Inquiry into Australia's Transition to a Green Energy Superpower

Attached is a submission by the undersigned relating to the matters proposed by Queensland Senator Matthew Canavan regarding the Federal Joint Standing Committee on Trade and Investment Growth. Details of this submission are intended to apply in accordance with guidance provided in

https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/Joint_Standing_Committee_on_Trade_and_Investment_Growth/GreenEnergySuperpower

Green Energy Superpower is interpreted to mean the large-scale generation of electrical power by use of solar panels, wind turbine generators or hydroelectric generators. There is probably scope for green energy systems in a minor scale such as in remote communities where transportation costs for fuels are high. However, there are serious risks in using these systems on a major scale for Australian cities. These are the matters dealt with in this submission.

It is the opinion of the undersigned that because of the risks described in this submission, no change be made to current technologies used for provision of electrical power delivery in major cities, until such time as nuclear power systems become available with acceptable lifetime costs.

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Risks With Renewable Energy

Has any city anywhere in the world of a size close to an Australian capital and its environs, replaced in entirety its fossil fuel electrical power generation with wind and solar? If so, we need full data on how they have managed to do this, the full cost, the duration taken from the commitment of funds to completion of the installation and commissioning of the new power delivery system, and how effective the new power system has become. Until this information is available, Australia should not commit to proceeding with such a new power generation system on a major city basis because there are severe risks which must be explored and managed.

In Australia there is no urgency to shut down coal and gas fuelled electrical power system but if we do, here are five very serious risks to consumers.

These risks are:

1. The ability of the system to provide reliable electrical energy.

2. The cost to consumers of electrical power delivered from renewable sources.

3. Long term environmental hazards

4. Geostrategic Security

5. Safety

Risk 1 – System Reliability

To provide electrical power when the wind and solar are insufficient to meet demand will need energy storage systems with sufficient capacity to meet the duration of the shortfall. Currently there are only three storage systems which could possibly become available. These are batteries, hydro from restorage of water in a dam and hydrogen. At present, only batteries are practical for most Australian cities although Hobart may be able to use hydro, so long as rainfall catchment forecasts can provide assurance of available back up power. Hydrogen may have some potential in the distant future but at present, solving the safety conditions of large-scale transportation, storage, and conversion of hydrogen to electrical power is little more than wishful thinking. Currently, recovery of hydrogen by electrolysis from water is very inefficient. 100MW of electrical power will give you approximately 20MW of useful hydrogen energy before transportation.

But what energy storage capacity must the pack of batteries have? Clearly, extensive daily weather history will be needed to identify periods of limited supply of wind and solar energy. This data can only be supplied by the State Bureaus of Meteorology. That history would need to extend back for the last 20 years so that the weather patterns could be captured. Do the BoMs have continuous data on daily solar radiation (not just atmospheric temperature) and wind strength over such periods? Probably not.

It will also be necessary to know how many domestic properties, community buildings and business premises must be supplied with power from the battery storage system and how much power each of these consumers will require during periods when there is low delivery from the renewable resources. But above all, it will be necessary to know how often and for how long, local areas will be without power. The current criteria used by most authorities Australia wide for service delivery of power, water, natural gas, and telephone connections is that no more than 10 minutes outage per year is acceptable. If the outage periods are longer than 10 minutes or occur frequently, many manufacturing processes will be subject to serious damage to the extent that factories may shut down or go out of business.

A further complication to controlling the delivery of electrical power within a city is the effect of power delivery from numerous and largely uncontrolled domestic and commercial solar panel systems. This will require sophisticated electronic networks within the power distribution systems to ensure proper

adjustment of controllable components. Failure to get this right will result in components of the generating systems to trip out for network safety reasons.

In addition to capturing the periods when wind and solar are below the demands of the city's electrical needs, allowance must be made for the time taken to restore the capacity of the batteries. This will occur on occasions when the wind strength is low for periods on several days. That is when the maximum risk will occur to availability of power to each city's consumers.

It will also be necessary to know the daily electrical power demand from all the consumers. That will vary from season to season. The demand data can be expressed by daily graphical curves showing the power demand hour by hour. Fortunately, these curves will be more consistent day by day than the availability of wind and solar power, but it will add an additional complication to calculating how much stored capacity the city's batteries will need to have available each day. In winter more power for heating will be required even if continued use of natural gas is permitted. But if natural gas is withdrawn because it is seen to be non-compliant with green energy criteria the demand from electrical generation will be much higher than at present, especially at night. In summer additional electrical power for air conditioning will be required. These daily demands will be reasonably predictable, but in conjunction with the forecast weather conditions all this information will have to be used to calculate required storage battery capacity.

One way of limiting the required capacity of back up batteries is to instal additional gas turbine driven generators. They will vary considerably in their required electrical energy delivery capacity.

Whatever wind and solar generating capacity is installed for limited term use, it must make allowance for future growth. Where will the power come from for future electric vehicles, both domestic (electric cars) and commercial (trucks and trains)? And how much growth will there be in business demand, service industries and in population growth? A lot of guess work required here but some provision must be made.

But if we get the battery capacity wrong, we will have frequent blackouts and very angry consumers and voters.

Risk 2 – Cost

At present, the costs to consumers across the world, of electrical power which is generated by renewable systems has proven to be much higher than existing systems such as fossil fuelled steam turbines, gas turbines, hydro power and nuclear. For example, the two countries in Europe which are most converted to renewables are Denmark and Germany. They have the most expensive electricity. France with predominantly nuclear and Norway with hydro, have the lowest electrical costs. Part of the problem with renewables is the wide daily variations in available electricity which produces equally wide variations in the daily prices charged by the power distribution companies. Unless there are very large electrical power storage systems available, which means having very large and expensive batteries, this situation will continue.

In Australia, the state with the greatest proportion of renewable energy powered electricity is South Australia. South Australia has the highest Australian electricity costs.

While construction of solar systems equipment has a relatively modest cost, the land space needed to instal them is extremely large, measured by multitudes of square kilometres. And the cost of suitable land can be very high, especially if it is close to the city.

Wind farms also occupy a lot of space. It will not be acceptable to consumers to have multiple wind turbines close to homes, schools, sporting venues and entertainment areas or even businesses. If this means the wind farms are remote from the city there will also be a significant loss of electrical transmission efficiency due to the inherent energy losses from long transmission lines. This may amount to a considerable additional operating cost. The transmission losses could be reduced by installing the wind turbines in the ocean if that results in the turbine farms being closer to the city. However, they may not be too close to city coastlines or beaches because they will be visually distasteful to nearby residents, beach goers and tourists and may provide navigational hazards. Ocean installation, maintenance and inspection of wind turbines is more expensive than land-based systems.

If natural gas is discontinued as an energy source, current appliances will need to be replaced with electrical appliances. It is not clear what modelling has been done as we replace hot water systems, oven cooktops and gas heating. Two of these will have a significant impact on the evening peak demand

(heating and cook tops) due to their inherent large demand around mealtimes. The impact on electrical networks needs to be considered both from electrical demand and distributed system capacity (both substation and network capacity).

Risk 3 – Environmental Hazards

With new fossil fuel power stations or nuclear-powered stations, one can expect that they can remain serviceable for up to 60 years. Not so for wind and solar, or for batteries. The maximum one can expect for each of these components is a 20-to-25-year life. Worse, there is an issue removing old wind turbines, solar panels, and battery modules. In each case there are many environmental problems with disposal of these items. They cannot be economically recycled and finding a safe place to dispose of the scrap will not be self-evident. Each item contains some toxic materials such as lead, copper, cadmium, cobalt, and indium. Windmill blades are largely glass or carbon reinforced polymers which are not recyclable. Nobody in the world has yet had to deal with all of these on a large scale so there is very little experience to draw on. Soon, large numbers of domestic solar panels are going to have to be replaced as they wear out.

Risk 4 – Geostrategic Security

At present and for the foreseeable future, by far the greatest proportion of world-wide manufacture and export of solar panels and wind turbines comes from China. Australia does not have ideal trade relations with China and if international demand for renewable energy devices increases, Australia may have difficulty in obtaining a share of such equipment when needed. If trade relations deteriorate further, Australia could be in serious trouble.

The situation could get much worse if the rest of the world starts building large solar and wind systems with batteries. Currently, battery systems use very large amounts of lithium, nickel, and cobalt. Worldwide there will not be enough of these metals to supply demand.

Risk 5 – Safety

As described within Risk 1 above, there is considerable likelihood of frequent power blackouts under the renewable energy scenario. This is a very complex matter, but it is not difficult to see safety hazards emerging when the lights and power go out without warning. For example, interruption to electrical power required for heating in cold weather or cooling when the weather is hot, will put at risk the health and welfare of much of the populace, especially the elderly and the infirm. If loss of electrical power occurs frequently there will be a lot of angry consumers and very concerned voters. Another difficulty will be coping with loss of refrigeration which will result in damage to many foodstuffs. That may well put food supply at risk but also severely impact businesses. This has been demonstrated during repeated South Australia outages where the spoilage and loss of refrigerated goods ultimately closed businesses.

What is abundantly clear is that if a roadmap exists to manage the transition to deal with all these issues it is not being discussed openly, either with the public or with senior engineers and executives in the power generation and electrical distribution industry. Experience has shown us that in WA during August this year alone there were 3+ days when neither the sun shone nor did the wind blow, and all non-renewable assets (gas and coal) were struggling to make up the deficit.