The Impact of Changing Technology of Motor Vehicles on Road Tax Revenue

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ABSTRACT

This paper considers the impact on tax revenue as a consequence of the changing technology of motor vehicles.

As motor vehicles transform their drive trains from internal combustion engines to electric motors their energy source could change from fossil fuel to renewable energy. That may not necessarily be the case. Motor vehicle energy sources may simply move from the on-board, fossil fuelled, internal combustion engines to centralised, fossil fuelled electricity power stations. In that case, fossil fuel consumption, and accompanying greenhouse gas emissions, will continue unabated.

Fuel consumption, and its accompanying greenhouse gas emissions, may even increase. Inefficiencies in electricity generation, transmission, storage, as well as losses through storage and use of electricity in the vehicle itself will be added to overall vehicle energy consumption.

Regardless of whether the electricity to power the vehicle is sourced from renewable energy, or from fossil fuelled power stations, revenue from motor vehicle fuel excises, currently levied on petroleum products, will fall. In order to continue to build and maintain motor vehicle transport infrastructure governments will be obliged to change their focus pn how road tax revenue is raised.

This paper seeks to establish how that energy transition might impact the current tax revenue from motor vehicle fuel taxes. It considers the current number of electric vehicles on Australia roads and predicts what is likely to happen to future motor vehicle fuel excises. It looks at the impact of rising self-generated electricity from renewable energy sources, and how that energy might be used to power electric vehicles in the future.

The paper examines data published by the Australian Bureau of Statistics and data provided by the Australian Taxation Office statistics. It also refers to sales data provided by motor vehicle manufacturers. Further, it supports the findings of its analysis of statistical data by a case study of a plug-in hybrid electric vehicle (PHEV) owned by the Solex solar farm project in Carnarvon Western Australia. That data has been collated from fuel and electricity consumptions recorded from delivery of the vehicle in June 2016 to the October 2017.

It finds that unless motor vehicles are charged from independent electricity sources, such as dispersed, embedded solar pv installations, little is saved in the way of greenhouse gas emissions. However tax revenues from motor vehicle fuel sales may decline considerably. Although, overall tax revenue may remain consistent, as fuel excises become substituted by goods and services taxes on the sale of electricity.

It concludes that as a consequence of the introduction of the electric vehicle, revenue from fuel excise may fall. However, as there has been no official link between road tax revenue and road construction and maintenance expenditure since 1959, the reduction in excise revenue will not necessarily affect funding for the construction and maintenance of roadways by the Australian government.

Keywords: Income Taxes, Indirect Taxes, Goods and Services Tax, Fuel Taxes, Income Tax Deductions, Tax Deductible Expenses, Motor Vehicle Expenses, Renewable Energy Credits

1. AIM AND PURPOSE

In Australia, revenue raised from taxes on motor spirits, consumed by road transport operators and road users, has generally been applied to the development, construction and maintenance of the roadway network.

This paper aims to evaluate the impact of falling government revenue from reduced fossil fuel consumption, by the transport sector of the Australian economy, caused by the introduction of electrically powered vehicles.

The primary purpose of this paper is to investigate the possible impact of electric powered vehicles on tax revenue currently raised from fuel excises levied on the owners of fossil fuelled motor vehicles.

The secondary purpose is to make governments and tax administrators aware that, as technology changes, revenue structures to support the development and maintenance of road networks will have to be reviewed to find new methods of financing transport infrastructure.

2. INTRODUCTION

The internal combustion engine has powered the world's motor vehicles for over 140 years. However atmospheric pollution, produced by the otherwise efficient and reliable means of motorisation, has caused the world's population to seek cleaner energy systems. Electrical vehicles can be powered from non-polluting, renewable energy sources, thereby significantly reducing greenhouse gas emissions from the road transport sector.[1]

Therefore, in response to society's concerns for the natural environment, vehicle manufacturers are turning to replacing the fossil fuelled internal combustion engines of the past, with electric motors.

New and existing vehicle manufacturers, such as Tesla and Nissan, have launched many new models and makes of very powerful electric vehicles. Those electric vehicles are gaining considerable popularity with consumers and governments. Indeed some governments, such as Norway, France and the UK, are putting bans in place to transition away from petrol and diesel fuelled vehicles by as early as 2035.[2]

It is therefore inevitable that electric and electric hybrid vehicles will ultimately displace the current internal combustion powered vehicles. As a consequence of that transition, tax revenues, raised from excises currently levied on fossil fuels consumed by motor vehicle users, may fall.

In 2016, Crowe wrote a newspaper article that asserted:

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1 World Nuclear Association, *Electricity and Cars,* (2017) < http://www.world-nuclear.org/information library/non-power-nuclear-applications/transport/electricity-and-cars.aspx> at 19 October 2017.

2 Matt Pressman, *Electric Car Incentives In Norway, UK, France, Germany, Netherlands, & Belgium,* (2017) CleanTechnica < https://cleantechnica.com/2017/09/02/electric-car-incentives-norway-uk-france-germany-netherlands-belgium/> at 19 October 2017.

> Australians who drive Holden Commodores are paying three times as much tax for federal roads as those who own hybrid vehicles such as the Toyota Prius, sparking fears of a funding crisis that could keep every motorist in the slow lane for years.
>
> Wealthier Australians who can afford to buy hybrid and electric cars are starting to erode the $12 billion in annual fuel excise that pays for the nation's roads, forcing the federal government to look at new ways to raise cash for major projects. [3]

Despite Crowe's assertion, that rising numbers of electric vehicles will have a negative impact on road tax revenue, the nexus between fuel excises and expenditure on Australian roadway construction and maintenance is not as closely related as he indicates.

In 2000 a report to the Australian Parliament stated that

> [p]etrol and diesel excises are levied primarily to raise revenue. A second reason is to recover from road users the costs they impose on society. And, historically, revenue from excise was at times hypothecated to fund expenditure on roads. Hypothecation is the earmarking of the revenue from a particular tax for spending on a particular purpose.[4]

The report also stated that

> [w]ith the exceptions of road tolls and heavy vehicle road use charges,[5] road users do not pay *directly* for their use of roads. In the absence of direct road use charges, petrol and diesel excises are a proxy for the cost of road use, in that the total amount of excise a user pays through fuel consumption is related to distance travelled and vehicle weight.[6] But excises are an inefficient means of cost recovery in that the amount of excise a user pays does not vary directly with the social cost of using a specific road.[7]

While the impact on tax revenues will be worldwide, this paper focuses on the likely impact on fuel excises in Australia. Firstly, the paper gives a brief history of Australian fuel excises and how they were initially hypothecated to the construction and maintenance of roadways.

In 1959 the Commonwealth government removed the nexus between revenue raised from 'the collections from time to time of the duties of customs and duties of excise'[8] and 'the construction, reconstruction, maintenance and repair of roads or on the purchase of road-

3 Crowe, David, 'Electric Cars Blow Hole in Road-Building Petrol Tax Revenues' *The Australian* (Sydney), 16 August 2016.

4 Economics, Commerce and Industrial Relations Group, Parliament of Australia, *Petrol and Diesel Excises* (2000) <http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp0001/01RP06#WhyisExciseLevied> at 16 July 2017.

5 For a discussion of these charges, see Richard Webb, 'Cost Recovery in Road and Rail Transport', *Research Paper* no. 28, Department of the Parliamentary Library, 1999-2000.

6 The Australian Automobile Association advocates that petrol excise be divided into a road user charge component and a general revenue component, with the former allocated to road investment. See Lauchlan McIntosh, 'Charging for Road Use', CEDA Bulletin, October 1998, pp. 61-2.

7 Economics, Commerce and Industrial Relations Group, above n 4.

8 *Commonwealth Aid Roads Act 1954* (Cth) s 7.

making plant'.[9] The *Commonwealth Aid Roads Act 1959* (Cth) differed from its predecessors in that it provided for a tied financial grant[10] of £220 000 000 over five years (1959-63).[11]

The 1959 legislation made no reference to the collection of customs or excise duties to fund those grants. Speeches made in support of,[12] and opposition to,[13] the Commonwealth Aid Roads Bill 1959 make it quite clear that the nexus between revenue derived from petrol tax and grants to road funding was at an end.[14]

It is noted that Western Australia was very much dissatisfied with that decision of Commonwealth Parliament.[15] Despite the operations of the Commonwealth funding program WA continued to raise an excise on petroleum products consumed in road transport.[16]

For many decades since Federation in 1901 the Australian states placed an excise on alcohol, tobacco and petrol. It is beyond the scope of this paper to consider the validity of state excises and licence fees. It might also be argued that the findings in *Matthews v Chicory Marketing Board (Vic)*[17] (*Matthews Case*) should have put an end to state fuel excises in 1938.

However the 1960 decision in *Dennis Hotels Pty Ltd v Victoria* [18] left some room for the states to levy of licence fees, despite the fees being structured on a volumetric basis. In 1979, the State of Western Australia introduced a licence fee on the sale of petroleum products at the rate of 0.9 cents per litre of motor spirit sold by wholesalers.[19]

Finally, in 1996, the High Court decision in the *Ngo Ngo Ha & Ano v State of New South Wales* (1996) ('*Ngo Ngo Ha Case*')[20] brought about the end of state powers to tax alcohol,

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9 *Commonwealth Aid Roads Act 1954* (Cth) s 9 (2)(a).

10 *Commonwealth of Australia Constitution Act 1900* (Imp) 63 & 64 Vict, c 12, (*Australian Constitution)*, s 96.

11 *Commonwealth Aid Roads Act 1959* (Cth) s 4.

12 Commonwealth of Australia, *Parliamentary Debates*, Senate, 7 May 1959, (Agnes Robertson, Senator for Western Australia).

13 Commonwealth of Australia, *Parliamentary Debates*, House of Representatives, 29 April 1959, (Joseph Clark, Member for Darling)

14 The states responded with their own state Road Maintenance (Contribution) Acts. The acts established a motor vehicle licence fee based on the tare weight and carrying capacity of that vehicle – the heavier the vehicle the greater the fee, or contribution to road maintenance.

15 Commonwealth, above n 12.

16 *Acts Amendment and Repeal (Road Maintenance) 1979* (WA) s 47N.

17 (1938) 60 CLR 263.

18 (1959-1960) 104 CLR 529.

19 *Acts Amendment and Repeal (Road Maintenance) 1979* (WA) s 47N.

20 *Ngo Ngo Ha and Anor v. New South Wales and Ors,* [1996] HCA 17; handed down 1997.

tobacco and petrol and excises levied on those products is now the exclusive realm of the Commonwealth of Australia.[21]

Although detailed examination of that case is also beyond the scope of this paper, it is important to recognise that as a consequence of the *Ngo Ngo Ha Case* in 1997, it was agreed, by the state governments of Australia, that the Commonwealth would place levies on alcohol, tobacco and petrol, for and on behalf of the states.[22]

The concept of state fuel levies hypothecated for the construction and maintenance of roadways was at an end. The clarification of the Australian Parliament's budgetary position in 2000 makes it clear that there is no nexus between fuel excise and roadway construction and maintenance expenditure. Therefore whatever the impact of changing technology may have on 'road tax revenue' it is unrelated to road construction and maintenance expenditure.

Further, on 1 July 2000, the 1997 tax sharing arrangements with the Commonwealth, ceased with the introduction of Australia's goods and services tax (GST).[23] It was agreed by the states and the Commonwealth that the Commonwealth would 'legislate to provide all of the revenue from the GST to the States and Territories.'[24] The states were then, at more than any other point since Federation, financially dependent on the Commonwealth Government.

In order to provide background and context, as well as define the scope of research supporting this paper, the following section examines previously published research findings on the impacts of the introduction of electric vehicles to the transport sector.

3. Review of Published Literature

Mortimore has considered encouraging the introduction of electric vehicles as a method of reducing greenhouse gas emissions produced by the transport sector. In 2014, she stated that

> [t]he transport sector is arguably the most difficult and expensive sector in which to reduce greenhouse gas emissions (GHG), with carbon dioxide (CO2) generated by transport in Australia increasing by 50.7 percent (93.5 Mt CO2-e) in 2012–2013 from 1990 levels (62.0 Mt CO2-e). Unless the government reverses this trend, CO2 emissions will continue to rise and offset the gains made in reducing carbon emissions in other energy sectors. The largest contributor to transport GHG emissions is road transport.[25]

21 A more complete background on the impact of the *Ngo Ngo Ha case* on Australian fuel excises can be found in Alexander Robert Fullarton, The Apparition of Tax Reform: A Paper That Examines the Issue of Taxation Reform in Australia (November 14, 2003) Social Science Research Network (SSRN) <https://ssrn.com/abstract=3002871> at 20 July 2017.

22 Council of Australian Governments, Intergovernmental Agreement on the Reform of Commonwealth-State Financial Relations - 25 July 1999, (1999) <https://www.coag.gov.au/sites/default/files/agreements/reform_of_comm-state_financial_relations_PDF.pdf> at 16 July 2017, 2.

23 Ibid.

24 Ibid.

25 Anna Mortimore, 'Reforming vehicle taxes on new car purchases can reduce road transport emissions – ex post evidence' (2014) 29 *Australian Tax Forum* 177, 179.

She suggested using a taxation system to drive the transition towards adopting electric vehicles. She stated 'that vehicle taxes [could be] reformed into an environmental tax.' She stated that a tax based on vehicle greenhouse gas emissions, 'is a "powerful instrument" that can "drive consumer demand towards fuel efficient cars" and foster a more sustainable car market.'[26]

Everett and Boyle considered alternative fuels to petrol and diesel, which are currently chiefly used as a transport fuels. They focussed on the use of hydrogen as an alternative fuel and found that 'a hydrogen alternative could be sold at a similar price [to petrol and diesel] and still have room for taxation.'[27]

Twidell and Weir also considered alternative fuel sources. They looked at the concept of introducing bio-fuels as a substitute, or supplement, to the use of fossil fuels in transport. In pointing to the cost of bio-fuels in relation to the petroleum industry they noted that

> the great majority of governments tax automotive petroleum fuels, e.g. the UK with ~ 400% total taxation. Such taxation both raises revenue and discourages unnecessary driving to reduce pollution, road congestion and, usually, imports costing foreign exchange.[28]

Their findings suggest that the use of alternative fuels would not affect tax revenue as the fuel tax is simply varied to accommodate the changing fuel source.

However, significant reductions in the consumption of oil based energy sources could be achieved if electric vehicles were powered from renewable energy sources. Fullarton observed that 'while electric cars are a step forward in reducing greenhouse gas emissions created by motor vehicles, the electricity to refuel these electric cars is derived from fossil fuel generators.'[29]

Casals et al[30] and Lombardi et al[31] also point to the need to align renewable, non-polluting electricity sources with the operations of electric vehicles otherwise gains in reduced fossil fuel consumption and greenhouse gas emissions of the vehicle will be offset by increased fuel consumption and emissions at the power source of the electricity grid.

Further, while some vehicles purport to be 'electric' they continue to consume petrol or diesel, albeit in reduced volumes. Many electric vehicles are really 'hybrids' that rely on 'on board' fossil-fuelled generators to increase the useable range of the vehicle. Therefore the

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26 Ibid 216.

27 Robert Everett and Godfrey Boyle, 'Integration' in Godfrey Boyle (ed), *Renewable Energy: Power for a sustainable future* (2nd ed, 2004) 383, 410.

28 John W Twidell and Anthony D Weir, Renewable Energy Resources (2nd ed, 2006) 392-3.

29 Alexander Robert Fullarton, *Watts in the Desert: Pioneering Solar Farming in Australia's Outback* (2016) 186.

30 Lluc Canals Casals et al, 'Sustainability analysis of the electric vehicle use in Europe for CO2 emissions reduction' (2016) 127 *Journal of Cleaner Production* 425.

31 Lidia Lombardi et al, 'Comparative environmental assessment of conventional, electric, hybrid, and fuel cell powertrains based on LCA'(2017) *The International Journal of Life Cycle Assessment* <https://link.springer.com/article/10.1007/s11367-017-1294-y> at 7 November 2017,16.

move, from fossil-fuelled, internal combustion engine powered road vehicles to electric vehicles, may have little impact on the overall consumption of fossil-fuels, and their accompanying greenhouse gas emissions.

However the introduction of electric vehicles might provide access to an alternative, untaxable fuel source – self generated renewable energy. If fossil-fuel energy sources are to be displaced by renewable energy sources, the introduction of electric vehicles could achieve that. In that event road tax revenues from the sale of fossil-fuels to power road transport could fall significantly.

Passey, Watt and Macgill considered the financial impacts of self-generated electricity sourced from solar photovoltaic (pv) systems to fuel electric vehicles.[32] Although they did not specifically examine the impact of self-generated renewable energy for the use in electric vehicles on tax revenue, they found that diverting solar pv energy to plug-in electric hybrids (PHEVs) caused

> other customers' bills [to be] slightly higher than would be expected. This is because the greater on-site use of PV electricity by the 'Responsible customer' [solar pv and PHEV owner] decreases revenue for Transmission Network Service Providers and Distribution Network Service Providers, and so under the revenue cap scenario they increase their tariffs to compensate.[33]

While Passey, Watt and Macgill did not directly address the concept of tax revenue from road users, they suggest that if electricity vendors are to experience a fall in revenue, from the use of self-generated renewable energy to 'fuel' electric vehicles, then road tax revenue will fall accordingly.

Tax revenue generated from road users is an important source of government revenue. Therefore, despite hypothecation of road tax revenue for the construction and maintenance of roadways by the Commonwealth government ceasing in 1959, it is acknowledged government revenues have often been directed at constructing and maintaining roadways.

Nonetheless despite the threat to road tax revenue from taxes on fossil fuels, governments are being forced to address the issue of atmospheric pollution. In 1997 Briggs et al stated that

> [d]espite the major improvements in air quality seen in many European cities over the last 30 - 40 years, the problem of urban air pollution remains. Levels of traditional pollutants, such as smoke and sulphur dioxide (SO2) have declined, as a result of industrial restructuring, technological changes and pollution control, but the rapid growth in road traffic has given rise to new pollutants and new concerns.[34]

Yet it was to be 20 years before world governments began to take positive action to reduce greenhouse gas emissions from the transport sector. In 2017, Ali et al noted that world governments are taking action to severely curtail greenhouse gas emissions from all sectors of the transport sector including those from passenger cars.

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32 Robert J Passey, Muriel Emmeline Watt and Iain Macgill, 'The Financial Impacts of PV Systems and Plug-in Hybrid Electric Vehicles on Customers Who Do Not Have Them' (Paper presented at the 2014 Asia-Pacific Solar Research Conference, University of New South Wales, 8 December 2014).

33 Ibid, 9.

34 David John Briggs et al, 'Mapping Urban Air Pollution Using GIS: a regression-based approach' (1997) 11(7) *International Journal of Geographical Information Science*, 699, 699.

They stated:

> Currently, air pollution is a serious issue, especially in heavily populated cities, such as London, Paris, Beijing, and Tokyo. Approximately 25% of global CO2 emissions are due to passenger road and air travel, and the transport of goods. In addition to CO2, Sox [sulphur dioxide] and Nox [nitrogen dioxide] are also generated.[35]

Falcão, Teixeira and Sodré concluded that while electric vehicles emit lower amounts of greenhouse gases 'the total cost of ownership is 2.5 times higher than the conventional vehicle.'[36] They also pointed to the use of renewable energy sources to drive down CO_2 emissions.[37]

The use of renewable energy sources is relevant to the case study used in the research supporting this paper. However this paper disputes their comparative costs of electric vehicles to conventional vehicles. The PHEV used in this research has a comparable capital cost and on-road licensing fees equal to the same model of the petrol fuelled version of the Mitsubishi Outlander.

Desbarats considered the concept of trading 'carbon credits' from the savings of reduced carbon emissions. While she focused on reducing carbon emissions generally, she noted that 'emissions trading may simply result in the purchase of offsets depending on the price of carbon.'[38] Further, she noted that

> [u]nless vehicle owners are able to purchase carbon credits to offset deductions from their carbon accounts, their only alternative to minimizing their own vehicle use is to either drive less or to purchase low emission vehicles. This would help drive purchases of electric vehicles and could help incentivize the purchase of low carbon fuels.[39]

Her findings are important to the case study in this research as the PHEV used is charged from a renewable energy resource which has been registered to create renewable energy credits. Therefore the carbon credits created from 'fuelling' the vehicle further offset the operating cost of the vehicle and are included in this analysis.

Of significance to this research is the ultimately impact of the uptake of electric vehicles by mainstream consumers. A comparative indicator of the uptake of electric vehicles might be the uptake of solar pv installations in Australia.

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35 Syed Abid Ali Shah Bukhari et al, 'Future of Microgrids with Distributed Generation and Electric Vehicles' in Wen-Ping Cao and Jin Yang (eds) *Development and Integration of Microgrids* (2017) 55,55.

36 Eduardo Aparecido Moreira Falcão , Ana Carolina Rodrigues Teixeira and José Ricardo Sodré 'Analysis of CO2 Emissions and Techno-economic Feasibility of an Electric Commercial Vehicle' (2017) 193 *Applied Energy* 297, 306.

37 Ibid 305.

38 Jane Desbarats, *An Analysis Of The Obstacles To Inclusion Of Road Transport Emissions In The European Union's Emissions Trading Scheme* (2009) Institute for European Environmental Policy <https://ieep.eu/publications/an-analysis-of-the-obstacles-to-inclusion-of-road-transport-emissions-in-the-european-union-s> at 29 October 2017.

39 Ibid, 16.

Fullarton found that the uptake of solar pv installations in Australia was minimal from 2000-09. It was not until 2010 that Australia experience a 'surge' in the uptake of consumer owned solar pv renewable energy generation systems.[40] At that point in time there was a raft of government driven incentives introduced to encourage consumer confidence in purchasing small generation sized solar pv systems for residential properties.

Simpson found that while there were some environmental considerations expressed by householders who purchased of solar pv installations, a significant incentive to install solar pv systems was the economic saving of self-generating one's own electricity, and the substantial fiscal government rebates for doing so.[41] She also pointed to the influence of government intervention impacting on the absorption of 'self-generation electricity systems' by householders.[42]

Additionally, Graham-Rowe et al found that the uptake of electric vehicles depended on a raft of factors other than environmental concerns and capital costs.

> EVs were judged by ICE vehicle standards in relation to cost, performance, convenience, comfort and aesthetics, and intentions to purchase were largely dependent on EVs meeting these standards at some future date. Production and marketing of EVs may be more successful if these perceptions, comparisons and concerns are addressed.[43]

Furthermore, they

> found that two PHEV drivers did not plug their vehicle into the electricity supply, instead relying on the ICE and regenerative braking system to charge the vehicle, thereby negating the carbon savings associated with using grid electricity to power their vehicles.[44]

Galvin stated that:

> Recently a discussion has arisen as to whether e-vehicles do, in fact, reduce overall emissions. For countries generating electricity mostly through fossil fuels, much of the gain at the vehicle itself may be lost at the generating plant. Even for countries which are moving rapidly towards renewable electricity generation, such as Germany, lifecycle analysis shows that emissions and wastes produced in the manufacture of e-vehicles and their batteries can negate most of the gains.[45]

Galvin's study, which is based on laboratory condition tests of eight makes and models of electric cars, is of particular relevance to this research. The vehicle used in this research is one of those used by Galvin, a Mitsubishis Outlander PHEV. His findings from his

40 Fullarton, above n 29, 24.

41 Genevieve Simpson, 'Network operators and the transition to decentralised electricity: An Australian socio-technical case study' (2017) 110 *Energy Policy* 422.

42 Ibid, 431.

43 Ella Graham-Rowe et al, 'Mainstream consumers driving plug-in battery-electric and plug-in hybrid electric cars: A qualitative analysis of responses and evaluations' (2012) 46 *Transportation Research Part A* 140, 150.

44 Ibid.

45 Ray Galvin, 'Energy consumption effects of speed and acceleration in electric vehicles: Laboratory case studies and implications for drivers and policymakers (2017) 53 *Transportation Research Part D* 234, 235.

laboratory trials provide a comparative for the data collated from field trials of the case study supporting the findings of this paper.

This research indicates, that while there may be significant environmental considerations for the introduction of electric vehicles, and that transition may have some impact of road tax revenues from fuel excises, unless consumers can expect economic benefits, the transition to electric vehicles may not significantly impact the transport sector. Experience with the solar pv system installation rates indicates significant government incentives will be required.

It remains to be seen if the uptake of electric vehicles will follow the same rate of uptake as did the uptake of solar pv installations in Australia. Discussion on the savings of greenhouse gas emissions, other than the income generated from the creation of renewable energy credits by charging electric cars using renewable energy, is beyond the scope of this paper.

Ultimately, the introduction of electric vehicles may have little or no significant impact on Australia's rate of greenhouse gas emissions. Rather, the source of the emissions moves from the exhaust pipes of motor vehicles, to the chimney stacks of power stations.

4. RESEARCH METHOD

This section considers the research method adopted by this paper to support its conclusions. A mixed research approach has been adopted. That approach uses a quantitative analysis of published statistics and is compared the findings of a case study of the use of a Mitsubishi PHEV in the Northwest of Western Australia.

The research program is conducted by way of:

- An examination of Commonwealth Scientific and Industrial Research Organisation (CSIRO) and a statistical analysis of published Australian Bureau of Statistic (ABS) motor vehicle census data and ABS raw data supporting those publications.

  An estimate of the growth of substitute renewable energy fuels to power Australia's passenger vehicles is made based on the growth of dispersed embedded solar photovoltaic installations in Australia to indicate a possible impact of the uptake of electric vehicles on tax revenues;

- An examination of Australian Taxation Office (ATO) statistics to establish tax revenue received by the Commonwealth of Australia from fuel excise tax levied on motorists in Australia. From that revenue, the annual diesel fuel rebate tax expenditure is deducted to establish the net value of the taxation of petroleum products to the Commonwealth Government.

  The ABS data is compared to the findings from the examination of the ATO statistics to estimate the contribution of fossil-fuel powered passenger vehicles to the net revenue; and

- Finally, the findings of a case study based on the operation of a Mitsubishi PHEV (Plug-in Electric Hybrid Vehicle) Outlander sports utility vehicle (SUV) will be examined to support or refute the statistical analysis. The case study includes examination of Western Australian Department of Transport registration documents to determine the accuracy of vehicle descriptions – particularly vehicle fuel sources.

Conclusions are made as to the expected impact of fuel excise revenue, and to estimate at point where a significant reduction in revenue might occur, as users move away from taxable fossil-fuels to untaxable renewable energies.

The following section examines reports published by Australian government agencies, and published statistics, to investigate quantitative support for the assertions that tax revenues raised from road users are declining, or are likely to decline, in the near future.

5. GOVERNMENT AGENCY REPORTS

5.1 Commonwealth Scientific and Industrial Organisation (CSIRO)

Since 2000, the CSIRO has released a number of reports on studies of the introduction of electric vehicles and projections of future road transport revenues.[46]

The reports are generally mathematical projections and forecasts of estimations based on a given series of variable factors. However they are not intended to be relied on as scientific data but rather serve as a guide to what may or may not happen given certain assumptions of generally economic factors.

It is noted that the reports carry a disclaimer:

> CSIRO advises that the information contained in this publication comprises general statements based on scientific research. The reader is advised and needs to be aware that such information may be incomplete or unable to be used in any specific situation. No reliance or actions must therefore be made on that information without seeking prior expert professional, scientific and technical advice.[47]

The reports examined in this research attempt to quantify various economic impacts to revenue caused by the introduction of electric vehicles.[48] Generally they find there will be little overall fiscal impact to households until 2050. They suggest overall energy costs to households to power motor vehicles may simply move from purchases of fossil fuel to purchases of electricity. Those suggestions are supported by the literature examined above.

According to the Australian Government Department of Industry and Science, 27.3 per cent of Australia's energy production for the 2013-14 fiscal year, was consumed by the transport industry.[49] An almost equal amount of energy was consumed in the production of

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46 Commonwealth Scientific and Industrial Research Organisation Publications – Tom Campey et al, *Low Emissions Technology Roadmap* (2017); Paul W Graham and Thomas S Brinsmead, *Efficient capacity utilisation: transport and building services electrification* (2016); Paul W Graham and Luke J Reedman, *Projecting future road transport revenues 2015-2050* (2015); Paul W Graham and Alan Smart, *Possible Futures: Scenario Modelling of Australian Alternative Transport Fuels to 2050* (2011) CSIRO Research Publication Repository < https://publications.csiro.au/rpr/home> at 1 November 2011.

47 Paul W Graham and Luke J Reedman, *Projecting future road transport revenues 2015-2050* (2015), CSIRO Research Publication Repository < https://publications.csiro.au/rpr/home> at 1 November 2011.

48 Commonwealth Scientific and Industrial Research Organisation, above n 46.

49 Australian Government, Department of Industry and Science, *Australian Energy Update* (2015) 13.

electricity.[50] Together with energy consumed by the manufacturing sector, the three sectors made up nearly three quarters of Australia's energy consumption in 2013-14.

Road transport consumed just short of three quarters (72.8 per cent)[51] of the total energy consumption of the transport industry, that sector is the focus of this paper. Further, as it is unlikely that coal and gas are currently used as energy sources for road transport, the 38.4 per cent contribution to Australia's energy sourced from oil[52] is assumed to be primarily consumed by road transport.

It is acknowledge however, that a considerable volume of diesel is consumed in electricity generation, particularly in smaller generation systems such as power stations with a generational capacity of less than 15 megawatts. Further, a diesel fuel rebate scheme is provided by the Australian Government to return most of the fuel excise paid by the operators of stationary engines. Therefore diesel fuel consumed by power stations is outside the scope of this paper. In addition certain heavy transport vehicles receive a diesel fuel rebate in compensation for part of the fuel excise.

Almost from the outset of the rise of the motor car in the early 20th Century, governments have raised revenue for roadways primarily from taxes levied on fuel as well as licensing and registration fees.

It may be considered in Australia, that the major revenue source for the maintenance road transport infrastructure, and the construction and maintenance of roadways, is the excise raised from the sale of petroleum products to fuel motor vehicles. The impact of the introduction of electric vehicles will greatly reduce motor vehicle petroleum fuel consumption. Therefore that revenue source for road maintenance expenditure may be in jeopardy.

In particular, that concern has been expressed in a 2016 CSIRO report which states:

> EVs will impact government road revenue, particularly fuel excise and government may eventually move to find another way to recover costs which could moderate uptake (e.g. a reduction in fuel excise in favour of a kilometres travelled based mechanism would improve the relative competitiveness of internal combustion vehicles).[53]

According to the report, it is estimated that hybrid and electric vehicles will comprise up to 20 per cent of light duty road vehicles by 2035.[54]

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50 Ibid. It is noted that the Dept of Industry and Science does not consider electricity to be an energy source therefore it is considered only as a means of conversion and transportation of energy rather than an input to energy production. That is important to this paper as the focus of the paper is the shift in energy source from fossil fuels to renewable energy for road transport. Excluding electricity as an energy source eliminates possible errors due to the duplication of data.

51 Ibid, 14.

52 Ibid, 11.

53 Paul W Graham and Thomas S Brinsmead, *Efficient capacity utilisation: transport and building services electrification* (2016) 7 < https://publications.csiro.au/rpr/home> at 1 November 2011.

54 Ibid, 1.

The paper now considers statistical data provided by the ABS and the ATO to establish the value of fuel excise revenue.

5.2 ABS Statistics

ABS data shows that the total number of motor vehicles registered in Australia rose 12.33 per cent from 16 368 383, in 2011, to 18 387 136, in 2016.[55] Conversely, by far the greatest numbers of motor vehicles consume liquid fossil fuels, and vehicles powered from 'other sources'[56] actually declined during that period from 513 562, in 2011 to 423 635 in 2016.

Therefore, in 2016, the proportion of motor vehicles not using petrol or diesel in Australia was only 2.30 per cent. Of passenger vehicles, the main type of electric vehicle, it was even less at 2.15 per cent. It is also noted that buses were by far the category of vehicle powered by 'other fuels' at 4.19 per cent in 2016, down from 4.39 per cent in 2011.[57]

The ABS motor vehicle census of 2016 reveals that of all vehicles registered in Australia only 6546 were classified as electric.[58] That number is extremely modest when compared to the total number of registered vehicles of more than 20 million from 2013 onwards.

Overall, passenger vehicles consuming unleaded petrol make up the bulk of Australian road users with 11 801 876 of the total of 18 387 136 motor vehicles registered in 2016, or 64.18 per cent. It is assumed that the data does not mean that passenger vehicles consume two thirds of motor vehicle fuels as the 2 344 653 registered commercial vehicles, trucks and buses consume more than one third of the total fuel consumed due to their higher fuel consumption rates, but nonetheless passenger vehicles undoubtedly consume the bulk of unleaded petrol and therefore contribute the bulk of fuel tax revenue.

It is also noted that there may be inaccuracies in the ABS data. Appendix A shows the registration papers for the PHEV used in the case study supporting this research. The 'plug-in hybrid electric vehicle' has been recorded as a petrol powered vehicle. The error arises from the use of the term 'petrol/hybrid' by the motor vehicle dealer, instead of 'plug-in'.

One incorrect registration in 6546 is insignificant but it does indicate a lack of awareness of the difference between internal combustion engine powered and electric vehicles, even by motor vehicle distributors. Although as examined later in the case study section of this paper, the clerical misunderstanding of terminology may not give rise to significant statistical errors at this point in time.

It is likely that passenger vehicles will dominate in the rise of electrically powered vehicles in the foreseeable future, as technology for heavy transport vehicles has not yet fully developed to the commercial market. Therefore this paper focuses on passenger vehicles on Australian roads.

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55 Australian Bureau of Statistics, *9309.0 - Motor Vehicle Census, Australia, 31 Jan 2016* (2016) <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/9309.031%20Jan%202016?OpenDocument> at 17 February 2017.

56 The ABS data aggregates LPG, dual fuel and electric fuels sources into one category.

57 ABS, above n 55.

58 ABS Motor Vehicle Census 2016 constructed from raw data.

In order to indicate the impact of the uptake of electric vehicles in Australia, Table 1 shows the growth of licensed electric vehicles on Australian roads for the years 2013-16.

Year	Electric Vehicles	Passenger Vehicles	Percentage of EVs	Total Vehicles	Percentage of EVs
2013	4167	13 000 023	0.032	20 757 657	0.020
2014	4705	13 297 170	0.035	21 313 721	0.022
2015	5215	13 549 450	0.038	21 785 979	0.024
2016	6546	13 815 108	0.047	22 249 088	0.029

Table 1: Growth of electric vehicles in Australia 2013-16.
(Source: ABS Motor Vehicle Census data 2013-16)[59]

While the actual volume of electric vehicles on Australian roads numbers is trivial, and certainly nowhere near the 20 per cent as projected by the CSIRO,[60] or 30 per cent according by Crowe's article.[61] At a total rate of growth of 57 per cent, or 12 per cent per annum,[62] the rate of growth is considerable.

However, according to the ABS data, despite such a considerable growth rate in the number of electric vehicles on Australian roads, by 2035 electric vehicles will only make up less than 1 per cent of all passenger vehicles.[63]

In 2016, the number of electric vehicles was just 6546 vehicles of a total of 13 815 108. Given that the annual growth rate of all Australian passenger vehicles is 1.53 per cent,[64] as revealed in Table 1, then the total volume of passenger vehicles on Australian roads would be 18 435 190[65] by 2035. Table 1 indicates that there has been a compounded growth rate of just 12 per cent over the four years. However, electric vehicles could be registered at increasing exponential rates if the take up was influenced by external social and economic influences.

While ABS data reveals that the market share of electric vehicles on Australian road in 2016 was less than one half of a percent (0.05%), European and US statistics indicate that electric

59 This table is compiled from ABS raw data and does not necessarily precisely match published Australian Bureau of Statistics, Catalogue *9309.0 - Motor Vehicle Census, Australia, 31 Jan 2016* which is a count of registered vehicles.

60 Graham and Brinsmead, above n 53, 1.

61 Crowe, above n 2. It is unclear as which CSIRO report Crowe is referring to. However the modelling in the 2016 CSIRO report considers 'a medium projection of 20 percent light duty road electric vehicle adoption by 2035, consistent with other studies which tend to focus on the next 15- 20 years.' Graham and Brinsmead, above n 48,1. It is possible he has used a 'high projection rate for journalistic impact'.

62 Compounded rate to produce and increase of 57 per cent over four years using the factor $f(x) = (1 + y)^n$.

63 Calculated at a growth rate of 19 per cent against a growth rate of 6.2 per cent for all passenger vehicles.

64 Compound factor $f(x) = (1 + y)^n$.

65 From compound interest tables: Number of PVs in 2035 = 13 815 108 x (1.33442244287) = 18 435 190.

vehicle sales increase sharply and exponentially. Therefore it is possible, that in the two decades, around 20 per cent of passenger vehicles using Australian roads could be powered by electricity.

To achieve a 20 per cent composition of all passenger cars by 2035, the number of electric vehicles on Australian roads would have to be 3 687 038 or around 3.7 million. That is considerable growth of around 56 225 per cent over the remaining 19 years. To achieve that proportion, the compound rate of annual increase would have to be at the rate of 40 per cent, as shown in Figure 1.

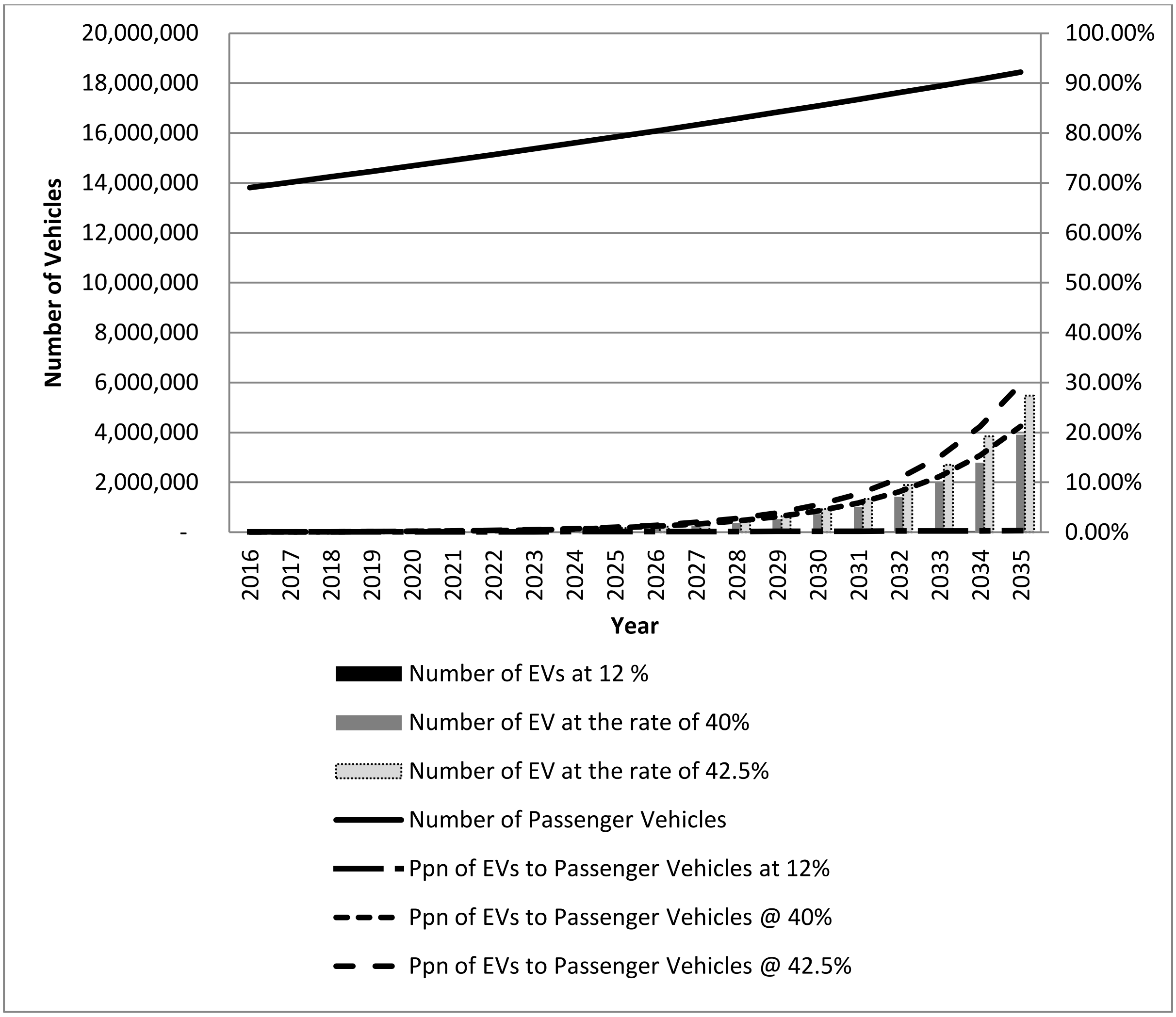

Figure 1: Possible Future Proportions of Electric Vehicles in Australia.
(Source: projected from ABS Motor Vehicle Census data 2013-16)[66]

Although Figure 1 reveals that the proportions projected by CSIRO reports (20 per cent) could only be achieved by an annual increase of a 40 per cent rise in the rate of sales of new electric vehicles. It also indicates, that with a very slight increase in the take up rate to just

66 This graph is compiled from ABS raw data and does not necessarily precisely match published Australian Bureau of Statistics, Catalogue *9309.0 - Motor Vehicle Census, Australia, 31 Jan 2016* which is a count of registered vehicles.

42.5 per cent, the proportion of electric vehicles on Australian roads to as high as 30 per cent by 2035.

However current sales trends do not support those estimates. Mitsubishi Australia advises that ‘up to the end of CY2016, Mitsubishi had sold 1660 PHEVs in Australia.’[67] That sales data tends to support the ABS statistical data above.

Mitsubishi Australia’s sales evidence and the ABS statistical data cast significant doubt on an annual increase in electric vehicles to achieve a proportion of 20-30 per cent of Australia’s passenger vehicles by 2035. On that evidence it is more likely that electric vehicles will account for less than one half of one per cent of passenger cars within the foreseeable future.

The rising awareness of environmental influences could also increase the rate at which electric vehicles replace fossil-fuelled passenger vehicles in Australia. There are also environmental benefits in reducing greenhouse gas emissions, through the introduction of electric vehicles.

Although it is beyond the scope of this paper to investigate the myriad external influencing factors that could lead to a rapid increase in the rate of uptake of electric vehicles, it is noted that the uptake of roof-mounted solar pv installations, in the late 2000s, exceeded the expectations of governments and electricity utilities.

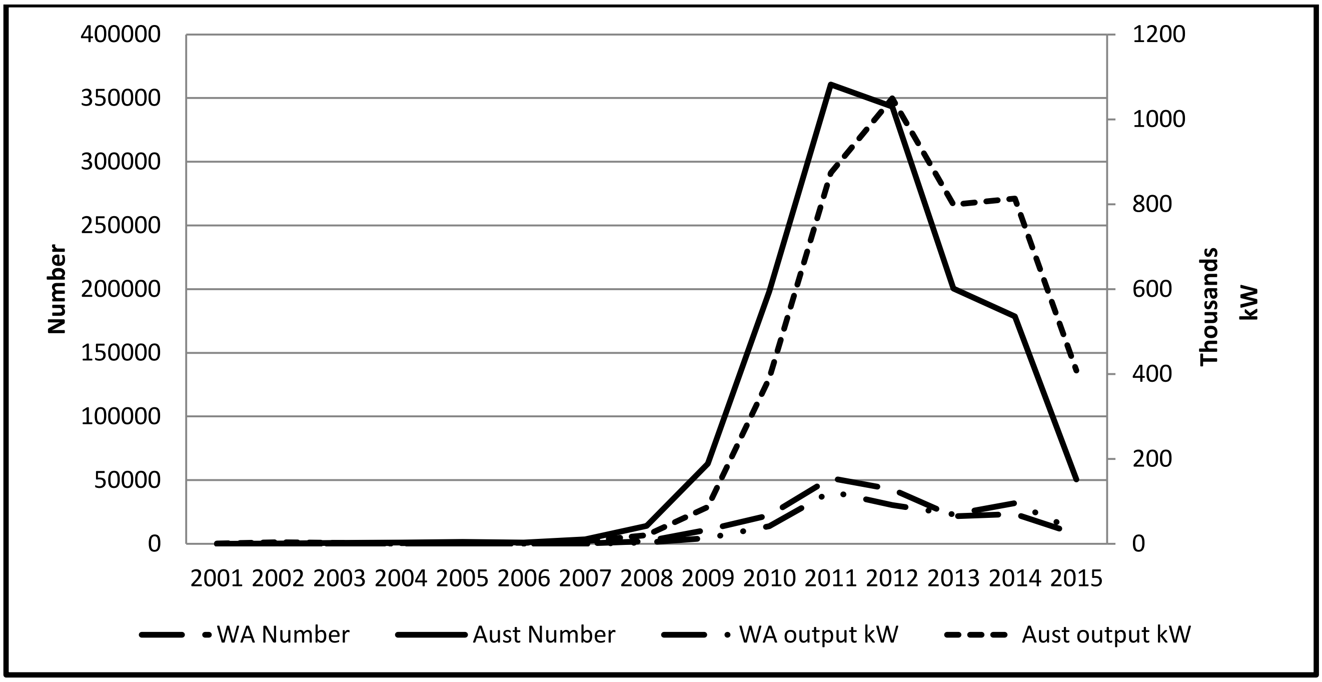

Figure 2: The number of small-scale solar pv installations by year for Western Australia and Australia: 2001–2015.
(Sources: Solex data, Australian Clean Energy Regulator, and Australian PV Institute[68])

67 Email from Karl Gehling (Head of Corporate Communications, Mitsubishi Motors Australia Ltd) to Alexander Robert Fullarton, 10 May 2017.

68 Sources: Solex data held by Alexander Fullarton, Australian Clean Energy Regulator, and Australian PV Institute as quoted in Fullarton, above n 29, 4.

Figure 2 shows the numbers of small-scale solar pv installations for the years 2001-15. Of significance to this paper is the period 2007-11. Solar pv installations rose from 5689 in 2007 to 360 745 by the end of 2011. In just four years the Australian public had embraced this type of renewable energy by a margin of 6 341 per cent. Given similar social and economic influences the uptake of electric vehicles could replicate the rate of uptake of solar pv installations.

Consequently, taxation administrators and policy makers may be well advised to consider the impact of the uptake of electric vehicles sooner rather than later. To determine the likely impact to tax revenue from fuel excises caused by the transition from the internal combustion engine to the electric vehicle, the following section examines published ATO statistics.

5.3 ATO Statistics

Fuel Excises

Table 2 shows Australia's fuel excise rates and the total annual fuel excise revenue for the period 2003-04 to 2015-16.

Year ended 30 June	Fuel Excise Rate Cents/Litre	Excise Revenue $m
2004	38.143	13 186
2005	38.143	13 599
2006	38.143	13 596
2007	38.143	14 305
2008	38.143	14 729
2009	38.143	14 559
2010	38.143	14 975
2011	38.143	15 507
2012	38.143	16 429
2013	38.143	16 903
2014	38.143	17 033
2015	38.600	17 242
2016	39.200 - 39.500	17 468
2017	40.100 - 40.300	tba
2018	40.300	tba

Table 2: Australia's Fuel Excise Rates 2004-16.
(Sources: *Excise Tariff Amendment (Fuel Indexation) Act 2015* (Cth) [69]; Australian Government *data.gov.au*[70])

ATO statistics, shown in Table 2, indicate that in 2003-04 the ATO collected $13 186 million from road users and by 2014-15, revenue from motor vehicle fuel excise had risen to $17 242

69 *Excise Tariff Amendment (Fuel Indexation) Act 2015* (Cth) No. 101, 2015.

70 Australian Government, *data.gov.au*, (2017) Australian Tax Office Taxation Statistics 2014-15 <http://data.gov.au/dataset/taxation-statistics-2014-15/resource/37b0b252-7c5a-4895-a708-db071c54d5fd?inner_span=True> at 25 November 2017.

million.[71] This excise revenue compares to just $4 761 million being spent by the Australian government on roadways for the same fiscal year.[72] However the Bureau of Infrastructure, Transport, and Regional Economics' (BITRE) statistics reveal that the combined Commonwealth, state and local governments expended $23 464.8 million on Australian road infrastructures.[73] Although BITRE, also cautions that '[t]here may be some double counting of state and local government funding due to lack of data on transfers from state/territory governments to local governments'.[74]

It is noted that the rise of 31 per cent over the 10 year period, represents only around 2.47 per cent per annum,[75] or just below the average Australian rate of inflation in that period.[76] It is also noted that in 2015 a rise in the excise rate of 1.20 per cent resulted in a rise of 1.23 per cent in excise revenue. However in 2016, a rise in the excise rate of 2.33 per cent caused the excise revenue to rise by only 1.31 per cent. Two periods are insufficient to indicate a real long term trend, but the law of diminishing returns may be beginning to apply as consumers seek ways to reduce their fuel consumptions.

The following section considers the impact of fuel tax credits refunded or rebated to certain eligible business considered to be essential to the Australian economy such as the heavy transport industry and off-road users such as the fishing and agricultural sectors.

Fuel tax credits

Table 3 shows the impact of fuel tax credits refunded to certain taxpayers in the transport, mining and other industries which are not considered to be road users, such as agriculture, forestry and fishing. Eligible businesses[77] can claim all or part of their fuel excises as tax rebates.

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71 Australian Taxation Office, *Organisations/Australian Taxation Office/Taxation Statistics 2014-15/Excise – Table 1* (2017) Australian Government, data.gov.au <http://data.gov.au/dataset/taxation-statistics-2014-15/resource/37b0b252-7c5a-4895-a708-db071c54d5fd?inner_span=True> at 12 July 2017.

72 Australian Government, Department of Infrastructure and Regional Development, Bureau of Infrastructure, Transport, and Regional Economics, *Key Australian Infrastructure Statistics 2016*, <https://bitre.gov.au/publications/2016/files/BITRE_yearbook_2016_pocket_book.pdf > at 13 July 2017, 9.

73 Ibid.

74 Ibid.

75 Average compounded rate of inflation for 12 years.

76 According to ABS data $17 242 million in 2015 would have been worth $12 926 in 2004: Australian Bureau of Statistics, *Consumer Price Index Inflation Calculator* (2017) <http://www.abs.gov.au/websitedbs/d3310114.nsf/home/Consumer+Price+Index+Inflation+Calculator> at 13 July 2017.

77 Australian Taxation Office *Fuel Schemes/Eligible Activities* (2017) <https://www.ato.gov.au/business/fuel-schemes/fuel-tax-credits---business/eligibility/eligible-activities/> at 25 November 2017.

Year	Fuel Excise $m	Fuel Tax Credits $m	Net Revenue $m
2005	13 600	3 747	9 853
2006	13 593	3 814	9 779
2007	14 305	4 309	9 996
2008	14 729	4 703	10 026
2009	14 559	5 065	9 494
2010	14 975	4 994	9 981
2011	15 507	5 109	10 398
2012	16 429	5 527	10 902
2013	16 903	5 408	11 495
2014	17 033	5 706	11 327
2015	17 242	6 010	11 232
2016	17 468	6 082	11 386
2017	tba	tba	tba

Table 3: Tax Credits paid to Australian Eligible Off-Road and Heavy Transport Activities.
(Sources: 2005-06; ATO Taxation Statistics 2004-05; 2007-16; data.gov.au Taxations Statistics 2014-15/Excise[78])

Table 3 indicates that during the period 2005-16 fuel excises rose 28.44 per cent, however after fuel tax credits had been returned to eligible businesses the increase in net road revenue from this source only increased by 15.56 per cent overall, or an annual compound interest rate of just 1 per cent. That net increase in revenue closely aligns with the gross revenue analysis shown in Table 2, but at the same time fuel tax credits to eligible businesses rose by 62.32 per cent or 6 per cent per annum. It is concluded therefore, that the bulk of taxed road users are the drivers of passenger vehicles.

5.4 Statistical Analysis Conclusion

The ATO data indicates that the burden of fuel excises is borne chiefly by the passenger vehicle sector. Therefore a change in the proportion of electric vehicles may have a significant impact on net road revenue from that taxation source. However ABS data indicates the number of electric vehicles on Australian roads is minimal. Accordingly, even at considerable growth rates in the adoption of electric vehicles the impact to fuel excise revenue is also negligible.

ABS data does not bear out the projections suggested by CSIRO reports and projections. It is possible that external influences could occur to severely impact the transition to electric vehicles, as experienced with the adoption of dispersed embedded solar pv installations in the late 2000s, but at present they are little more than speculation.

78 Australian Taxation Office *Research and Statistics; Taxation Statistics* (2007) <https://www.ato.gov.au/About-ATO/Research-and-statistics/In-detail/Taxation-statistics/Taxation-Statistics-2004-05/?page=41#Energy_grant_schemes> at 25 November 2017 ;Australian Taxation Office, *Organisations/Australian Taxation Office/Taxation Statistics 2014-15/Excise – Table 4* (2017) Australian Government, data.gov.au <http://data.gov.au/dataset/taxation-statistics-2014-15/resource/37b0b252-7c5a-4895-a708-db071c54d5fd?inner_span=True> at 25 November 2017.

Sales evidence from one of the major motor vehicle distributors in Australia does not indicate a high take-up of electric vehicles. Rather, sales data from Mitsubishi Motors Australia supports the ABS data. The conclusion of the ABS data is that the entire number of electric vehicles on Australian roads is less than one half of one per cent is likely to be very accurate.

Despite the hypothecation of fuel excise revenue to expenditure roadway construction and maintenance being ceased in 1959, and therefore any link between the road revenue source and expenditure on roads non-existent, if fuel excises were to fall to around one-third of 2016 levels they would continue to meet Federal government funding on Australia's roadways.

This examination of statistics concludes that in the unlikely event that electric vehicles were to comprise nearly one-third of vehicles on Australian roads then fuel excises would remain nearly twice volume of revenue over current levels of Federal expenditure on roadway construction and maintenance.

6. CASE STUDY

6.1 Case Study Data

This section examines a case study conducted on a Mitsubishi Outlander PHEV which is owned and operated by the Solex Solar Project in Carnarvon Western Australia. The vehicle was used in a rural/urban setting for a period of 17 months from May 2016 to October 2017.

The vehicle is fuelled from an unleaded petrol engine to power the on-board electricity generation system and an external electricity connection. The power unit for the on-board generation system is a 2L Mitsubishi internal combustion engine.

The engine is a standard power plant used most Mitsubishi, and similar makes and models of, sports utility vehicles of comparative size and class. The electricity source is renewable energy sourced electricity from the Solex solar farm. An electricity meter and a log book are kept to record electrical energy inputs.

It is recognised that motor vehicle owners are levied with a range of other taxes. The main focus of this paper is on the negative impact on fuel excise revenue caused from the transition to electric vehicles therefore examination of those taxes is outside the scope of this paper.

Table 4 shows a range of taxes applicable to motor vehicles in Australia and illustrates those taxes can be avoided by the transition from internal combustion engines to electric vehicles.

Tax	Energy Source			
	Petrol/diesel	Mains Electricity	Self-generated fossil fuel	Self-generated renewable energy
Fuel Excise	Yes	No	No	No
GST	Yes	Yes	Yes[79]	No
Licence/Registration	Yes	Yes	Yes	Yes

Table 4: Taxes applicable to alternative motor vehicle fuel sources.

79 Goods and Services Tax applies to fuel consumed but not to the self-generation of renewable energy.

Note that the 2016 Mitsubishi Outlander Plug-In Electric Hybrid vehicle used for this case study is slightly larger and heavier than the 2012 Mitsubishi I MiEV used by Galvin in his laboratory studies.[80] Detailed specifications of these vehicles are given in this paper as they can be readily accessed from the manufacturers' websites, although the MiEV is no longer available for sale in Australia.

However to provide reasonable comparatives the kerb mass and engine power are as follows:

MiEV kerb mass 1305kg and engine power of 49kW; and
Outlander PHEV kerb mass 1810kg and 60kW combined engine power.[81]

Therefore, it is expected that the heavier mass and power of the Outlander should increase fuel consumption over that of the MiEV. In addition the on-road conditions introduce the factor of wind resistance which is also expected to influence fuel consumption over those data obtained from laboratory condition trials.

The Outlander is garaged in Carnarvon Western Australia. It is primarily used for travel within the small town of round trips of less than 20km. It fuel source while in Carnarvon is exclusively electricity sourced from renewable energy generated by the Solex Solar Farm. It is energised by way of a 15 amp general purpose outlet to a 240 volt AC supply.

The vehicle is charged during daylight hours when not in use. The supply is metered however no data of charging times has been kept.

Long range trips of around 1000km were conducted in roughly three month periods. They are part of normal Solex operations to travel to adjacent towns, or to the City of Perth which is some 900km distant from Carnarvon. In that role of the vehicle is no different from internal combustion engine (ICE) powered vehicles previously used by the owner or the community generally.

During the period 30 May 2016 to 1 November 2017 the vehicle travelled 23 976km (14 899 miles) and consumed 1333.36L (293.29Imp gal) of unleaded petrol in excess of 90 octane rating. That data shows an average fuel consumption of just 5.56L/100km (50.81mpg Imp). In addition, the vehicle also consumed 1423.99kWh of electricity. By applying an estimate of 330ml of petroleum to produce 1kWh of despatch-able electricity,[82] an additional 469.92L (103.37 Imp gal) of unleaded petrol has been displaced.

The total fuel consumption, including the electric charge in equivalent unleaded petrol, is 1803.28L (396.67 Imp gal) which produces an average fuel consumption, including the

80 Galvin, above n 45.

81 Mitsubishi Motors Owner's Manuals.

82 Santiago Arnalich, *Epanet and Development: How to Calculate Water Networks by Computer* (2011) 153. Arnalich uses diesel to establish a calculation of 300ml/kWh, this calculation has been made on the basis that motor petroleum is 88 per cent of the energy contained in diesel. This paper uses the schedule in Part 3 of the National Greenhouse and Energy Reporting (Measurement) Determination 2008 made under subsection 10(3) of the *National Greenhouse and Energy Reporting Act 2007* to support the calculation used here.

electric charge, of 7.52L/100km or 37.56mpg (Imp). A detailed log of trips is shown in Appendix B.

Fuel consumptions range considerably from 1.61L/100km (175.45mpg Imp) for local running in Carnarvon to 7.95L/100km (35.53mpg Imp) for a trip from Perth to Carnarvon against strong to moderate winds in November 2016.

It was noted that wind resistance has considerable influence on the fuel consumption rates of the Mitsubishi Outlander PHEV. When located in Carnarvon the vehicle is charged regularly with electricity, and therefore uses very little unleaded petrol. The electricity is sourced from solar pv renewable sources generated from the Solex solar farm.

The manufacturer has advertised fuel consumption rates of as low as 1.7L/100km (166mpg Imp).[83] Examination of the logbook data, provided in Appendix A, supports that claim – provided the electricity used in charging is not considered in the fuel consumption calculations.

Galvin's laboratory trials of eight electric vehicles focused on energy consumptions under acceleration. However his analysis four electric vehicles driven under various levels of acceleration for a distance of 2.4km give a reasonably comparison with the range of driving conditions of the Outlander PHEV driven in this case study.

Galvin's data reveals an average energy consumption of 1 956 621W/s over 2400m[84] or 22.65kWh/100km.[85] By applying the energy conversion rate calculated by Arnalich,[86] an equivalent fuel consumption rate of 7.47L/100 is established.[87] That is very close to the fuel consumption rate established in this case study.

The published anticipated fuel consumption rates of the vehicles similar to the Outlander PHEV are contained in Table 5 to provide a comparison between the established PHEV fuel consumption and that of its petrol fuelled competitors.

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83 Mitsubishi Motors, *Outlander PHEV* (2017) < https://www.mitsubishi-motors.com.au/vehicles/outlander-phev> at 5 November 2017.

84 Galvin, above n 45, 243.

85 1 kWh = 3600000 W/s (1x60x60/1000).

86 Arnalich, above n 82.

87 22.65/0.33 = 7.4745.

Make and Model	Published fuel consumption
Mitsubishi Outlander PHEV 1GAV414	Established 7.52L/100km[88]
Mitsubishi Outlander PHEV	1.7L/100km[89]
Ford Escape 1.5L	7.5L/100km[90]
Kia Sportage Si 2.0L	7.9L/100km[91]
Mitsubishi Outlander – AWD petrol 2.4L	7.2L/100km[92]
Nissan Qashqai ST 2.0L	7.7L/100km[93]
Subaru Forester 2.0L	7.2L/100km[94]
Toyota RAV 4 2.0L	7.7L/100km[95]

Table 5: Comparative Published Fuel Consumption for a Range of Vehicles similar to the Outlander PHEV.
(Sources: Motor Vehicle Manufacturers' Internet Websites as referenced)

The published fuel consumptions of the petrol fuelled internal combustion engines of the comparative makes and models reveal that around 7.5 ± 3 litres of unleaded petrol is required to move a sports utility vehicle of around 2000kg for a distance of 100 km, at moderate driving speeds. That data closely correlates with the findings of this case study and Galvin's laboratory trials of similar vehicles.

In conclusion, those findings are consistent with the principles of physics of work, power and energy.[96] It is simple physics that the energy required to carry out the movement of a certain mass, a certain distance, within a certain time, will always be the same no matter what the energy source is.

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88 Case Study Log Book recordings.

89 Mitsubishi Motors, *Outlander PHEV* (2017) < https://www.mitsubishi-motors.com.au/vehicles/outlander-phev> at 5 November 2017.

90 Ford Motor Company of Australia Limited 'Explore ESCAPE | Escape Ambiente 1.5L EcoBoost Petrol AWD' <https://www.ford.com.au/suv/escape/models/ambiente-awd/?intcmp=vhp-return-model> at 6 November 2017.

91 Kia Motors Corporation, *Sportage* (2017) <http://www.kia.com/au/cars/sportage/specification.html> at 6 November 2017.

92 Mitsubishi Motors, *Outlander AWD Petrol* (2017) <https://www.mitsubishi-motors.com.au/vehicles/outlander/specifications/outlander-awd-petrol> at 6 November 2017.

93 Nissan Motor Co (Australia) Pty Ltd, *Nissan Qashqai* (2017) <http://www.nissan.com.au/~/media/Files/Brochures/Specifications/QASHQAI/QASHQAI%20Spec%20Jul%202015.ashx> at 6 November 2017.

94 Subaru (Australia) Pty Ltd, *Subaru Forester* (2017) <https://www.subaru.com.au/forester/performance> at 6 November 2017.

95 Toyota Motor Corporation Australia Limited, *RAV 4, GX 2.0L petrol 5D Wagon* (2017) <http://www.toyota.com.au/rav4/specifications/gx-2-0l-petrol-5d-wagon-6-manual-2wd> at 6 November 2017.

96 Stanley Leonard Martin and Andrew Kenneth Connor, *Basic Physics 1*, (1968) 64-76.

The manufacturer's publications that disclose a fuel consumption rate of around 2L/100km appears not to take into account the fossil fuel equivalent for the generation of the electrical charge of around 24kWh/100km.

6.2 Case Study Conclusion

The case study found that unless electricity is provided from renewable energy sources then there is no impact on fuel consumption rates between the PHEV used in this case study and similar makes and models of internal combustion engine driven passenger vehicles. Should the PHEV be fuelled entirely from its on-board petrol driven generation system then there is no impact on fossil fuel consumptions.

Should the PHEV be fuelled entirely from mains electricity sources, and in particular fossil fuel based power stations, there will be no impact to greenhouse gas emissions, other than to emit them from the power station rather than the vehicle itself. Likewise fuel consumption rates remain the same as for fossil fuelled vehicles.

Given that fossil fuel for power stations is not levied by way of the fuel tax credit system therefore should all electricity be sourced from mains supplies the fuel excise is avoided. At the rate of 4km/kWh or 12km/L then a distance of 24 000km travelled amounts to 2000L or a fuel excise impost of $800 is avoided.[97] In this case some 6700 kWh would have been consumed and cost $2000 at 2017 ruling rates for electricity in Western Australia. That would have attracted around $180 GST. The cost of avoided tax to the Federal government is reduced to just over $600 per annum or merely $11 per week.

Should 5.5 million electric vehicles make up the composition of passenger vehicles on Australian roads then total fuel excise of $3 300 million, or 18.89 per cent of the gross revenue for 2017 would be avoided.

There is no concession for the licensing or other imposts on passenger vehicles afforded to electric cars therefore there is no impact on other road revenues from the passenger vehicle sector of road transport. In addition, other imposts such as goods and services tax on electricity purchases remain levied on the users of electric vehicles.

7. CONCLUSION

The examination of data provided by the ABS and ATO did not provide a clear and distinct indication that the proportion of electric vehicles on Australian roadways will escalate to a level that will significantly impact on fuel excise revenues.

ABS data indicated that the proportion of electric vehicles to all passenger vehicles was less than one half of one percent to the end of the 2016 calendar year.

An anomaly was found in the registration documents of the PHEV used in this case study. It appears that registration staff have incorrectly registered the 'plug-in electric hybrid' as a petrol fuelled vehicle, rather than as an electric vehicle. That misclassification might create errors in the accuracy of the ABS data. However sales data provided by one of the main

97 The distance travelled in this case study at a fuel excise rate of 39.80 cents per litre (The average excise rate for the period under review).

motor vehicle manufacturers of electric vehicles supports the ABS data. Therefore the misclassification may be within tolerable error ranges and of no overall significance.

ATO data reveals any reductions to fuel excise revenue caused by the transition to electric vehicles to be so small as to be irrelevant to national road revenue collections. It also indicates that any reduction in revenue could be readily compensated by equal reductions in fuel tax credits paid to eligible enterprises engaged in heavy road transport or off-road industries.

Examination of legislation supporting fuel excises finds there is no legislative support to the assertion that fuel excises are hypothecated to roadway construction and maintenance in Australia. It was found that until 1997 Western Australia had a fuel levy that may have been intended to contribute to roadway construction and maintenance. That legislation was repealed as a consequence of the findings in the *Ngo Ngo Ha Case* as to the legality of state excises in 1996.

The Federal government removed hypothecation of fuel excises to roadway construction and maintenance in 1959. Therefore assertions that the transition to non-petroleum based passenger vehicles will severely negatively impact on expenditure on Australian roads are not supported by this research.

Despite the removal of the hypothecation of funding roadway construction from fuel excise revenue in 1959, if a connection between road revenue and expenditure is perceived to exist, a relatively simple means of continuing road funding from fuel excises would be to reduce fuel subsidies for fossil fuel purchased by 'eligible enterprises'.

In the modern world, where the reduction of greenhouse gas emissions from burning fossil fuel is viewed as a pressing environmental concern, the subsidisation of fossil fuels appears incongruous with those social goals.

The case study has proven that the 'hybridisation' of coupling an internal combustion engine powered, on-board generation system with an external electrical charging capability, works effectively and efficiently. The vehicle performs a dual role – that of an electric vehicle in an urban setting, and an internal combustion engine powered vehicle for the purposes of long distance travel.

8. RESEARCH LIMITATIONS

This research is limited to Australian and Western Australian legislation applicable to fuel excises levied on petroleum products used in the road transport industry. There are many other jurisdictions and enterprises which have not been examined and the findings of this research should not be applied directly to other jurisdictions or economies.

Government sponsored incentives, and other influencing factors, which may encourage the uptake of electric vehicles by the Australian motor vehicle owners, have not been considered in this research. Therefore the impact of those social and economic drivers on the uptake of electric vehicle proportions is not investigated or estimated in this paper.

The case study is limited to a rural/urban environment in a remote hamlet some 900 km distant from Western Australia's capital city. Several long distant journeys have been included in the fuel consumption data collated over 17 months and 24 000km.
However while it portrays a blend of urban and long distance travel reasonably well, the use of the vehicle is far from being typical of average urban use, either in Western Australia or any other urban environment.

In its current use pattern it can be readily re-charged from renewable energy sources and only makes short trips of less than 25km. An urban commuter is likely to make far longer journeys. When the vehicle makes long distance trips they are for distances greater than 500km. A vehicle located in a city is unlikely to make such regular long distant journeys.

No attempt has been made to quantify a comparative fuel cost between an internal combustion engine powered vehicle and an electric vehicle. Nor has a comparative cost of capital or maintenance been attempted. It is noted that both of those comparatives will vary wildly from state to state, vehicle manufacturer to manufacturer and nation to nation. They will vary considerably on the cost of unleaded petrol, licensing and insurance fees and the source and supply costs of electricity.

This case study has only indicated how costings could be carried out, not what the actual costs could be. That area of research could form the focus of future research, suggested in the following section.

9. SUGGESTIONS FOR FURTHER RESEARCH

This section considers some areas of research beyond the scope of this paper that could be investigated further to develop a broader understanding of the impact of changing technology in the manner in which passenger vehicles are used and powered.

Firstly, the impact of electric vehicles to the electricity grid could be researched as the fuel source moves from unleaded petrol, provided by existing petrol bowser type filling stations, to standard electrical general purpose outlets.

The introduction of the electric vehicle does not reduce overall energy demanded by road transport. The energy consumed by road transport will almost certainly remain unchanged, that is, if it does not rise due to population and economic growth. However the source of energy will alter. A looming problem associated with the rise of the electric vehicle is that of the impact of charging electric vehicles from the existing electrical distribution networks.

Du and others have considered the impact of charging electric vehicles from network sources and have suggested a model to optimise charging and discharging electricity to level demand on the power system. They conclude that instead of destabilising existing electricity networks electric vehicles

> can be integrated [into the grid and] operated [in a manner] which [is] based on [the] optimization model [presented]. It would have a [beneficial] effect on power system stability. Compare with the only charging methodology, this optimization method is more flexible, stability and efficiency. In addition, with the probability of vehicle online respect to power grid, the optimized load profiles would present more practical status.

> This optimization methodology proposed in [their] paper can be applied in different operational circumstances. For instance, it can be applied in industrial, commercial and residential power demand where detailed information of demand profiles are known.[98]

Secondly, the integration of renewable energy sources to the distribution networks goes some way towards reducing greenhouse gas emissions, and the reliance on fossil fuels. The impact on the rates of greenhouse gas emissions by the introduction of the combination of growing proportions of electric vehicles and renewable energy electricity sources to power them could be further researched.

Thirdly, economic impacts to households could be researched to quantify the fiscal costs as savings or additional imposts as fuel sources change. In particular the economic impact to households charging electric vehicles from dispersed, embedded solar pv installations or electricity purchased from the existing fossil fuel generated utilities. That economically focussed study could include fiscal impacts to government revenue and businesses.

Fourthly, investigations could be conducted as to the introduction of electric vehicles in the workplace for the purpose of employee commuting from their residences to places of work. It is suggested that employers could provide electric vehicles charging facilities powered from renewable energy sources. Employers could install roof mounted solar pv systems and provide employees with free, or heavily subsidised, electricity. Employees benefit from reduced costs of commuting to and from the workplace, and the environment benefits from reduced greenhouse gas emissions. The economic savings of reduced fuel costs could be shared between the employer and employees.

The introduction of the electric vehicle enables such a transition to renewable energy sources for the road transport sector to readily develop. It is a transition strongly recommended by this paper.

98 Guanhao Du et al., 'An Optimization Model of EV s Charging and Discharging for Power System Demand Leveling' (Paper presented at the 2016 Institute of Electrical and Electronic Engineers' Power and Energy Society Asia-Pacific Power and Energy Conference, Xi'an, China, 25 October 2016), 841.

Appendix A

Government of Western Australia
Department of Transport
Driver and Vehicle Services

Licence and Motor Injury Insurance Policy

FIRST AND FINAL ACCOUNT

ABN: 27 285 643 255

PAYMENT DUE BEFORE
27 November 2016

053D 024908

ALEXANDER ROBERT FULLARTON
PO BOX 180
CARNARVON WA 6701

VEHICLE PLATE NUMBER
1GAV414

ACCOUNT ISSUE DATE 17/10/2016
This Account will become a **TAX INVOICE** for GST purposes when a valid receipt is attached.

WARNING: *To ensure continuity of your licence and motor injury insurance cover you must pay before **27 November 2016**. If you do not wish to renew the vehicle licence, the plates must be returned within 3 months of the expiry date to avoid **a penalty**.*

Make:	MITSUB	**Model:**	OUTLAN	**Body:**	STNSDN	**Year:**	2016	**Colour:**	WH
Tare:	1785	**Agg:**		**GCM:**		**Cyl:**	4	**Fuel:**	PET
Ins.Cl:	1A	**Fee Type:**	01	**Class:**	A				
Engine No:	4B11 NH4636			**Vin/Chassis No:**	JMFXDGG2WEZ001570				

RATE

3 MONTH — Expiry Date: 26/02/2017 — **TOTAL DUE $214.70**

**3 MONTH payment ONLY available by BPay®, online or phone (1300 655 322). CANNOT be paid at Australia Post, Department of Transport centres or agents.*

6 MONTH — Expiry Date: 26/05/2017 — **TOTAL DUE $412.50**

06 C 412.50

12 MONTH — Expiry Date: 26/11/2017 — **TOTAL DUE $796.70**

12 C 796.70

FEE BREAKDOWN	3 MONTH*	6 MONTH	12 MONTH
Licence Fee	95.45	190.90	375.25
Insurance	88.59	173.18	338.37
GST on Insurance	8.86	17.32	33.83
Insurance Duty	9.70	19.00	37.15
Recording Fee	12.10	12.10	12.10
Adjustment	0.00	0.00	0.00
Total Due	$214.70	$412.50	$796.70

The insurance premium includes the cost of expanded motor injury insurance which covers you if you are catastrophically injured in a crash in Western Australia from 1 July 2016. Visit nowcovered.com.au for details.

Do **NOT** detach unless paying by mail

PAYMENT ADVICE

VEHICLE PLATE NUMBER
1GAV414-5

Trancode	User code	Customer Reference Number
831	066351	0110 6146 54320

RATE
☐ 6 months $412.50 ☐ 12 months $796.70

Biller Code: 484634 (New Biller Code)
Ref: 613 0110 6146 5432 1
Please check your BPAY Ref No. as it changes with each bill

PART PAYMENTS WILL NOT BE ACCEPTED
PAYMENT MUST BE MADE IN FULL

PAYMENT DUE BEFORE
27 November 2016

ACCOUNT NUMBER
0110 6146 5432

*699 260217 1061465432 33

D292MV 024908 080899

DOT #01 v13

PAYMENT OPTIONS OVERLEAF

<066351> <000110614654320> >

Western Australian Licence Notice for Mitsubishi PHEV Outlander

Government of Western Australia
Department of Transport
Driver and Vehicle Services

VL1A

Application for Bulk Licensing

New vehicle/vehicle not previously licensed

Section A - must be completed in full.

- If the vehicle owner is a body corporate, the full registered name must be shown.
- If the vehicle is jointly owned, a Proof of Identity Nominated Owner/Vehicle Licence Holder (VL186) form must be completed.
- Must be signed by the applicant or applicant's agent (selling Dealership can not sign as the applicant's agent).
- Must be completed irrespective of whether vehicle licence duty is to be paid.

Section B

- Must be signed by an authorised representative of the selling Dealership as endorsed on the dealerships Bulk Licensing Nomination/Permit (E177) form.

APPLICATION FOR VEHICLE LICENCE (SECTION A)

ORGANISATION/COMPANY (CORPORATION):

AUSTRALIAN COMPANY NUMBER (ACN): ORGANISATION CODE:

FAMILY NAME: I, **Fullarton**

FIRST NAME/S: **Alexander**

DRIVER'S LICENCE NUMBER: DATE OF BIRTH: / /

PHONE NUMBER: **0409 845 318**

EMAIL ADDRESS:

RESIDENTIAL ADDRESS: **118 Boor Street**

SUBURB: **CARNARVON**

STATE: W A POST CODE: **6701**

POSTAL ADDRESS:

SUBURB:

STATE: POST CODE:

hereby make application for grant of vehicle licence in the above name

SIGNATURE OF APPLICANT (OR APPLICANT'S AGENT)

DATE / /

I purchased the vehicle described in Section C for (if not purchased mark N/A)

PURCHASE PRICE: $

The 'DUTIABLE VALUE' of this vehicle at the date of application is $

THIS VEHICLE IS FITTED WITH AN APPROVED IMMOBILISER. YES NO

(See reverse for definitions of Purchase Price, Dutiable Value and Approved Immobiliser)

WARNING: A purchaser who understates the purchase price or dutiable value of a vehicle commits an offence under the *Duties Act 2008* and is liable to a penalty of $20,000.
The purchaser is also liable for the payment of the amount of the shortfall of vehicle licence duty to the extent of the amount understated, together with a penalty of 100% of that amount.

DECLARED AT (LOCATION): SIGNATURE OF DECLARANT:

DATE / /

DECLARATION OF SELLER/DEALER (SECTION B)

FAMILY NAME: I,

FIRST NAME:

DEALERSHIP: of **DVG Wanneroo**

sold the vehicle described below to

FAMILY NAME/ORGANISATION/COMPANY (CORPORATION): **Fullarton**

FIRST NAME/S: **Alexander**

PURCHASE PRICE: $ DECLARED AT: **DVG Wanneroo**

SIGNATURE OF DECLARANT: DATE / /

WARNING: A seller who understates the purchase price or dutiable value of a vehicle commits an offence under the *Duties Act 2008* and is liable to a penalty of $20,000.
The seller is also liable for the payment of the amount of the shortfall of vehicle licence duty to the extent of the amount understated, together with a penalty of 100% of that amount.

DETAILS OF VEHICLE (SECTION C)

THIRD EDITION ADR COMPLIANCE PLATE FITTED YES NO

MONTH/YEAR OF COMPLIANCE: **02 / 16** STANDARD VEHICLE CODE:

VIN/CHASSIS NUMBER: **JMFXDGG2WEZ001570**

ENGINE NUMBER (INCLUDE PREFIX AND SUFFIX): **4B11 NH4636**

BODY TYPE: **WAGON** FUEL: **PETROL/HYB**

TRANSMISSION: **CVT** PRIMARY/SECONDARY COLOUR: **STARLIGHT**

MAKE: **Mitsubishi** MODEL: **ZJ Outlander PHEV AWD**

SEATING CAPACITY: YEAR: **2014** M/CYCLE CAPACITY:

CYLINDERS: **0** AXLES: TARE:

AGGREGATE: MANUFACTURER GVM:

Last updated: 24.11.2016

IMPORTANT INFORMATION

Section 1 - Scope of Bulk Licensing Scheme

The Bulk Licensing Scheme permits dealers to certify the accuracy of information submitted and the fitness of motor vehicles or trailers, under the provisions of the *Road Traffic (Inspection of Vehicles)Notice 2012*, without individual inspection of these vehicles. The Scheme applies to approved dealerships for the licensing of new or not previously licensed vehicles only, relevant to:

- standard vehicles;
- standard vehicles with manufacturer's options; and
- vehicles subject to modifications which do not require Chief Executive Officer approval under the *Road Traffic (Vehicles) Act 2012* currently in force.

Section 2 - Duties of Authorised Representative

An authorised representative is required to verify the accuracy of the particulars shown on this form and that:

- the VIN on the VL1A form matches the VIN on the vehicle;
- that the correct number plates have been allocated and will be attached to the vehicle; and
- if the vehicle is a trailer, a VSB1 trailer plate has been affixed by an authorised installer.

PLEASE NOTE: It is an offence under provisions of the *Road Traffic (Administration) Act 2008* to wilfully mislead by falsifying and/or incorrectly declaring information on this form.

Section 3 - Definitions

Dutiable value

The term 'dutiable value' is defined by Division 5 of the *Duties Act 2008*.

The following interpretation is provided **as a guide only**.

'Purchase Price', in respect of a vehicle, includes any of the following —

a. an amount allowed by the seller on a trade-in or an exchange of any article;
b. an amount paid to the seller for anything included with or incorporated onto the vehicle; and/or
c. an amount paid to the seller for the preparation of the vehicle for delivery to the purchaser.

'New Vehicle'

For a new vehicle (which includes a demonstration model that has been used for that purpose for not more than 2 months) that is a motor car, motor wagon or motorcycle, the 'list price' (see definition below), **plus** the price fixed by the manufacturer, importer or principle distributor as the additional retail selling price in Western Australia for a particular type of transmission fitted to the vehicle (for example, the set fee to upgrade a manual transmission to automatic).

'List Price'

List price means the price that has been fixed by the manufacturer, importer or principle distributor as the retail selling price of that vehicle in Western Australia.

APPROVED IMMOBILISER

An approved immobiliser means an immobiliser fitted by the manufacturer or an immobiliser approved under the Vehicle Engine Immobiliser Scheme. For details of approved immobilisers please visit **www.transport.wa.gov.au/licensing** or contact Driver and Vehicle Services on 13 11 56.

CERTIFICATION (SECTION D)

Section 2 - Authorised Representative Certification

I certify that I have complied with the duties of an authorised representative as specified in Section 2 of the Important Information.

PERMIT NUMBER (AS SHOWN ON BULK LICENSING NOMINATION)

SIGNATURE OF AUTHORISED REPRESENTATIVE

NAME

DATE __ / __ / ____

FOR AND ON BEHALF OF

(OFFICIAL STAMP OF DEALERSHIP)

DEALER USE ONLY

CONCESSION CODE

CONCESSION APPLICATION ATTACHED ☐

DEALER CERTIFICATE ATTACHED ☐

POI ATTACHED (WHERE APPLICABLE) ☐

PERIOD OR BLOCK DATE

PLATE NUMBER

Appendix B

Date	Distance	Odometer	Litres	Fuel Consumption in L/100km	Trip
30/05/2016	0				Delivery Per
			12.09		
			28.66		
			36.93		
Sub-total	1088	1088	77.68	7.139706	per/cvn
4/09/2016	1449	2537	23.32	1.609386	cvn
23/09/2016			7.00		
			32.65		
			36.4		
			15.53		
			30.01		
Sub-total	1741	4278	121.59	6.983917	cvn/per/cvn
13-Oct			34.69		
			28.75		
			35.61		
			32.09		
			18.72		
Sub-total	2307	6585	149.86	6.495882	cvn/per/cvn
28-Oct			13.34		
			27.01		
Sub-total	1012	7597	40.35	3.987154	cvn/per
16-Nov			32.08		
			45.21		
			13.80		
			33.27		
Sub-total	1565	9162	124.36	7.946326	per/cvn
19-Nov			34.00		
			34.43		
Sub-total	1316	10478	68.43	5.199848	cvn/ger/cvn
19-Dec			44.35		
			44.15		
Sub-total	1632	12110	88.5	5.422794	cvn/ger/cvn
25-Jan			44.35		
			44.57		
			38.77		
			44.58		
			41.38		
	3703	15813	213.65	5.769646	cvn/per/cvn
26-Mar			38.06		

			37.23		
Sub-total	967	16780	75.29	7.785936	cvn/ger/cvn
30-Apr			36.55		
			10.48		
			44.16		
Sub-total	1906	18686	91.19	4.784365	cvn/ger/cvn
12-Jul			47.04		
			10.00		
			46.41		
			10.01		
Sub-total	2194	20880	113.46	5.171376	cvn/ger/cvn
27-Jul			41.23		
			27.82		
			35.36		
			11.27		
			30.00		
Sub-total	2221	23101	145.68	6.559208	cvn/kta/cvn
17-Nov	875	23976	21.43	2.449143	cvn
Total	**23976**	**23976**	**1333.36**	**5.561228**	

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