Providing Renewable Energy for Future Australian Electric Cars
Richard Davoren

- **Motor vehicle batteries, if used for storing renewable power could make a major contribution to providing an effective storage medium to balance the output variations that occurs with wind and solar generation.**
- **By adopting my model where commuting cars charge at work places, reduces the need for public charging points and reduces demand on the grid by the predicted growth in battery powered cars.**

For the basis of this study I am using the **Hyundai Kona Electric car** powered by a 150kW/395Nm electric motor fed by a large – for the vehicle's overall size, a 64kwh battery.

Background:

- There were 19.2 million registered motor vehicles in Australia as at 31 January 2018.
- 14,342,400 or 74.7% were cars.
- 64kW/h lithium-ion polymer battery! (Compare this with a Tesla 2 Powerwall at 13.5 kwh battery)
- The private motor vehicle fleet therefore has a huge energy storage potential.
- The Kona will travel 449 kms on 64KwHs or for 1km use .143kWhrs.
- **Roy Morgan's automotive data, reveals that:**
- there are almost 15.5 million drivers on our roads,74% cars and
- They drive an average of 15,530 km each per annum nationwide**, or on** average, 42kms per day.

So by Energy use :.142kw per kilometre 15.5 million drivers each driving 42kms per day each, consumes 2250 kWh per annum or in total 2250*15.5m or **32,000 gigawatts per annum.**

It is estimated that Australia produced 48,279 gigawatt-hours (gWh) of **renewable electricity** in 2018.

Conclusion:

It is likely that cars with internal combustion engines will not exist in Australia by 2050. However an all-electric car fleet at current driving patterns would require close to Australia's current renewable energy output.

A car such as the Kona, driving average km, would use less than 10% of its fully charged capacity, so such vehicles would provide enormous storage capacity if regularly connected to a solar source and act as a solar storage battery. At times of peak load, those cars connected to the grid could provide a significant buffer to ensure that blackouts did not occur. As is achieved with PV arrays, through an appropriate inverter and voltage sensing and switching modules, AC can be fed into the network from the battery when required. Control would remain with the owner so if battery discharging was not convenient, it need not occur.

The need for pumped hydro, and another Basslink seem unnecessary. Utilising spare motor vehicle battery storage would take up all available renewable electrical energy capacity for now and the foreseeable future.

Each battery, on average, would hold in excess of 57 kWhrs of energy, not required for the daily travel. As the electric car fleet expands, so does the capacity of the system.

The network would draw on the vehicle batteries during peak demand. If the owner wished to utilise the maximum storage capacity of the battery for a longer trip, then isolating the battery from the system to prevent draw-down would be applied.

Where would the extra energy needed come from?

At average kilometres a motorist would consume less than 6 kWh per day.

6 kWh per day would cost 87 cents per day or $319 per year on an off-peak tariff (in Tasmania).

If the batteries were “floated” they would **fully charge** over time without a significant daily increase in energy needed for average driving.

A 1.5 kW solar installation would cost $2150 with an annual cost of around $150 and produce sufficient energy for average kilometres usage. Logically, with a small addition of between 1-1.5 kWh to an existing solar installation would, cost less.

An average home uses 20 kWh per day. Installers suggest employing a 5 kW solar system. Add a car, a 6 kW system should prove adequate for both home and car. This should cost around $4000 to install or an annual cost of around $200 for both car and home. As suggested, the car battery can suffice as a storage battery for the system in many cases.

Of course there are many factors to consider, the times the battery can be connected is the largest variable. A car regularly used to commute to work would not provide much opportunity to be charged through a home solar system but there is a viable option.

Commuter battery charging by solar.

A study of census data has found that nearly two in three Australians drive to work in a private car while only one in 10 commuters relies on public transport. Therefore less than one third of electric cars could be charged by home solar on a regular basis. The situation could prove better than this as the figures relates to commuters. Not all cars are owned or driven by commuters.

If major workplaces were to provide solar charging of staff motor vehicles, then Australia’s alternative energy source problem could be resolved. Factories, schools office blocks have huge roof top areas to exploit. See attached photo.

Mini solar farms on work places used to charge these vehicles would benefit commuters and Australia’s electricity grid. These charged vehicles driven home and connected to the home grid in darkness hours, could provide a valuable back-up source of energy when solar is unavailable. Funding for the workplace installations could come partly from subsidies or charging users of the service or simply from the value gained by having a solar installation for operational purposes.

A 6kW solar system has 24 solar PV panels. As each panel is around 1.6m by 1m in size, a work-place would need only 40m^2 of roof space to re-charge around 4 to 6 cars after their typical commute.

So rather than concentrate on storage such as pumped Hydro which uses energy, utilising the motor vehicle mobile batteries for storage would seem a better option. Australia should continue to pursue options that utilise opportunities to generate more solar power such as subsidising if necessary, work place solar.

During daylight hours, commuters’ cars are also located in public car parks and on kerbside. Some public carparks have the capacity to provide roof-top solar and provide slow charging outlets. Kerbside charging could be fed by PV.s on adjacent buildings and costs charged through parking meters, if utilised.

Hectares of space, already connected to the grid!

About the author.

I have worked in Electrical Engineering and Facility Management for in excess of 60 years. I have qualifications and experience in industrial electronics, robotics, electrical traction and conveying systems and buildings engineering services.