THE FUTURE OF ELECTRIC VEHICLES (EV) IN AUSTRALIA

SUMMARY

Introduction

There is a great deal of chat at present about Electric Vehicles (EV), with pundits, electioneering politicians and climate watchers waxing lyrically about their future, and with virtually all major car manufacturers in a race for potential market share. Although these cars are still relatively expensive, early adopters of EVs will undoubtedly have a good run with running costs, but only until the market takes off and electricity distribution and consumption costs and inevitable government charges start to bite.

What is the realistic future for electric vehicles in Australia? Indeed, what is feasible here, given our well-known constraints of low population, vast distances, reliance on vehicles, abundant energy resources but reliant on imported liquid fuels? A few facts will help to clarify things for readers currently bamboozled by climate hype and, election promises and, dare I say it, deliberate misinformation more idealistic members of our society.

Comment

Renewable Energy

Nevertheless, EVs are a reality and numbers will inevitably grow as infrastructure permits. The Federal Opposition leader wants 50% of all new vehicles to be EVs by 2030. That can be shown to be far from feasible and has more to do with electioneering than supportable by current facts.[1]

A big unknown at present is whether electricity from renewables will ever be able to keep up with traditional demands for power (domestic and industry) as well as replacing the consumption of petrol and diesel by Internal Combustion vehicles (ICV).[2] The full potential of EVs will not be realised unless they are powered by renewable energy, and we are a long way off that state, given that 79 per cent (%) of electrical power in Australia is generated from fossil fuel. However, even if powered off a fossil-fuelled grid, EVs can still result in lower CO2 production than ICVs, because of relative efficiencies.

In 2018, there were some 19 million registered vehicles in Australia, of which about 15 million are passenger vehicles. Commercial vehicles used in cities can readily be EVs but long-haul transport as EVs is unlikely, unless a clear economic case can be made for conversion, ie unless there are significant time and cost savings to operators – 'time is money'. Buses are currently a major target as EVs, with good reason.

Most of the 15 million cars are in our cities, many primarily for commuting but also essential for family use. EVs lend themselves particularly well to city users, especially for commuting and as run-arounds and for reduction of pollution.

It can be shown that by 2050 there could be about 22.5 million EV (passenger cars), assuming a generous 75% of cars being EVs by then. There are huge savings on offer but at a cost. There will be large savings in fossil liquid fuels currently used in cars, about 70 % (maybe 80%)[3] of which is converted into heat and wasted. All that fuel not burnt means less gas and particulate pollution (including CO2). On the other side though: there will need to be a large investment in generation of renewable electricity and recharging networks; there will not necessarily be fewer vehicles on the road and traffic congestion (and travel time lost) will not be less (as some pundits may think). Less pollution will be good for commuter health, albeit in Australia, it has negligible impact on world climate change.

According to www.abs.gov.au, at end-June 2018, there were 14,258,620 passenger cars in Australia, running a total of 179,761 million km pa (pa). Let's assume 15,000,000 at end-June 2019, running 180,000 million km pa.

[1] Canberra Times, 7Apr19 "Powering on in the push for a greener future" covers many of the aspects raised in this newsletter.

[2] An article in The Australian (5Apr19) discusses whether the EV roll-out is a 'threat to the power grid'.

[3] Only 20-30% of energy consumed by ICVs is converted to 'wheels on road" power, the rest is wasted as heat into the atmosphere and, later absorbed into the land and oceans, with the rest (not enough because of CO2 production, radiated out into space.

Currently available EV cars consume from 16 to 20 KwH[4] per 100km. It can be shown that a good average, given a current average city speed of 45 kmph, is just on 18 KwH per 100 km. With an EV efficiency[5] of 70%, a fleet of 15 million passenger EVs would consume about 46,250 GwH[6] of electricity pa. Each EV would consume an average of 3.1 MwH pa. In 2050, there could be 22.6 million EV passenger cars consuming 69,703 GwH pa

Would renewable energy generation into the national grid be able to cope? How feasible is all this for renewables and EV adoption, given the political mess on energy and EVs at present?

It is problematic but solvable and for EV adoption to be accommodated. However, no matter what Australia does with EVs, it will have negligible effect on the world climate. By all means have EVs, but let them evolve as economic sense dictates. Government subsidies would be largely wasted (even if attractive politically).

Labor Party pledge for EVs

A Federal Labor election pledge is for 50% of cars sold in Australia to be EVs by 2030. Is that feasible? Not really. As may be seen in the following table (from detailed spreadsheeting), Labor's pledge would mean that there would have to be 665,400 new EV sales in 2030, whereas the feasible figure is only about 171,000, if that, despite the massive subsidies Labor is talking about.

ICVs vs EVs	
Table 8C	
EV (passenger) adoption- Estimates	
Claim	
1	Labor promise 50% of all new car sales will be EVs by 2030.
	Is that election promise reasonable?
Facts	
1	In 2018: were 15 million passenger cars (*www.abs.gov.au*)
2	In 2018: were 1.153 million new passenger car sales. (*www.carsales.com.au)*
2	National population growth is 1.6% pa (*www.abs.gov.au*)
Assumptions	
1	Assume total numbers and new car sales increase at same rate as population.
2	By 2050, 75% of cars will be EVs (generous assumption for Australia).
Estimates	
1	In 2030: there would be 18 million cars and 1.33 million new car sales.
2	In 2050: there would be 30 million cars and 2.38 million new car sales.
3	In 2030, 50% of new sales would be 665,400 - the number of EVs that the Labor party is claiming.
4	In 2050, there would be 22.6 million EVs (cars)
5	To reach 22.6 million, EV adoption would need to increase at a compound rate of 29.1% pa
6	At that rate, by 2030, there would be 476,000 EVs.
7	At that rate, in 2030, there would be only **171,000 EVs** sold - **not 665,400** as Labor would claim.
Conclusion	
1	The Labor claim 665,400 EVs sold in 2030 cannot be sustained.

Conclusions

So, what does all this mean for the future of EVs in Australia?

EVs are a reality and adoption will increase at an increasing pace, as economics, subsidies and government policy permit.

The brightest future for EVs is obviously in cities where short, daily running is predominant, recharging networks relatively cheaper to install and where roof-top solar is prevalent for overnight charging of vehicles.

[4] KwH = Kilowatt.Hours, ie thousands of watts power generated/consumed for H hours.Labor

[5] Percentage of power consumed by EVs converted to work done (at wheels on road), which is much higher than for ICVs.

[6] GwH = Giga watt.Hours, millions of watts power generated/consumed for H hours.

However, adoption of EVs in Australia can never be hoped to match what is occurring in densely populated countries, especially those with cheap renewable power like Norway. ICVs will always be a necessity in Australia.

Growth in renewable electricity generation will not only have to cope with adoption of EVs but also will have to cope with the increase in domestic, commercial and industrial demand. Nevertheless, EV demand will be accommodated, if at a cost. But, do not expect the annual cost of owning an EV to be any less than for your current ICV.

A most important conclusion though, is that the adoption of EVs in Australia should be as economic development and productivity gains permit. Contrary to what is being said politically, there is no imperative to push adoption of EVs through subsidies or law. The reality is that whatever Australia does with EVs, it will have negligible effect of world climate change – very much greater influences than Australia's puny effort are at work.

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DISCUSSION

Introduction

There is a great deal of chat at present about Electric Vehicles (EV), with pundits, electioneering politicians and climate watchers waxing lyrically about their future, and with virtually all major car manufacturers in a race for potential market share. Although these cars are still relatively expensive, early adopters of EVs will undoubtedly have a good run with running costs, but only until the market takes off and electricity distribution and consumption costs and inevitable government charges start to bite.

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In 2018, there were some 19 million registered vehicles in Australia, of which about 15 million are passenger vehicles. Commercial vehicles used in cities can readily be EVs but long-haul transport as EVs is unlikely, unless a clear economic case can be made for conversion, ie unless there are significant time and cost savings to operators – 'time is money'. Buses are currently a major target as EVs, with good reason.

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It can be shown that by 2050 there could be about 22.5 million EV (passenger cars), assuming a generous 75% of cars being EVs by then. There are huge savings on offer but at a cost. There will be large savings in fossil

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Would renewable energy generation into the national grid be able to cope? How feasible is all this for renewables and EV adoption, given the political mess on energy and EVs at present?

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Some background information

To put things in perspective:

- Total power generation in Australia in 2017 was 261,400 GwH pa of which about 19% (49,400 GwH) was from renewables; not much more than would be required to power a 15 million passenger EV fleet.
- Of the 19 % of renewables, 7% was from hydro, 6% from wind and 6% from solar and 1 % other. Most of the hydro generation was in Tasmania.
- Future growth in renewables will have to come largely from wind and solar. Although Hydro 2.0 will have a generating capacity of some 2,000 Gw, to produce a probable 3,000 GwH pa, its main function will be as a storage facility (battery) fed from unused renewable generation, logically from overnight wind generation. One may presume that all solar generation would be consumed on the day elsewhere. Snowy 2.0 should be thought of only as a 'battery', releasing power on demand and with zero net contribution to renewables generated.
- National power consumption (demand on the grid) can be expected to grow by about 2% pa (current CPI), being about 5,500 GwH pa. Car ownership could be expected also grow with population (currently 1.6% pa).
- Current generation of renewables (19%) is growing at about 21% pa, ie 5,500 GwH pa (2018-19), ie about the same as the growth in total demand.
- Wind and solar currently (2018) generate about 60 % of that by renewables, ie about 33,000 GwH pa.
- Wind and solar power generation is increasing at about 11% pa, ie about 3,500 GwH pa.
- Despite a great deal of political in-fighting, there is no plan to build more fossil fuel generators and so, current growth in renewables is only enough to cope with the growth in overall demand.

[9] Only 20-30% of energy consumed by ICVs is converted to 'wheels on road" power, the rest is wasted as heat into the atmosphere and, later absorbed into the land and oceans, with the rest (not enough because of CO2 production, radiated out into space.

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- Given the planned (by some politicians) demise of the fossil fuel power stations, over the same 30-year period, renewables would be expected to pick up an additional 79% of the current demand, ie about 9,000 GwH pa, assuming a steady run-down of fossil-based power.[13]
- Total growth of the renewables sector would need to be at about 11,000 GwH pa, ie double the current rate of growth, if at all possible. That is a very tall order!
- If the massive growth and investment needed in renewables were to be achieved (highly doubtful), the consumption by growth in EVs would appear to be able to be accommodated.
- The temptation to calculate the additional number of wind generators and solar farm acreage that would be needed to take over from fossil fuels has been resisted here. That is a problem for energy providers and how much subsidy they can screw out of governments.
- If feasible, there would be huge savings in imported fuel (petrol and diesel). Currently, 15 million cars consume about 22 million tonnes of fuel pa of which at least 70 % is converted to pollutants and wasted heat energy, that otherwise would be avoided.
- Whatever the rate of EV adoption, there will be a significant drop in consumption of liquid fuels and corresponding drop in CO2 production therefrom. The average passenger ICV produces about 5 tonnes of CO2 pa. The average EV, even drawing on the current grid (70% powered by fossil fuel), would produce only about 1.6 tonne of CO2 pa.
- How feasible is all this for renewables and EV adoption, given the political mess on energy and EVs at present? Problematic but solvable and for EV adoption to be accommodated. However, no matter what Australia does with EVs, it will have negligible effect on the world climate. By all means have EVs, but let them evolve as economic sense dictates. Government subsidies would be largely wasted (even if attractive politically).

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[13] Not a valid assumption, given that power stations would come off stream in great lumps.

Not all beer and skittles

On the down side:

- Wind generators and solar cell farms have to be replaced at great cost (in money and pollution), about every 25 years or so. Fossil-fuelled stations have a life of about 40 years. While there are claims that the cost of currently-subsidised renewables is coming down to competitive levels, it is problematical that their life-cycle cost would ever be cheaper than fossil-fuelled generation. Note that, while the initial cost of renewable generators is important, it is really the life-cycle 'green' footprint that is really important. For example, how often do advocates ever talk about the hundreds of tonnes of concrete that support each wind generator or the continuous decline in solar farm efficiency and the need to regularly clean those thousands of acres of glass.
- There will need to be a massive investment in recharging networks. Not all 20 or so million EVs by 2050 would be chargeable at home.
- EVs will still need the same investment in road infrastructure because the number of vehicles will not decrease with an ever-increasing population (at least for the foreseeable future).
- Governments will need to make up the loss of fuel excises ($10 billion by 2040)[14] one way or the other, probably by higher electricity charges, especially at times of peak grid usage, and other measures. EV motoring will not necessarily be any cheaper than for ICVs today.

Data cited in this paper, either from reliable sources or calculated, have been taken from spreadsheet tables listed in the following table. The tables can be made available upon request.

ICVs vs EVs - Data Tables [File: *ICVs vs EVs_1.x*]		
Table	**Title**	**Sheet**
1	ICV - Subaru Outback for comparison	ICV/EV Comparison
2	EVs - Tesla for comparison	ICV/EV Comparison
3	ICV/EV Comparison	ICV/EV Comparison
4	Comparison - EVs vs ICV - Variables & Constants	ICV/EV Comparison
5	ICVs Fuel Energy consumption	ICVs vs EVs
6	Snowy Generation	ICVs vs EVs
7	CO2 Generation	ICVs vs EVs
8A	Passenger cars - Growth	ICVs vs EVs
8B	EV Adoption - Predicted Rates	ICVs vs EVs
8C	EV (passenger) adoption- Estimates	ICVs vs EVs
9	EV calculations Electricity consumption pa	ICVs vs EVs
10	National Electricity Generatiion	ICVs vs EVs
11	Renewables power generation	ICVs vs EVs

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[14] The Australian, 11Apr19

accommodated, if at a cost. But, do not expect the annual cost of owning an EV to be any less than for your current ICV.

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M.R. Flint
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14 April 2019