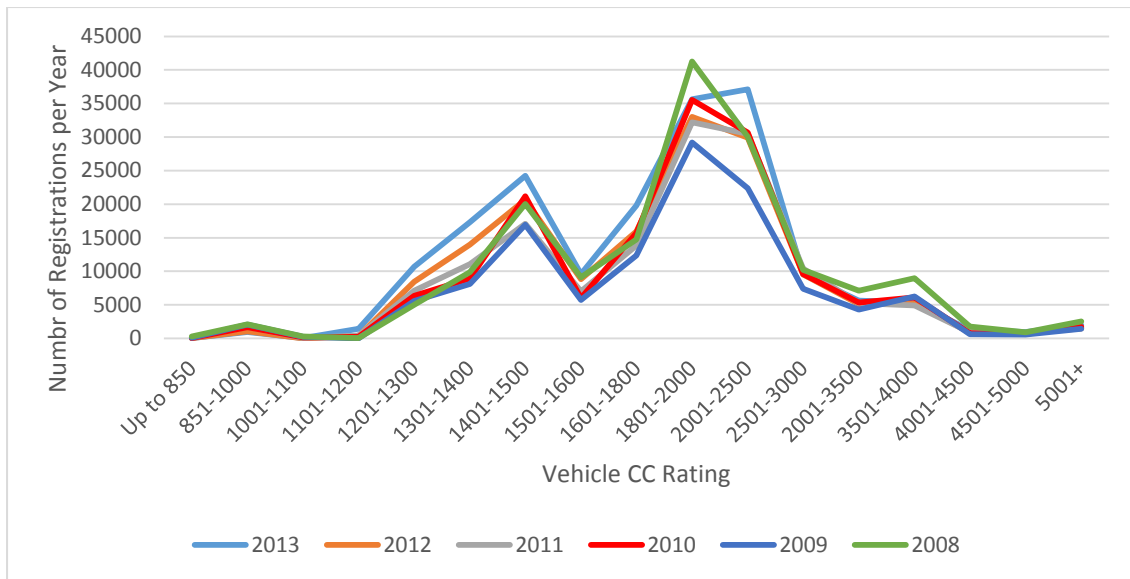
**Table 5: Annual Registration of New Vehicles by CC Rating (2008-2013)**<sup>34</sup>

<sup>30</sup> Ministry for the Environment, Above, n.14, 34.

<sup>31</sup> Lemon, Scott and Miller, Allan. (2013) *Electric Vehicles in New Zealand: From passenger to driver?* Electrical Power Engineering Centre Discussion Paper, May 2013, University of Canterbury, 20.

<sup>32</sup> Ministry of Transport, Above, n.25, 33.

<sup>33</sup> New Zealand Transport Agency, *New Zealand Motor Vehicle Registration Statistics 2013*. Retrieved from <http://www.nzta.govt.nz/assets/resources/motor-vehicle-registration-statistics/docs/2013.pdf>, Accessed 27 October 2015, 3. Figures include ex-overseas vehicles (i.e. second-hand imported vehicles).



## 2.4 Electric Vehicles

There are three main types of electric vehicles: those that are all-electric, often referred to as plug-in vehicles; hybrid electric vehicles, which have an internal combustion engine and a battery powered electric motor; and plug-in hybrid vehicles.<sup>35</sup> While this study primarily focuses on all-electric vehicles, the next section includes the literature on other low-emission vehicles.

It is also important to note that when discussing electric vehicles, that these are displaced emissions, rather than zero emission, as the electricity generation process to power the vehicles is likely to generate both CO<sub>2</sub> and conventional pollution.<sup>36</sup> While this remains the case in New Zealand, as around three-quarters of electricity generation is from renewable sources, the country is better placed than most to take advantage of electric vehicle technology.<sup>37</sup> An advantage of encouraging greater uptake of electric vehicles is that it will assist New Zealand in meeting its international emissions reduction obligations.

## 2.5 Kyoto Protocol

New Zealand, along with 194 other nations, has signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC).<sup>38</sup> The UNFCCC is an international treaty designed to enhance cooperation among nations to address climate change. The UNFCCC was adopted in 1992, was ratified by New Zealand in 1993 and came into force in 1994. The aim of the UNFCCC is to stabilise greenhouse gas concentrations in an agreed timeframe.<sup>39</sup> By ratifying the UNFCCC, countries are required to implement measures to address climate change. Part of the obligations of

<sup>34</sup> New Zealand Transport Agency. Above, n.33, 9. Figures include ex-overseas vehicles. A CC rating is a measure of a car's engine capacity (in cubic centimetres). A larger measure is a more powerful vehicle.

<sup>35</sup> Lemon and Miller, Above, n.31.

<sup>36</sup> Crist, Philippe. (2012) "Electric Vehicles Revisited – Costs, Subsidies and Prospects", Discussion Paper 2012-03, International Transport Forum at the OECD. Paris: International Transport Forum.

<sup>37</sup> In New Zealand, 38 per cent of total energy is sourced from renewable resources. Energy Efficiency and Conservation Authority. *Renewable Energy Resources*. Retrieved from: <https://www.eeca.govt.nz/energy-use-in-new-zealand/renewable-energy-resources/>, Accessed 28 October 2015.

<sup>38</sup> Ministry for the Environment, Above, n.17, 1.

<sup>39</sup> Ministry for the Environment, Above, n.17, 1.



the UNFCCC is to monitor greenhouse gas emissions and this is achieved by an annual inventory reported by each country.<sup>40</sup>

By 1995, concerns were raised that emission reduction targets in the UNFCCC were inadequate.<sup>41</sup> Negotiations followed to enhance the global response to climate change, which resulted in adoption of the Kyoto Protocol in 1997. It is the Kyoto Protocol that legally binds developed countries to emission reduction targets.<sup>42</sup> New Zealand ratified the Kyoto Protocol in 2002 and it came into force in 2005. Signing up to the Kyoto Protocol committed New Zealand to reducing greenhouse gas emissions over the first commitment period (2008-2012) to 1990 levels, or to take action if this target could not be achieved.<sup>43</sup> At the time of writing there are 195 Parties to the UNFCCC and 192 Parties to the Kyoto Protocol.<sup>44</sup>

Under the Kyoto Protocol *'the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed for it in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990...'*<sup>45</sup> New Zealand was one of these nations, committing to a 100 percentage of base year emission limitation in the first commitment period.<sup>46</sup> Only three countries committed to a higher level: Australia (108 per cent); Iceland (110 per cent) and Norway (101 per cent). Two other countries (the Russian Federation and the Ukraine) also committed to the 100 per cent limitation. The second commitment period is 2013-2020, but New Zealand has withdrawn from the second Kyoto Protocol commitment period, while retaining its targets under the UNFCCC.

Currently, the key target in New Zealand (announced in July 2015) is to reduce greenhouse gas emissions to 30 per cent below 2005 levels by 2030.<sup>47</sup> However, this is described as a 'provisional target'. Other targets are an unconditional target of five per cent below the 1990 greenhouse gas emissions levels by 2020, and a longer-term target of 50 per cent below 1990 greenhouse gas emission levels by 2050.<sup>48</sup> These commitments will be met through domestic emission reductions, removing carbon by forests, participation in international carbon markets and the surplus achieved during the first Kyoto Protocol commitment period.<sup>49</sup>

The Kyoto Protocol has flexible market mechanisms, based on the trade of emission permits. Countries have to meet their emission targets *'largely through domestic action – that is, to reduce their emissions onshore'*.<sup>50</sup> However, part of the target may be met through market-based mechanisms. Under the UNFCCC and the Kyoto Protocol only emissions and removals of direct

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<sup>40</sup> Ministry for the Environment, Above, n.17, 1.

<sup>41</sup> UNFCCC, Above, n.1.

<sup>42</sup> UNFCCC, Above, n.1. Developed countries are bound by the Kyoto Protocol as they are largely responsible for the high levels of greenhouse gases in the atmosphere.

<sup>43</sup> Ministry of Business, Innovation and Employment, Above n.24.

<sup>44</sup> UNFCCC. *Fast Facts and Figures*. Retrieved from: [http://unfccc.int/essential\\_background/basic\\_facts\\_figures/items/6246.php](http://unfccc.int/essential_background/basic_facts_figures/items/6246.php), accessed 15 October 2015.

<sup>45</sup> UNFCCC. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Retrieved from: <http://unfccc.int/resource/docs/convkp/kpeng.html>, Accessed 27 October 2015, Article 3 at 7.

<sup>46</sup> UNFCCC, Above, n.45, Annex B.

<sup>47</sup> New Zealand Government. *New Zealand's emissions reduction targets*, Retrieved from: <https://www.climatechange.govt.nz/reducing-our-emissions/targets.html>, Accessed 22 October 2015.

<sup>48</sup> New Zealand Government, Above, n.47.

<sup>49</sup> Ministry for the Environment, Above, n.3.

<sup>50</sup> UNFCCC. *Making those first steps count: An introduction to the Kyoto Protocol*, Retrieved from: [http://unfccc.int/essential\\_background/kyoto\\_protocol/items/6034.php](http://unfccc.int/essential_background/kyoto_protocol/items/6034.php), accessed 15 October 2015.

greenhouse gases are reported. These seven gases are: carbon dioxide (CO<sub>2</sub>); methane; nitrous oxide, hydrofluorocarbons; perfluorocarbons; sulphur hexafluoride; and nitrogen trifluoride.<sup>51</sup> Vehicle emissions typically report on CO<sub>2</sub> emissions only.

## 2.6 New Zealand's Emissions Trading Scheme

New Zealand's Emissions Trading Scheme (ETS) is the government's key policy to address greenhouse gas emissions.<sup>52</sup> This choice of policy tool is justified on the basis that it is the lowest-cost option.<sup>53</sup> The ETS requires those participating in the scheme to report on emissions. Emissions units (New Zealand Units) are surrendered correlating to emissions. Industries were phased in, starting with forestry, and followed by transport, some energy sectors, industrial processes, synthetic gases and waste sectors.<sup>54</sup> Not all industries and organisations have the same obligations. For example, at the present time, the agricultural sector has 'reporting only' obligations and there is no date for when the sector will fully join the ETS.

The first sectors entered the scheme in 2008. The ETS is well thought of, being described by the OECD in its early days of operation as *'the most developed, comprehensive carbon-trading scheme of its kind outside the European Union'*.<sup>55</sup> However, as also observed by the OECD, the carbon price signal is weak in the absence of internationally agreed emissions targets.<sup>56</sup>

New Zealand units are issued by the New Zealand Government. New Zealand units are allocated to individuals or organisations in certain sectors, or in response to certain activities, such as planting forests.<sup>57</sup> For those individuals or entities that are participating in the ETS, greenhouse gas emissions must be recorded and reported. New Zealand units, or approved Kyoto units, are surrendered to cover any emission obligations.<sup>58</sup>

Projecting future emissions is problematic. Factors such as future oil prices, the future carbon price, afforestation and deforestation, and even weather patterns can impact on emissions.<sup>59</sup> Nonetheless, forecasts of future emissions have been made, which suggest that gross and net emissions in New Zealand are projected to gradually increase.<sup>60</sup>

## 3 PRIOR STUDIES

This section investigates the literature on changing behaviour through the tax system. It starts with taxes that have been introduced to influence vehicle purchasing behaviours. However, as this is a relatively new field, studies in this area are still emerging. Therefore, a wider range of literature is examined, including literature on fuel taxes, together with a brief discussion on price elasticity of demand.

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<sup>51</sup> Note that only the first six of these were included in the 1998 Kyoto Protocol to the UNFCCC (as outlined in Annex A).

<sup>52</sup> Ministry for the Environment, Above, n.3.

<sup>53</sup> Above, n.52.

<sup>54</sup> Ministry for the Environment, Above, n.14, 14.

<sup>55</sup> OECD. 2013, *OECD Economic Surveys – New Zealand*, OECD: Paris.

<sup>56</sup> OECD, Above, n.55.

<sup>57</sup> Ministry for the Environment, Above, n.17, 24.

<sup>58</sup> Ministry for the Environment, Above, n.17, 24.

<sup>59</sup> Ministry for the Environment, Above, n.14, 15.

<sup>60</sup> Ministry for the Environment, Above, n.14, 16.

From an economic perspective, there are few arguments in support of using the tax system to encourage electric vehicle purchases.<sup>61</sup> Ideally, the negative externalities generated by high-emissions vehicles would be taxed. However, in many cases it is lower-income earners who have higher emissions vehicles, as these are the older and less expensive vehicles. Using the tax system to influence behaviour is more likely to have an impact if it is directed as a concession towards higher-income earners rather than an additional tax on lower-income earners, who are less likely to be able to change their behaviour in response to the price signal. This has been the approach adopted in many European countries. As well as examining subsidies to encourage uptake of low-emissions vehicles the study also investigates penalties for new purchases of high-emissions vehicles.

### 3.1 Price Elasticity of Demand

Price elasticity of demand attempts to capture the sensitivity of the quantity demanded for a particular good or service to changes in its price. Where the price elasticity of demand coefficient is zero, demand is perfectly inelastic: no price increase will impact on the level of demand. When the percentage change in demand is less than the percentage change in price, the good is said to be relatively elastic:  $E_d > -1$ . When the percentage change in demand is greater than the percentage change in price, the good is said to be relatively inelastic:  $E_d < -1$ . Unitary elasticity occurs when the percentage change in demand is equal to the percentage change in price:  $E_d = -1$ . A low elasticity for a particular policy tool suggests that it will be a relatively ineffective lever for influencing demand or alternatively it could be effective for increasing revenue.<sup>62</sup>

For most goods the elasticity of demand is negative: there are few goods or services where increasing the price will increase demand. The formula for calculating the price elasticity of demand is the percentage change in quantity demanded divided by the percentage change in price. By way of illustration, if increasing the price of a good by 5 per cent reduces demand by 10 per cent, this would return a coefficient of -2 (-10/5), suggesting it was relatively elastic. By way of contrast, increasing the price of a good by 10 per cent, where demand was reduced by 5 per cent as a result, would return a coefficient of -0.5 (-5/10), suggesting it was relatively inelastic.

Thus, the price elasticity of demand of vehicles is an important consideration when considering the use of the tax system to change the price of vehicles with the aim of making them more or less attractive depending on their CO<sub>2</sub> emissions. The concept of cross-price elasticity of demand is also relevant to this topic, which is where the change in the price of a good may result in a change in demand of another good, for example, where the other good is a substitute. This may occur when tax incentives reduce the price of low-emission vehicles or additional taxes are attached to high-emission vehicles.

Multiple factors will impact on the price elasticity of demand for vehicles, of which price is one: this price may be the use of an economic tool to increase the price of high-emission vehicles or the use of an economic tool to decrease the price of low-emission vehicles. Other factors include:

- The presence of substitutes. There are many substitute products in the vehicle market and an increasing number of substitute vehicles in the low-emission or all-electric vehicle

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<sup>61</sup> Braathen, Nils Axel. (2012) CO<sub>2</sub>-Based Taxation of Motor Vehicles. In T Zachariadis (ed) *Cars and Carbon: Automobiles and European Climate Policy in a Global Context*, (181-200), Springer Science and Business Media.

<sup>62</sup> Goodwin, P.B. (1992) "A Review of New Demand Elasticities with Special Reference to Short and Long Run Effects of Price Changes", *Journal of Transport Economics and Policy*, 26(2):155-169.

market. Greater numbers of substitute products are likely to increase the price elasticity of demand.

- Income. As vehicle purchases are likely to be a high proportion of the income of the purchaser, this is expected to decrease the price elasticity of demand. Where a good or a service is not a significant component of an individual's income, a change in price is less likely to result in a change of behaviour.

The price elasticity of demand is often used to assess factors such as whether revenue will increase or decrease with a price change, or whether more or less quantity will be demanded with a price change. Therefore, it is also useful for the purposes of assessing the likely impact of tax concessions or tax penalties on vehicles.

### 3.2 Tax Incentives

While hybrid and all-electric vehicle technology is relatively new, there are some studies that have attempted to measure the impact of incentive schemes on their adoption. Many of these studies investigate earlier hybrid vehicles, rather than all-electric vehicles. Both examples are included here, although it is acknowledged that the hybrid vehicle uptake may be higher than electric vehicle uptake due to the current limitations of driving range associated with electric vehicles.

A number of studies have investigated the impact of tax incentives on new passenger car purchases. In general, these show that consumers do respond to upfront price signals, such as rebates on purchase taxes or other tax incentives.<sup>63</sup> Kok finds that tax incentives in The Netherlands resulted in 11 per cent lower average CO<sub>2</sub> emissions in 2013.<sup>64</sup> Three vehicle tax policy instruments were used in The Netherlands, all of which were introduced after 2007. These included a one-off vehicle purchase tax on initial registration of the vehicle at 45.2 per cent of the net list price. Low emission vehicles were exempt from this tax and the tax was increased based on CO<sub>2</sub> emissions.<sup>65</sup> In addition, the annual road tax was reduced, and in some cases, fully exempt, based on CO<sub>2</sub> emissions and the company car tax, paid by the employee, was increased to 20 per cent for high emission vehicles and reduced to as low as zero for lower emission vehicles.<sup>66</sup>

Modelling of policy scenarios in Ireland for private vehicle transport suggests possible improvements of 32 per cent in car stock efficiency and a 22 per cent reduction in private vehicle CO<sub>2</sub> emissions (relative to 2009 levels).<sup>67</sup> Other studies concur that the use of fiscal instruments has resulted in behavioural change in Ireland.<sup>68</sup> The policy instruments adopted in Ireland are discussed in more detail in section 4.1.

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<sup>63</sup> Kok, Robert. (2015) "Six years of CO<sub>2</sub>-based tax incentives for new passenger cars in The Netherlands: Impacts on purchasing behaviour trends and CO<sub>2</sub> effectiveness", *Transportation Research Part A*, 77:137-153; Brand, Christian, Anable, Jillian and Tran, Martino. (2013) "Accelerating the transformation to a low carbon passenger transport system: The role of car purchase taxes, feebates, road taxes and scrappage incentives in the UK", *Transportation Research Part A*, 49:132-148. West, Sarah, E. (2004) "Distributional effects of alternative vehicle pollution control policies", *Journal of Public Economics*, 88:735-757.

<sup>64</sup> Kok, Above, n.63.

<sup>65</sup> Kok, Above, n.63, 139.

<sup>66</sup> Kok, Above, n.63, 140.

<sup>67</sup> Daly, Hannah E and O Gallachoir, Brian P. "Future energy and emissions policy scenarios in Ireland for private car transport", *Energy Policy*, 51:172-183.

<sup>68</sup> Giblin, S. and McNabola, A. (2009) "Modelling the impacts of a carbon emission-differentiated vehicle tax system on CO<sub>2</sub> emissions intensity from new vehicle purchases in Ireland," *Energy Policy*, 37(4):1404-1411.

In Austria, there are three primary tax instruments that impact on the cost of vehicles: a fuel consumption tax paid upon initial registration; an engine related tax; and a fuel tax.<sup>69</sup> Modelling scenarios considering these taxes and subsidies for traditional and electric vehicles, suggests that electric vehicles will become cost-competitive with electric vehicles in the short-term, if production volumes increase to the point where economics of scale are reached. The authors conclude that an up-front price signal is likely to be of greatest impact in achieving this.<sup>70</sup>

The use of price signals has been shown to be effective in Norway. The vehicle registration tax was reformed with the aim of reducing CO<sub>2</sub> emissions in new vehicles purchased, by providing incentives to encourage purchases of more fuel efficient cars. These incentives are outlined further in section 4.3. Research by Ciccone shows that the tax reforms resulted in a reduction in average CO<sub>2</sub> intensity of new vehicles, with approximately half of this attributable to the tax reform.<sup>71</sup> However, a similar outcome is found in Norway as was found in Ireland, which is a shift in purchasing behaviour from petrol vehicles to diesel vehicles.<sup>72</sup> More recent initiatives have targeted financial incentives more directly towards electric vehicles. Therefore, it is possible that this pattern may change as the impact from these changes becomes visible.

Research from Canada produces similar findings. Chandra, Gulati and Kandlikar report that tax rebates in Canadian Provinces resulted in a large increase in the market share of hybrid vehicles.<sup>73</sup> The authors' estimate that 26 per cent of hybrid vehicles sold during the period when the tax rebates were provided could be attributed to the rebate and other, higher emission vehicles, were crowded out as a result.<sup>74</sup> This study also estimates the cost of reducing CO<sub>2</sub> emissions at C\$195 per tonne. A similar estimation from the United States of America is US\$177 per tonne.<sup>75</sup>

Research from the United States of America on hybrid-electric vehicles suggest a strong relationship between fuel prices and hybrid uptake, but a weaker relationship between incentive policies and hybrid uptake.<sup>76</sup> However, in agreement with the studies outlined above, this research also finds that upfront payments are the most effective.

A further study in the United States of America examined different types of tax benefits, including state sales tax waivers, income tax credits and non-tax incentives, such as the ability to use carpool lanes when driving a hybrid vehicle.<sup>77</sup> The study finds that the type of tax is as important as the value of the tax benefit. Sales tax waivers are reported as being associated with a more than tenfold increase in hybrid sales, as compared to income tax credits. This finding is in agreement with studies outlined above. Results on carpool lane access are less consistent, with a positive correlation found in only one state.

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<sup>69</sup> Gass, V., Schmidt, J and Schmid, E. (2014) "Analysis of alternative policy instruments to promote electric vehicles in Austria", *Renewable Energy*, 61:96-101.

<sup>70</sup> Gass, Schmidt and Schmid, Above, n.69.

<sup>71</sup> Ciccone, Alice. (2014) *Is it all about CO<sub>2</sub> emissions? The environmental effects of a tax reform for new vehicles in Norway*. Memorandum, Department of Economics, University of Oslo, No. 19/2014.

<sup>72</sup> Ciccone, Above, n.71.

<sup>73</sup> Chandra, Ambarish, Gulati, Sumeet, and Kandlikar, Milind. (2010) "Green drivers or free riders? An analysis of tax rebates for hybrid vehicles", *Journal of Environmental Economics and Management*, 60:78-93.

<sup>74</sup> Chandra, Gulati and Kandlikar, Above, n.73.

<sup>75</sup> Beresteanu and Li, Above, n.5.

<sup>76</sup> Diamond, David. (2009) "The impact of government incentives for hybrid-electric vehicles: Evidence from US states", *Energy Policy*, 37:972-983.

<sup>77</sup> Gallagher, Kelly Sims and Muehlegger, Erich. (2011) "Giving green to get green? Incentives and consumer adoption of hybrid vehicle technology", *Journal of Environmental Economics and Management*, 61: 1-15.

Beresteanu and Li also used the United States of America for their analysis, which examined both increases in fuel prices and income tax incentives.<sup>78</sup> They conclude that the income tax deductions that were used prior to 2005 were less effective than the more generous income tax credits that were introduced in 2006. Beresteanu and Li estimate that the tax deductions explained less than five per cent of hybrid vehicle sales from 2001 to 2005, whereas the tax credits from 2006 accounted for approximately 20 per cent of hybrid vehicle sales.<sup>79</sup> The authors also suggest that a flat rebate scheme, rather than the income tax-based scheme, will be more cost-effective at promoting energy conservation, due to the high cost of the tax credit programme.

The above research is supported by research from the OECD, which suggests that the advantage of using the tax system to influence behaviour is effective where it provides support for positive externalities, i.e. where '*a subsidy would help to deliver more social benefits than would otherwise be the case*'.<sup>80</sup> Thus, the literature shows a general agreement that tax incentives generate behavioural change. However, the behavioural shift is achieved at a high cost.

### 3.3 Fuel Prices

While innovations relating to electric vehicles are relatively new, there is a range of literature that has investigated the impact of changes in fuel prices on behaviour. This literature is also relevant to this study, as in New Zealand the costs associated with roading and transport are paid through additional taxes on fuels, which are paid into the National Land Transport Fund. Most of these costs are collected through taxes on fuel at source, including petrol, compressed natural gas and liquefied petroleum gas. Petrol is taxed in New Zealand at around 45 per cent, plus the Emissions Trading Scheme levy, and goods and services tax at 15 per cent.<sup>81</sup> Drivers of diesel vehicles do not pay an excise tax on fuel. Instead, they pay road-user charges, based on a vehicle's weight and vehicle type. For a low-weight vehicle (under 3.5 tonnes) this is approximately NZ\$67 per 1,000 kilometres travelled, including the administration charge.

Fuel taxes tend to be politically unpopular.<sup>82</sup> Perhaps a more significant issue is that they are regressive.<sup>83</sup> West suggests that greater price responsiveness among lower-income earners minimises the regressive impact of fuel price increases. Thus, West claims that taxes on engine size are more regressive than a fuel tax.<sup>84</sup> This claim is supported by Graham and Glaister who observe the conventional wisdom that suggests that standards of living have a strong impact on demand for road travel.<sup>85</sup> In Graham and Glaister's review of the literature, they find that numbers of car trips are less responsive to fuel price changes in the long-run than the number of kilometres driven.<sup>86</sup> This

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<sup>78</sup> Beresteanu and Li, Above, n.5.

<sup>79</sup> Beresteanu and Li, Above, n.5, 181.

<sup>80</sup> Greene and Braathen, Above, n.11, 3.

<sup>81</sup> The fuel tax is a fixed excise of 67.13 cents/litre. This mostly goes to the National Land Transport Fund New Zealand Automobile Association, *How Petrol Prices are Calculated*. Retrieved from: <http://www.aa.co.nz/cars/maintenance/fuel-prices-and-types/how-petrol-prices-are-calculated/>, Accessed 28 October 2015.

<sup>82</sup> Lemon and Miller, Above, n.31, 14.

<sup>83</sup> West, Sarah, E., and Williams, Robertson, C. (2003) "Estimates from a consumer demand system: Implications for the incidence of environmental taxes", *Journal of Environmental Economics and Management*, 47:535-558.

<sup>84</sup> West and Williams, Above, n.84.

<sup>85</sup> Graham, Daniel, J., and Glaister, Stephen. (2004) "Road Traffic Demand Elasticity Estimates: A review", *Transport Reviews*, 24(3):261-274.

<sup>86</sup> Graham and Glaister, Above, n.85.

may be due to people's ability to adapt to other transport options or change destinations. Car ownership also responds to fuel price changes in the long run.

Studies suggest that there is limited behavioural change to be made through fuel taxes in the short- to medium-term. For example, Giblin and McNabola suggest that fuel taxes have minimal short-term impact on the type of new vehicles purchased. The authors suggest that policy changes, such as that introduced in Ireland, will result in an overall reduction in CO<sub>2</sub> emissions, in the range of 3.6-3.9 per cent.<sup>87</sup> The authors also note the loss of tax revenue, which is forecast to be €191 million annually. Whether this is a positive outcome depends on if the tax is intended to change behaviour or whether it is intended to raise revenue. If the assumption is made that it is to change behaviour, then the loss of revenue is likely to be a predictable and necessary correlation to any behavioural changes resulting from the policy.

Gallagher and Muehlegger's study, discussed in the previous sub-section, also investigated whether consumers respond to increasing fuel prices and how this impact differs for different types of tax incentives. Increasing fuel prices are generally associated with increases in hybrid vehicle sales.<sup>88</sup> Similar results are found by Beresteanu and Li who estimate that hybrid vehicle sales in the United States of America in 2006 would have been 37 per cent lower if fuel prices had stayed at the level they were in 1999 (US\$1.53 versus US\$2.60).<sup>89</sup> Thus, the authors conclude that the combination of high fuel prices and income tax incentives contributed significantly to the growing uptake of hybrid vehicles.

### 3.4 Research Questions

Following from the background outlined in section two and the literature outlined in the above section, the research questions addressed in this study are twofold. The literature has established that tax benefits for purchasing electric vehicles are likely to be effective, notwithstanding that this will be at a high cost. Moreover, the background section outlines the potential for New Zealand to be optimally positioned to take advantage of electric vehicles as part of its emission reduction strategy, due to the high, and increasing, proportion of electricity that is generated via renewable resources. Therefore, the first research question is: what can New Zealand learn from approaches adopted in European countries that are transferrable to the New Zealand environment?

Mortimer writes that Australia *'has no mandatory fuel efficiency standards, no CO<sub>2</sub> emission targets, and no effective fiscal or incentive environmental instruments to reduce road transport emissions'*.<sup>90</sup> New Zealand can claim no better. Therefore the second, and concomitant, research question is: what should be done in New Zealand to address the current lack of action towards reducing road transport emissions in New Zealand.

## 4 EUROPEAN OPTIONS

This section outlines policy adopted in Ireland, the United Kingdom and Norway in order to encourage uptake of electric or low-emissions vehicles. These three countries are used as they have

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<sup>87</sup> Giblin and McNabola, Above, n.68.

<sup>88</sup> Gallagher and Muehlegger, Above, n.77.

<sup>89</sup> Beresteanu and Li, Above, n.5, 181.

<sup>90</sup> Mortimore, Anna. (2015) Will Cars Go Green in the ACT: Study of policy design and barriers of the reformed vehicle stamp duty. Paper presented at the *Australasian Tax Teachers' Association Conference*, Adelaide, January 2015, p.3.

adopted different approaches with the same objective: to discourage purchases of high-emission vehicles and provide incentives for low-emission vehicles. The section concludes with a brief outline of a range of other policy tools that have been adopted in European countries.

#### 4.1 Ireland

The current vehicle tax system in Ireland was introduced in July 2008. There are two components to the scheme: vehicle registration tax and motor tax. While the vehicle tax system that was in place prior to July 2008 is still in operation for vehicles registered prior to this time, this discussion will focus on vehicles covered in the later period.<sup>91</sup> After July 2008, vehicles are taxed based on their CO<sub>2</sub> emissions. The use of the tax system to increase or decrease the cost of a vehicle depending on its CO<sub>2</sub> emissions is '*to encourage the use of smaller, cleaner, fuel-efficient cars in the fight against climate change by reducing the emission of carbon dioxide (CO<sub>2</sub>) from cars to help protect the environment and improve local air quality*'.<sup>92</sup>

Vehicle CO<sub>2</sub> emissions are determined based on tests undertaken on the model of each vehicle. Before new models of vehicles are sold in Europe, they undergo a series of tests to ensure they meet approved safety and environmental standards.<sup>93</sup> One of the tests certifies the level of CO<sub>2</sub> emissions of the vehicle model and it is this level that is used for tax purposes.<sup>94</sup> There are two taxes that are influenced by the level of vehicle CO<sub>2</sub> emissions: the vehicle registration tax and the motor tax.

The vehicle registration tax is charged when a vehicle is first registered in Ireland.<sup>95</sup> All vehicles, unless they are in Ireland temporarily, must be registered. Motor tax is an ongoing tax that must be paid when vehicles are used on public roads or in public places. There are 12 bands for the motor tax and vehicle registration tax as outlined in Table 1.

**Table 1: CO<sub>2</sub> Bands and Charges for Motor Tax and Vehicle Registration Tax<sup>96</sup>**

Band	CO <sub>2</sub> Emissions – grams per kilometre	Annual charge for vehicles registered after 1 July 2008 (€) / NZ\$ <sup>97</sup>	Vehicle Registration Tax Rate
A0	0	€120 (NZ\$214)	
A1	1g to 80g	€170 (NZ\$303)	14%
A2	81g to 100g	€180 (NZ\$321)	15%
A3	101g to 110g	€190 (NZ\$339)	16%
A4	111g to 120g	€200 (NZ\$357)	17%
B1	121g to 130g	€270 (NZ\$482)	18%
B2	131g to 140g	€280 (NZ\$500)	19%
C	141g to 155g	€390 (NZ\$696)	23%
D	156g to 170g	€570 (NZ\$1,017)	27%
E	171g to 190g	€750 (NZ\$1,338)	30%

<sup>91</sup> Vehicles registered prior to 1 January 2008 will be taxed on engine size. Vehicles registered overseas between 1 January and 30 June 2008 will be taxed on the lesser of the engine size or CO<sub>2</sub> emissions. Irish Tax and Customs, Retrieved from: <http://www.revenue.ie/en/tax/vrt/#section4>, Accessed 29 September 2015.

<sup>92</sup> Irish Tax and Customs, Above, n.91.

<sup>93</sup> Irish Tax and Customs, Above, n.91.

<sup>94</sup> Irish Tax and Customs, Above, n.91.

<sup>95</sup> *Finance Act 1992*, s132(1).

<sup>96</sup> Environment, Community and Local Government. *Motor Taxation: Rates of duty on motor vehicles (effective 1 October 2013)*, September 2013; and Irish Tax and Customs *Guide to Vehicle Registration Tax*, Retrieved from: <http://www.revenue.ie/en/tax/vrt/vrt-guide.html>, Accessed 29 September 2015.

<sup>97</sup> Conversion rate used EUR/NZD 1.7847, 29 September 2015.



F	191g to 225g	€1,200 (NZ\$2,142)	34%
G	More than 225g	€2,350 (NZ\$4,192)	36%

The vehicle registration tax is a percentage of the expected retail price of the vehicle, including all taxes.<sup>98</sup> Table 1 shows the vehicle registration tax categories for Revenue Category A vehicles, which includes most light passenger vehicles.<sup>99</sup> Minimum charges also apply for vehicle registration tax.

Research undertaken following implementation of the policy has generally agreed that it has been successful in influencing purchasing decisions towards lower CO<sub>2</sub> emission vehicles.<sup>100</sup> However, the trend was a movement from petrol vehicles towards diesel powered vehicles, which result in a more modest reduction in CO<sub>2</sub> emissions than a situation where people replaced large-engine vehicles with smaller engine vehicles.<sup>101</sup> As with studies mentioned above, the strong price signal also resulted in a reduction in tax revenue from the vehicle registration tax. Moreover, there has more recently been the suggestion that the CO<sub>2</sub> benefits may have resulted in an adverse consequence of increased NO<sub>x</sub> emissions.<sup>102</sup>

Early research based on modelling suggested the policy would result in CO<sub>2</sub> emission reductions of between 3.6 and 3.9 per cent, but at a loss of €191 million in tax revenues.<sup>103</sup> Subsequent research supports the suggestion that the loss of revenue from the vehicle registration tax has been significant.<sup>104</sup> Thus, the overall conclusion is that the costs per tonne of CO<sub>2</sub> avoided are high.<sup>105</sup>

## 4.2 The United Kingdom

There are a number of incentives in the United Kingdom intended to encourage uptake of electric vehicles. On 1<sup>st</sup> January 2011, a 'Plug-In Car Grant' programme was introduced. This initiative initially provided a 25 per cent grant towards the purchase of a new all-electric (plug-in) vehicle and was increased to 35 per cent in 2015. The grant is capped at £5,000 (NZ\$11,800).<sup>106</sup> The grant is available to corporate vehicles, as well as privately owned cars. In a similar approach to that adopted by Norway (see below), this initiative is in place until 50,000 grants have been given, or 2017, whichever is the earlier. Different initiatives exist for electric vans.

The types of vehicles that are eligible for the government grant are broader than some other countries. Traditional all-electric vehicles are eligible. However, so are plug-in hybrid vehicles that use either a petrol or diesel engine, but with a battery that is plugged into a mains electrical

<sup>98</sup> Irish Tax and Customs. *Guide to Vehicle Registration Tax*, Retrieved from: <http://www.revenue.ie/en/tax/vrt/vrt-guide.html>, Accessed 29 September 2015.

<sup>99</sup> *Finance Act 1992*, s.130.

<sup>100</sup> Rogan, Fionn, Dennehy, Emer, Daly, Hannah, Howley, Martin and O Gallachoir, Brian, P. (2011) "Impacts of an emission based private car taxation policy – First year ex-post analysis", *Transportation Research Part A*, 45:583-597. Leinart, Stephan, Daly, Hannah, Hyde, Bernard and O Gallachoir, Brian. (2013) "Co-Benefits? Not always: Quantifying the negative effect of a CO<sub>2</sub>-reducing car taxation policy on NO<sub>x</sub> emissions", *Energy Policy*, 63:1151-1159.

<sup>101</sup> Hennessy, Hugh and Tol, Richard, S.J. (2011) "The impact of tax reform on new car purchases in Ireland", *Energy Policy*, 39:7059-7067.

<sup>102</sup> Leinart, Daly, Hyde and O Gallachoir, Above, n.100. NO<sub>x</sub> is the term for nitric oxide and nitrogen dioxide.

<sup>103</sup> Giblin and McNabola, Above, n.68.

<sup>104</sup> Rogan, Dennehy, Daly, Howley and O Gallachoir, Above, n.100.

<sup>105</sup> Above, n.101.

<sup>106</sup> Converted at 1 October 2015, using a rate of GBP1/NZD2.36.

network. Vehicles powered by hydrogen fuel cells and other low-emission technologies are also eligible.<sup>107</sup>

Electric vehicles also benefit from reductions in vehicle tax rates. For vehicles registered prior to 2001, the rate of vehicle tax is determined by the engine size of the vehicle. For cars registered after this time, the tax rate is determined by CO<sub>2</sub> emissions and fuel type.<sup>108</sup> However, where information is not available for a particular vehicle, the system prior to 2001 will be adopted. There are 13 bands for petrol and diesel fuelled vehicles, ranked A to M, ranging from a cost of zero for band A (CO<sub>2</sub> emissions up to 100 g/km) through to band M at £505 (NZ\$1,192 ) (CO<sub>2</sub> emissions over 255 g/km).

#### 4.3 Norway

Norway is notable for having the highest uptake per capita of plug-in electric cars in the world, with 13.8 per cent of new car sales in 2014.<sup>109</sup> The Parliament of Norway established a target of 50,000 zero emission vehicles by 2018, which was reached in 2015. As part of the incentive to encourage electric car utilisation, vehicles that are completely electric (i.e. not hybrids) are exempt from all non-annual vehicle fees. This exemption extends to purchase taxes and the 25 per cent value-added-tax on initial vehicle registration. Further incentives exist in the form of exemptions for all-electric vehicles from public parking fees, toll payments, domestic ferries and the annual motor vehicle tax (as outlined in Table 2). All-electric vehicles may use bus lanes. These incentives were initially introduced until the target of 50,000 zero emission vehicles was achieved. As this target has recently been met it is likely that there will be changes to the incentive structure. At the time of writing negotiations to determine future incentive structures were ongoing. The annual motor vehicle tax for passenger vehicles are outlined in Table 2.

**Table 2: Annual Motor Vehicle Tax – Norway (2015)**

Vehicle	Norwegian Kroner / NZ\$ <sup>110</sup>
Vehicle (weight up to 7,500 kg)	NOK 3,060 / NZ\$570
Vehicle (weight up to 7,500 kg) – diesel without a particle filter	NOK 3,565 / NZ\$663
Electric vehicle	NOK 435 / NZ\$81

The only ‘tax’ payable at the time of initial registration is the vehicle scrap deposit of NOK3,000 (NZ\$560), which is payable by all vehicles. This vehicle scrap deposit was introduced in 1978 and is refundable when the vehicle is scrapped with an authorised dealer. Additional taxes payable by other (non-electric) vehicles include:

- A one-off registration tax when the vehicle is first registered in Norway. This amount will depend on factors such as CO<sub>2</sub> emissions, NO<sub>x</sub> emissions, the weight of the vehicle and the size of the engine. This charge may be hundreds of thousands of Norwegian Kroner (i.e. over NZ\$20,000), for high emission vehicles.
- Tax on greenhouse gases in air-conditioning systems: NOK460 / kg (plus VAT at 25 per cent).

<sup>107</sup> United Kingdom Government. *Plug-in car and van grants*. Retrieved from: <https://www.gov.uk/plug-in-car-van-grants/eligibility>, Accessed 1 October 2015.

<sup>108</sup> United Kingdom Government. *Calculate vehicle tax rates*. Retrieved from: <https://www.gov.uk/calculate-vehicle-tax-rates>, Accessed 1 October 2015.

<sup>109</sup> Cobb, Jeff. *Top 6 Plug-In Vehicle Adopting Countries – 2014*, Retrieved from: <http://www.hybridcars.com/top-6-plug-in-vehicle-adopting-countries-2014/4/>, Accessed 30 September 2015.

<sup>110</sup> Conversion rate of NZD/NOK 0.1861, 29 September 2015.

- In addition to the motor vehicle tax, when a vehicle is first registered, a Hydrofluorocarbon and Perfluorocarbon tax may be payable.

Norway's electric vehicle fleet is seen as particularly clean, due to the high levels of renewable electricity generated in the country. Norway has the highest level of renewable electricity generation in the world.

#### 4.4 Other Policy Tools<sup>111</sup>

Ten of the 28 European Union Member States provide no incentives for electric vehicles.<sup>112</sup> A range of policy tools are used in the other 18 countries that do provide incentives. Those of Norway, the United Kingdom and Ireland are outlined in more detail above. Other approaches, in brief, include:

- Exemptions from fuel consumption taxes and monthly vehicle taxes (in Austria);
- Allowable deductions for the use of company cars of 120 per cent for zero-emissions vehicles and 100 per cent for low emission vehicles (CO<sub>2</sub> emissions of 1-60 g/km). Above this rate, deductibility decreases gradually to 50 per cent (in Belgium);
- Exemptions from road tax for vehicles used for business purposes (Czech Republic);
- Exemption from annual circulation tax for 10 years from date of first registration (Germany);
- Exemption from registration tax (Denmark, Latvia, Romania);
- Payment of the minimum rate (5 per cent) of the CO<sub>2</sub> based registration tax (Finland);
- The adoption of a Bonus-Malus scheme. A bonus of up to €5,000 for the purchase of vehicles emitting CO<sub>2</sub> below 20g/km. Vehicles emitting between 20 and 60 g/km, the premium is €4,000 and for those emitting CO<sub>2</sub> between 61 and 110g/km, it is a maximum of €2,000. There is a cap relating to a proportion of the purchase price of the vehicle. The 'Malus' component of the scheme can contribute up to €8,000 in additional taxes for vehicles emitting over 200g/km of CO<sub>2</sub> (France);
- Exemptions from registration tax, luxury car tax and luxury living tax. Vehicles with an engine capacity up to 1,929cc are exempt from annual circulation tax (Greece);
- Exemption from annual circulation tax and registration tax (Hungary; Portugal);
- Exemption from annual circulation tax for five years from date of first registration – a 75 per cent reduction may apply after the initial five-year period (Italy);
- Exemption from registration tax. Low emissions vehicles (less than CO<sub>2</sub> emissions of 50g/km) are exempt from annual circulation tax (Netherlands);
- Five year exemption from annual circulation tax for vehicles classified as 'green'; reduction of company car taxation (40 per cent reduction); and the presence of a 'super green' car premium on new cars – a scheme for low emissions vehicles (<50g/km CO<sub>2</sub> emissions) that provides a subsidy up to SEK40,000 per car (NZ\$7,500) (Sweden).<sup>113</sup>
- Exemption from annual circulation tax (Slovakia).

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<sup>111</sup> For a comprehensive look at a range of policies, legislation and incentives adopted globally to encourage electric vehicle adoption, refer to Lemon and Miller (Above, n.31, 16-18), where policies in 40 countries are outlined.

<sup>112</sup> As at 2015. These countries are Bulgaria, Cyprus, Estonia, Spain, Croatia, Lithuania, Luxembourg, Malta, Poland, and Slovenia.

<sup>113</sup> European Automobile Manufacturers Association. *Overview of Purchase and Tax Incentives for Electric Vehicles in the EU in 2015*. Retrieved from: [http://www.acea.be/uploads/publications/Electric\\_vehicles\\_overview\\_2015.pdf](http://www.acea.be/uploads/publications/Electric_vehicles_overview_2015.pdf); Accessed 1 October 2015.

A further example is visible in the United States of America, where a tax credit of up to US\$7,500 is available for all-electric vehicles. This credit is US\$2,500, plus an additional tax credit of US\$417 per kilowatt-hour, for a vehicle that draws propulsion energy from a battery with at least five kilowatt hours of capacity, up to a maximum of US\$5,000.<sup>114</sup> Therefore the total credit is capped at US\$7,500. The credit will begin to phase out when 200,000 qualifying vehicles have been sold. This tax credit would be of most benefit to higher-income earners. This is a key criticism of the majority of the tools discussed herein. In a country such as New Zealand where the vehicle fleet is relatively old, introducing a system that penalises owners of older, higher-emissions vehicles is likely to result in the impact being felt most strongly by lower-income earners. It is acknowledged that the introduction of incentives to purchase electric or low emission vehicles is also likely to benefit higher-income earners, as this is the group most likely to be able to purchase a new car.

The signalling impact is also noticeable in Europe. The European Commission developed a new car fleet emissions reduction target to address vehicle emissions in the European Union. Similar to New Zealand, road transport is the second largest source of emissions, contributing about 20 per cent of total emissions of CO<sub>2</sub> in the European Union.<sup>115</sup> Passenger vehicles are responsible for around 12 per cent of European Union CO<sub>2</sub> emissions.<sup>116</sup> The European Commission has developed regulation of passenger cars as the primary measure of the European Union strategy to reduce emissions from light passenger vehicles. The targets are to reduce CO<sub>2</sub> emissions from cars to 130g of CO<sub>2</sub>/km by 2015, and to 95g/km by 2020.<sup>117</sup> The first target is a reduction of around 19 per cent of 2006 levels. A similar policy for light commercial vehicles has also been adopted. These policies are targeted at vehicle manufacturers, whereby manufacturers have annual targets, which have gradually increased since 2012. In 2012, manufacturers needed to ensure that 65 per cent of new vehicles registered in the European Union have average emissions below their target. This increased to 75 per cent in 2013, 80 per cent in 2014 and 100 per cent in 2015.<sup>118</sup>

## 5 DISCUSSION AND CONCLUSION

New Zealand has established ambitious targets to reduce greenhouse gas emissions. Writing in his capacity as the Minister Responsible for International Climate Change Negotiations in 2013, Tim Groser states that *'New Zealand is strongly committed to taking significant action on climate change'*. His correspondence continues to note New Zealand's support for *'an ambitious and effective legally binding agreement under the Durban Platform negotiations'* as well as *'active participation in initiatives such as the Global Research Alliance on Agricultural Greenhouse Gases, the Climate and Clean Air Coalition and the Friends of Fossil Fuel Subsidy Reform'*.<sup>119</sup> One of the outcomes reported against by the Ministry for the Environment is *'New Zealand becomes a*

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<sup>114</sup> Internal Revenue Service. *Plug-In Electric Drive Vehicle Credit (IRC 30D)*, Retrieved from <https://www.irs.gov/Businesses/Plug-In-Electric-Vehicle-Credit-IRC-30-and-IRC-30D>, accessed 11 November 2015.

<sup>115</sup> European Commission. *Questions and Answers on the Regulation to Reduce CO<sub>2</sub> Emissions from Cars*. Retrieved from [http://ec.europa.eu/clima/policies/transport/vehicles/cars/faq\\_en.htm](http://ec.europa.eu/clima/policies/transport/vehicles/cars/faq_en.htm), Accessed 27 October 2015.

<sup>116</sup> European Commission, Above, n.115.

<sup>117</sup> European Commission, Above, n.115.

<sup>118</sup> European Commission, Above, n.115.

<sup>119</sup> Office of Hon Tim Groser. Correspondence to the Executive Secretary, UN Framework Convention on Climate Change, 29 August 2013, available at: [http://unfccc.int/focus/mitigation/pre\\_2020\\_ambition/items/8167.php](http://unfccc.int/focus/mitigation/pre_2020_ambition/items/8167.php), retrieved 15 October 2015.

*successful low-carbon society that is resilient to climate change impacts on its climate, economy and lifestyle*'.<sup>120</sup> However, with the exception of the ETS, which excludes our largest greenhouse gas emitting sector – agriculture – there has been little action taken to actively meet this target. In order to achieve the targets established, New Zealand needs a clear strategy, combined with deliberate activity to ensure it is achieved. Part of this strategy needs to address our transport fleet and ways in which emissions reductions can be achieved. At the moment, our strategy towards meeting our international climate change obligations appears piecemeal and lacking in cohesion.

New Zealand is not alone in having a transport sector that makes high contributions to greenhouse gas emissions. For example, road transport contributes about 20 per cent of the European Union's total emissions of CO<sub>2</sub>.<sup>121</sup> However, unlike New Zealand, where emissions from the transport sector are stable, those in the European Union are decreasing. A key difference is that the European Union has policies to reduce emissions, including CO<sub>2</sub> emissions targets for vehicles.<sup>122</sup> The European Union recognise the need to have policies to reduce greenhouse gas emissions across a range of transport modes. These policies include strategies to reduce emissions from cars and vans, including: emissions targets for new vehicles; a strategy for reducing heavy duty vehicle fuel consumption and CO<sub>2</sub> emissions; a target to reduce the greenhouse gas intensity of fuels; initiatives associated with tyre labelling and tyre pressure monitors; and requiring public authorities to take account of life time energy use and CO<sub>2</sub> emissions when purchasing vehicles.<sup>123</sup> In addition to these measures, the importance of sending consistent signals to transport users and vehicle manufacturers to achieve greenhouse gas emissions is noted.

It is acknowledged that the demand for road transport is relatively inelastic in New Zealand. There are few substitutes, vehicles are relatively inexpensive and fuel prices have stabilised in recent years. Thus, small changes in charges relating to the vehicle registration and/or licence fee are likely to have little or no impact on behaviour. Indeed, the Ministry of Transport acknowledge that even the ETS will have a '*very minor impact on transport emissions*' and this is New Zealand's primary tool for fighting climate change.<sup>124</sup>

The range of policy tools outlined in the previous section have been shown to be successful in encouraging adoption of electric vehicles. It is not suggested that New Zealand should adopt a scheme that generates a financial penalty for people who currently own higher emitting vehicles. This has the potential to be regressive. Moreover, those who have older, higher emitting vehicles may be those least likely to be able to purchase a newer lower emitting vehicle. Therefore, any policy tools implemented are likely to be more effective if they are applied to those groups who can change their behaviour in response to financial incentives. Thus, there is an argument to be made for attaching financial penalties to new vehicle purchases, as is visible in countries such as Norway, Ireland and the United Kingdom. This avoids the potential regressive impact of placing additional taxes on high-emission vehicles that are currently in use.

Lemon and Miller argue that the key issue restricting greater adoption of electric vehicles in New Zealand is the price, which is unlikely to reduce in the short- to medium-term.<sup>125</sup> Lemon and Miller

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<sup>120</sup> Ministry for the Environment, Above, n.3, 57.

<sup>121</sup> European Commission *Reducing Emissions from Transport*, Retrieved from [http://ec.europa.eu/clima/policies/transport/index\\_en.htm](http://ec.europa.eu/clima/policies/transport/index_en.htm), Accessed 4 November 2015.

<sup>122</sup> European Commission, Above, n.121.

<sup>123</sup> European Commission, Above, n.121.

<sup>124</sup> Ministry of Transport, Above, n.25, 33.

<sup>125</sup> Lemon and Miller, Above, n.31, 19.

conclude that the most effective option to encourage electric vehicle uptake is to use fiscal instruments to reduce the price, such as tax reductions or subsidies.<sup>126</sup> Lemon and Miller also suggest that the price signal will need to be significant in order to result in behavioural shift, and question whether such an expense would be justifiable in New Zealand. While this question is valid, responses to climate change in European countries would suggest that decisions to provide tax benefits for electric vehicles are justified on measures other than cost-benefit.

At the present time, there are no deliberate financial incentives for people to adopt electric vehicles in New Zealand. However, electric vehicles do gain a tax benefit from not paying the road user charges paid by those with diesel vehicles or the fuel taxes associated with petrol vehicles. Multiple other opportunities exist to encourage the uptake of electric vehicles in New Zealand. These include, but are not limited to: excluding electric vehicles from the annual license charges; allowing electric vehicles to use bus lanes; allowing electric vehicles to park without charge in council owned parking spaces; or removing the goods and services tax on electric vehicles. All of these tools have the benefit of providing a financial, or other, gain for owners of electric vehicles. Importantly, they provide a strong signal that electric vehicles provide a positive outcome for society.

Notwithstanding the claim that the tax system is not typically used in New Zealand to influence behaviours, there are multiple examples of where this does occur. For example, since 1 July 2013, a levy has been charged on new motor vehicles that have an air-conditioning unit. The charge is called a Synthetic Greenhouse Gas (SGG) levy.<sup>127</sup> The objective of introducing the SGG Levy is to '*encourage industry to use alternative low global-warming refrigerants, which has a lesser impact on climate change*'.<sup>128</sup> The formula for calculating this levy is linked to the carbon price.<sup>129</sup> However, the levy collects little in the way of revenue: actual revenue collected in 2014/15 was \$49,000.<sup>130</sup>

As noted by the OECD '*many countries use tax preferences to achieve environmental policy objectives*'. Graham and Glaister's review of the literature suggests that as incomes increase, individuals will purchase more cars, which are likely to be larger and less fuel-efficient.<sup>131</sup> This supports the suggestion that targeting higher income earners, who are less constrained in their purchasing decisions, is likely to achieve the objective of increasing uptake of high-emission vehicles.

Environmental taxes in New Zealand are described as '*low by OECD standards*'.<sup>132</sup> While there are strong arguments to be made for neutrality and simplicity within the tax system, when activities exist that can minimise harmful externalities, there are also strong arguments for providing financial assistance to encourage such activities. This study reaches the same conclusion as Mortimer when concluding that a strong price signal should be sent to encourage a change in behaviour towards

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<sup>126</sup> Lemon and Miller, Above, n.31, 19.

<sup>127</sup> New Zealand Transport Agency. *Synthetic Greenhouse Gas (SGG) Levy on Motor Vehicles: Questions and Answers*. Retrieved from <http://www.nzta.govt.nz/assets/vehicle/registration-licensing/docs/sgg-levy-on-motor-vehicles-q-and-a.pdf>, Accessed 4 November 2015.

<sup>128</sup> New Zealand Transport Agency. *Media Release: Synthetic Greenhouse Gas Levy aims to reduce impact on climate change*. Retrieved from: <https://www.nzta.govt.nz/media-releases/synthetic-greenhouse-gas-levy-aims-to-reduce-impact-on-climate-change/>, Accessed 5 November 2015.

<sup>129</sup> Calculated as SGG rate (0.6 for small vehicles, 4 for large vehicles) x Global Warming Potential (1430) x Carbon Price. Formula in Cabinet Economic Growth and Infrastructure Committee, EGI Min (12) 8/4, Retrieved from: <https://www.mfe.govt.nz/sites/default/files/cabinet-egi-minute-12-8-4.pdf>, Accessed 4 November 2015. Levy figures in *Climate Change (Synthetic Greenhouse Gas Levies) Regulations 2013*, Schedule 1.

<sup>130</sup> Ministry for the Environment, Above, n.3, 68.

<sup>131</sup> Graham and Glaister, Above, n.85.

<sup>132</sup> OECD, Above, n.56, 22.

low-emission vehicles.<sup>133</sup> This approach is clearly visible in Europe, with a range of fiscal instruments adopted that are achieving this behavioural shift.

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<sup>133</sup> Mortimore, Above, n.90.