"Inquiry into the current circumstances, and the future need and potential for dispatchable energy generation and storage capability in Australia"

Dear Committee and Honourable Members,

Please find below my submission for the above titled inquiry.

Current circumstances:

Thanks to the Industrial Revolution and the resulting improvements in quality of life, healthcare, technology, education, economic development and an uncountable number of other improvements, humans have become extraordinarily successful and our numbers are now approaching ~8bn individuals, irrespective of the current pandemic and minor wars and disease which still afflict us. This has undoubtedly been a good thing, but it has come at a cost which is becoming increasingly harder to ignore. It is unfortunate that the primary stored energy source we have liberated from our Earth's crust should emit the most significant greenhouse gas as a by-product. Chemists have understood this relationship for more than a hundred years and it was originally thought to be a beneficial secondary effect, but it was only in the 1980s that scientists at Exxon discovered the potential for exponential accelerating climate change and the modern era for the understanding of climate science was born.

Currently in Australia we have a trifecta of energy challenges facing us – **climate change**, **pollution** and **changing energy profiles.** We have enjoyed the financial and societal benefit of exploiting naturally sequestered carbon stores but are now starting to endure its effects, beginning with the 2003 Canberra Bushfires which is the first extreme climate event that can be linked directly to climate change. Including our exports, Australia is responsible for around 5% of global carbon dioxide emissions, a huge percentage given our relatively small population. Additionally, the fuel we burn for our domestic use is of very poor quality, high in sulphur, is dependent on foreign regimes requiring significant fuel burn to bring it to us, and we have minimal emissions standards. Combined with these factors, our energy production and consumption profiles are also changing dramatically, which we are not yet addressing in any meaningful way. I have included three graphs below which illustrate the fundamental problem:

Figure 1 - Current CO2 levels ~420ppm and increase is accelerating. Source: co2levels.org

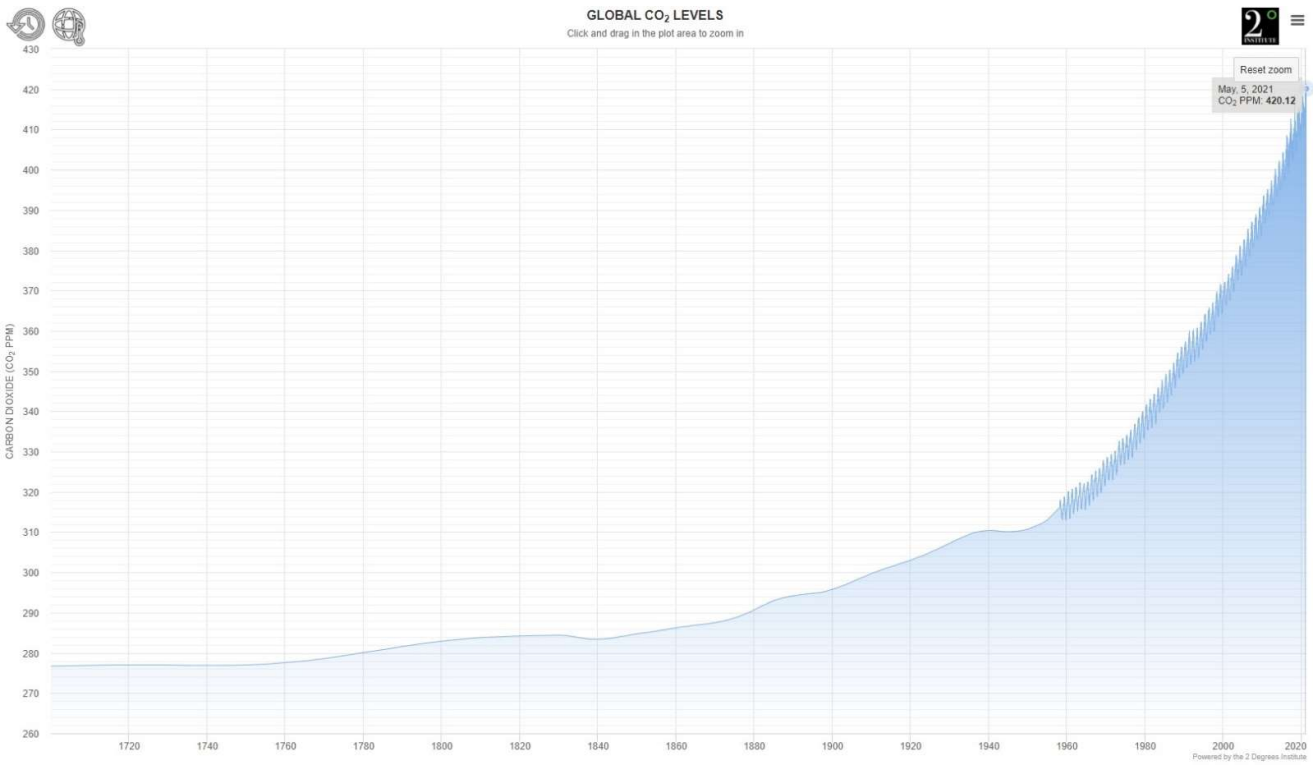


Figure 2 - NASA CO2 tracking. Source: climate.nasa.gov

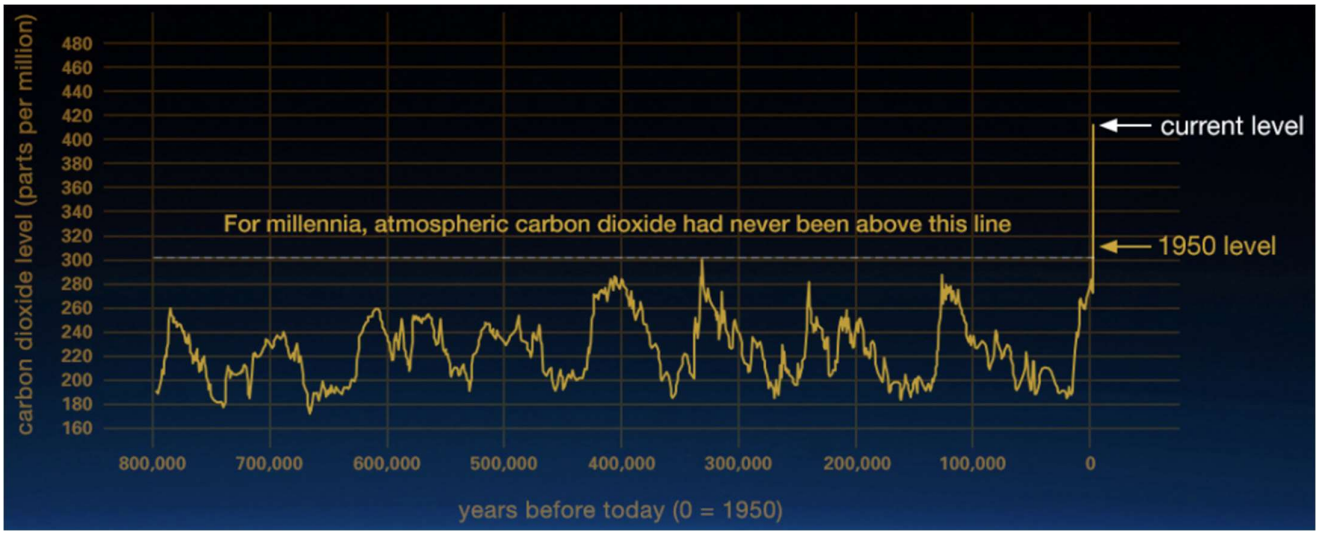
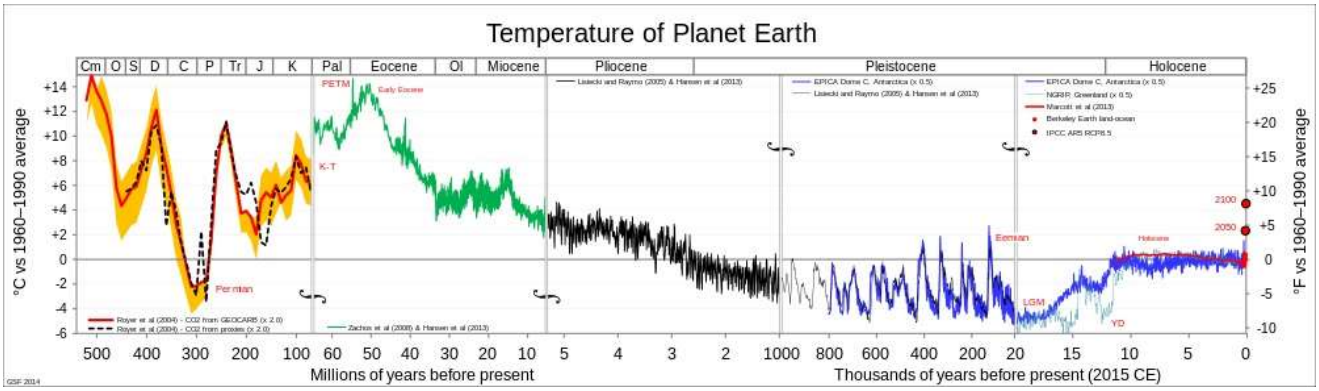


Figure 3 - Historic CO2 levels and subsequent temperature correlation. Source: https://en.wikipedia.org/wiki/Geologic_temperature_record



Australia is at the forefront of exposure to the risk of more frequent and more severe extreme weather events due to anthropogenic climate change, and we can expect more extremes and more frequent events to come sooner. Equally however, there is no reason why we cannot pivot quickly to take advantage of the opportunities that present themselves by combining the need to change with the benefits of changing our power supply and power consumption. If we act now, act decisively and act in a collaborative manner we can limit the worst of the likely consequences while creating new industries for which we can gain economic benefit. The developed and developing world is recognising the threat of climate change, the costly damage from pollution and the opportunity that new battery storage and dispatchable power technologies provide. The lack of battery storage and dispatchable power becomes a bigger problem as Australians and Australian companies buy Electric Vehicles in greater numbers, install Solar PV in significant numbers and demand action on climate change in greater numbers, all of which need addressing.

Future Need:

Due to the significant uptake of domestic Solar PV, commercial Solar PV and Wind turbine arrays in Australia combined with the likely uptake of both domestic and commercial Electric Vehicles, our energy production and consumption is changing beyond what our grids were originally designed to accommodate. **We urgently need both local and grid-scale battery storage if we are to avoid the risk of grid instability and costly transmission line infrastructure upgrades.** Existing power stations already have transmission lines running to them, which makes them ideal locations for large battery storage arrays with readily dispatchable power. Domestic homes and commercial properties all need batteries installed, both for their own needs and for grid operators to draw from them as Virtual Power Plants, such as the 50,000-home Virtual Power Plant project happening in South Australia in collaboration

between the South Australian government and Tesla. The old model of coal-burning power stations with gas generators as spinning reserves is being made redundant on cost by Renewables, what is lacking is the widespread investment in batteries to capture and dispatch that energy. **It is also of critical importance to recognise Electric Vehicles as part of the solution.** EVs are batteries-on-wheels, which can both soak up energy when required and dispatch it as part of Virtual Power Plants when required if the infrastructure is put in place and models with Vehicle-To-Grid capability are incentivised, particularly at workplaces.

Significant hurdles present themselves in Australia which need to be overcome. Fossil fuel industries are heavily subsidised and lightly taxed, which is the energy equivalent of subsidising alcohol and tobacco but underfunding healthcare. Whatever is incentivised will be what the market adopts, which is why the adoption of Electric Vehicles in Australia is far behind the rest of the developed world and therefore we do not have them to absorb the Solar PV production during daylight hours. To illustrate the issue, my Electric Vehicle was originally purchased by its first owner in NSW in 2015, who paid approximately $45,000 in Stamp Duty, Luxury Car Tax and Local Fees. I then purchased it from him in 2017 and imported it to WA, having to pay an additional ~$10K in Stamp Duty, Taxes and Local Fees. Very few people are going to be able to afford to do the right thing and stop burning fossil fuels when our taxes are used to subsidise fossil fuels and penalise the clean alternatives. In addition, yearly Registration in WA is based on vehicle weight, not emissions, meaning I pay the same amount as an equivalently weighted vehicle despite producing far less emissions. EV drivers subsidise those who burn fossil fuels.

Potential:

If we rapidly transition to Battery Storage in both stationary and moving forms we can protect our power grids, reduce infrastructure costs, reduce the risk of exponential climate change, reduce the breathing of pollutants, dramatically increase our energy independence, create new battery mineral mining and processing industries, restore our vehicle manufacturing industry and create new markets for export. We are once again the Lucky Country when it comes to the resources of the modern era – effectively limitless sunshine, wind and battery materials with a well-developed mining industry. We have everything we need to transition to the new economy that is emerging.

Over the past year I have spent approximately $40,000 converting our existing home completely away from all fossil fuels, including for the car. I have earned this money by working in our Iron Ore industry which has a bright future extracting the minerals we need to produce Electric Vehicles, Heat Pumps, Induction Hobs, Solar Panels, Inverters and everything else we need to transition completely away from fossil fuels. Mining too must go completely Electric, as must all industries, but Mining in Australia has an even brighter future aside from fossil fuel extraction. Below are some pictures of the equipment installed and working providing us with electricity, heating, cooling, hot water, cooking and car charging:

Figure 4 - Solar PV - 1.5kW facing East, 1.8kW facing North, 3.3kW facing West

Figure 5 - Tesla Powerwall (13.5kWh usable storage) and SolarEdge combined 5kW Inverter/Car Charger

Figure 6 - 2015 Tesla Model S 85kWh. 386kW/518bhp. 400km range. Frequent software updates bring new features.

Figure 7 - SolarEdge 5kW inverter charging 85kWh Tesla

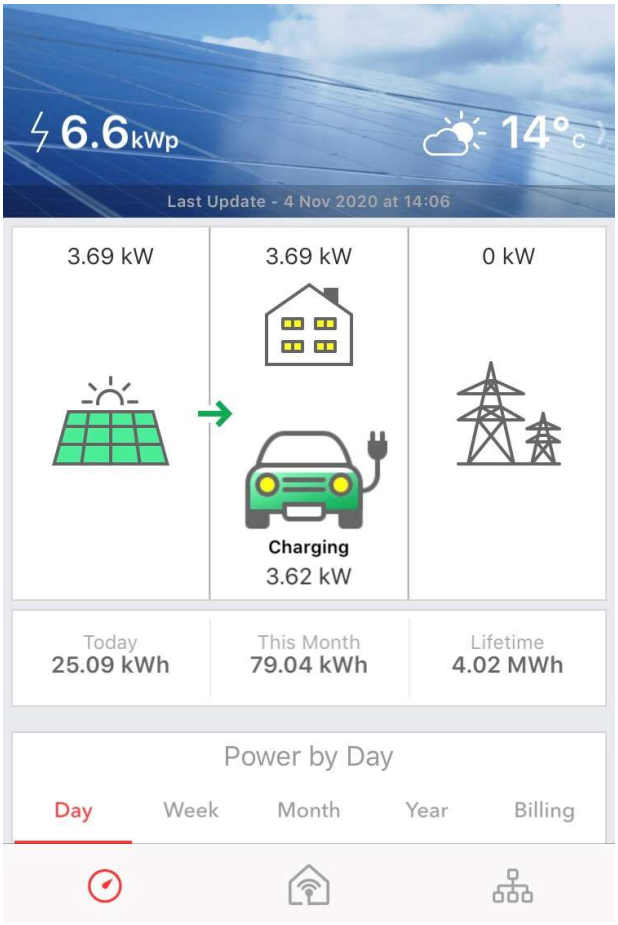


Figure 8 - SolarEdge 5kW inverter - Excess Solar Power charging

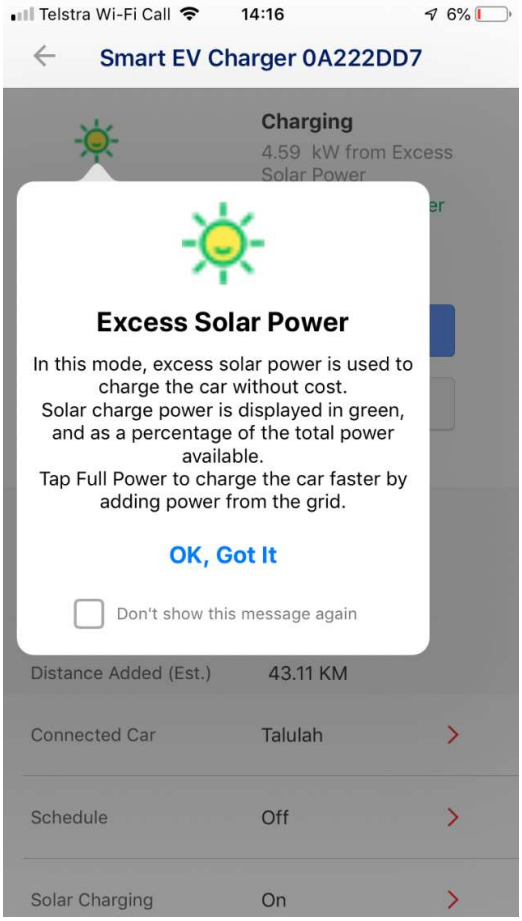


Figure 9 - Air Source Heat Pump for hot water

Figure 10 - Heat Pump powered by Solar PV

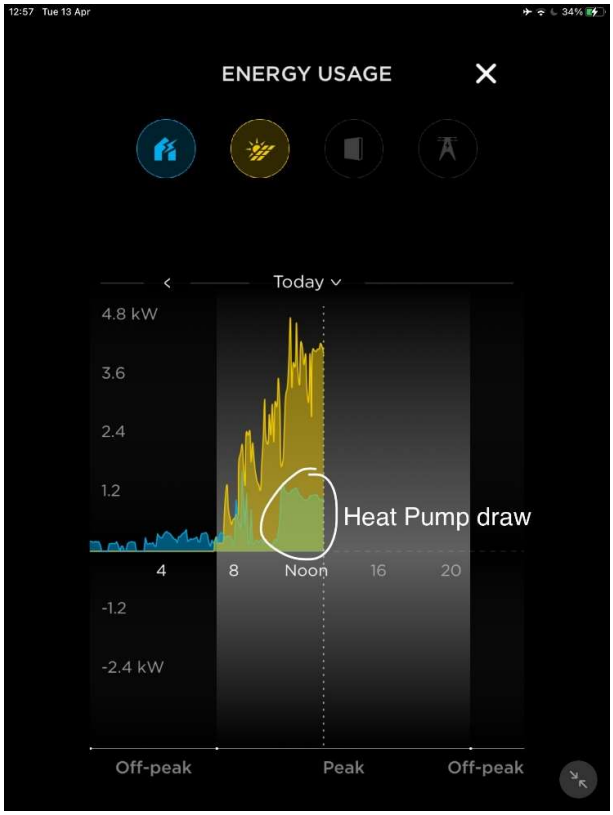


Figure 11 - Electric cooking - Electric ovens and Electric Induction Hob

Figure 12 - Energy efficient split cycle air conditioning in every room

Figure 13 - Efficient LED lighting throughout

Figure 14 - Battery events providing uninterrupted power

Figure 15 - Illustration of dynamic power flow

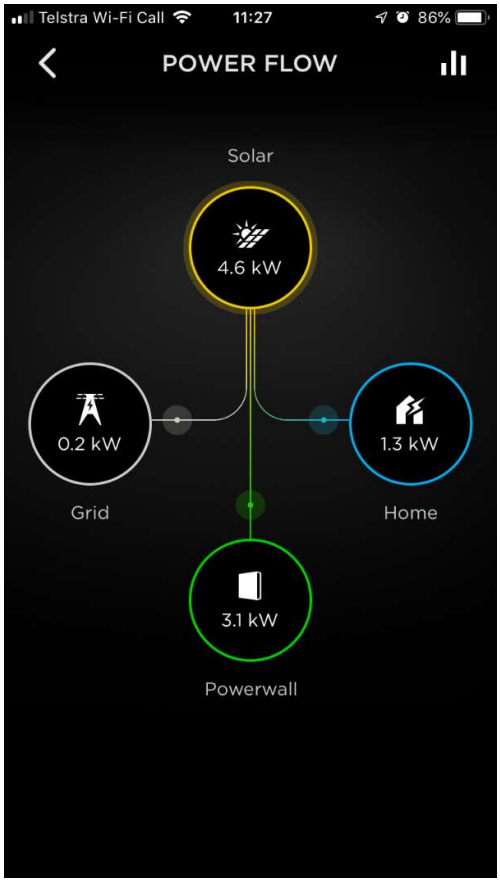


Figure 16 - Most recent Synergy bill. $65 for two months including fuel for the car. Battery storage reduces Peak demand (3pm to 9pm) to almost zero, reducing stress on electricity grid. Additional battery storage would further reduce need to import Off-Peak power.

Supply period: 20 Jan 2021 - 26 Mar 2021	**Units imported (kWh)**	**Units exported (kWh)**
Off-peak	^254.8140	
On-peak	^0.6490	
Weekday shoulder	^0.5260	
Weekend shoulder	^0.2570	
Net Export Peak		259.0340
Net Export Off Peak		331.5090

^Your current meter reading includes partial estimated interval data provided by the Network Operator.

†Your interval meter data is available online. Visit synergy.net.au/myaccount to login or register.

New charges

Synergy Smart Home Plan **Charge period:** 20 Jan 2021 - 26 Mar 2021	**Units**	**Unit of measure**	**Unit price (cents)**	**Amount**
On peak	0.6490	kWh	49.8311	$0.32
Off peak	254.8140	kWh	13.7275	$34.98
Weekday shoulder	0.5260	kWh	26.0978	$0.14
Weekend shoulder	0.2570	kWh	26.0978	$0.07
Supply charge	66	days	93.9330	$62.00
*Renewable Energy Buyback Amount	590.5430	kWh	7.1350	$42.14cr
Plus GST @ 10.00%				$9.75
Total new charges				**$65.12**

As can be seen from the above Synergy bill, our domestic battery storage almost entirely eliminates the time of peak stress on the electricity grid and shifts any remaining demand to overnight when demand is greatly reduced and peak capacity is not a limiting factor. This reduces the need for infrastructure upgrades, reducing cost. Using excess Solar PV to 'fuel' the car and heat water also reduces the peak Solar PV export, and shifts what excess remains to the latter part of the day. Incentivising consumers and industry with compelling tariffs such as 3c/kWh between 10am and 3pm would also dramatically shift usage to those times of peak Solar production, as would incentivising Desalination plants and Electric Vehicle fast charging between those times.

Conclusion:

What I have done on a small scale is a model that can be scaled up to encompass entire grids. For more power, add more Renewable generation. For more rapidly dispatchable power, add more Batteries. Renewable power generation is now the cheapest form of energy humans have ever had access to, what is lacking are the batteries to store it and the Electric Vehicles to use it. Australia has the potential to become a Renewable Energy and Battery Storage Superpower with completely independent power generation and transport. By removing fossil fuel subsidies, accurately taxing fossil fuels for the environmental and health damage they cause and removing inhibitive taxes from clean alternatives a level playing field can be restored. Furthermore, incentivising companies to conduct battery mineral mining, battery mineral processing and battery production on a significant scale will allow Australia's true potential to be realised. With incentives for both domestic and commercial power users to install battery storage, and further incentives for Australian mined-and-manufactured batteries and Electric Vehicles, new economies can be created. Tax the bad, subsidise the good, and the market will align.