



Submission to:
Senate Committee on
Preparedness for extreme weather events
Parliament House
Canberra ACT 2600
Australia

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16 January 2013
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ATTN: Senate Committee Members

Introduction

The World Bank (no less) released a report recently titled; Turn Down the Heat. In which it claimed that the world was on track for a 4°C rise in average earth temperature by 2100 however could rise by that much by 2060. In my limited understanding of the science should we get an average earth temperature increase of 4°C most of the world's 7 billion peoples will die. Leaving less than 1 million people on the planet fighting over whatever resources are left. This will be due to the earth's ecosystems and peoples not being able to adapt at the speed in which the earth's temperature will increase hence causing them to collapse.

Today's 7 billion world population is completely dependent on the planet ecosystems. Australia is no different to the rest of the world and is totally dependent on those ecosystems. So what services does nature provide to humans for FREE if any.

- Climate regulation
- Clean drinking water
- air quality regulation
- erosion regulation
- water regulation
- water purification and waste treatment
- disease regulation
- pest regulation
- pollination
- pollution and natural hazard regulation
- photosynthesis (oxygen)
- soil formation
- primary production
- nutrient cycling
- water cycling
- genetic resources
- medicines and biochemical
- food and fibre
- fuel
- knowledge systems
- education values
- cultural diversity
- AND INSPIRATION



I don't know about you but there was a few of my favorite things in that list.
Like clean water, oxygen and food.

Adding carbon dioxide into the atmosphere is causing more extreme weather events however the Carbon cycle is only one of 5 main cycles that Australia's eco systems and population are totally dependent on. The others are

- The Water cycle
- The Nitrogen cycle
- The Sulphur cycle
- The Phosphorus cycle

All these cycles are in decline around the world including Australia. The great cycles along with the energy flow from the sun are the backbone of the ecosystem processes that keep the planet in a habitable condition for life to exist. Due to mans exploration of the planets resources and his willful contempt for the natural world he has unbalanced the world's life support systems causing more and more extreme weather events year on year.

ALL AUSTRALIANS ARE TOTALLY DEPENDENT ON NATURE.

If you don't understand this you soon will.

(a) recent trends on the frequency of extreme weather events, including but not limited to drought, bushfires, heatwaves, floods and storm surges;

In 1980 the people of Saibai island built a sea wall to keep out increasingly high storm surges. Saibai island is one of 6 islands that are Australian territories in the Torres Straits that had been pleading with state and federal governments to provide funding to build seawalls to stop the islands being washed into the sea. To date there has been no action. These islands are Australian territories and the people that live on these islands are Australian citizens. Yet we treat them like they are from South Pacific. More frequent El Niño events are believed to be associated with global warming. Each El Niño event has resulted in water shortages and drought in Papua New Guinea, Marshall Islands, Federated States of Micronesia, American Samoa, Samoa, Tonga, Kiribati and Fiji. More frequent El Niño events also bring an increased risk of tropical cyclones and diseases, particularly for Tuvalu, Samoa, Tonga, Cook Islands and French Polynesia however Australia will also be impacted from the spread of disease and cyclones. In May 2009 the people of the Carteret Island forced to evacuate their island due to increasing storm surges and sealevel rise. In October 2011 Australia let the small island of Nukulaelae get down to 60 liters of fresh water between 330 people and did nothing. The New Zealand government had to step in and supply a portable Desal unit. Tuvalu and Tokelau ran out of fresh water. In March 2012 Kiribati is negotiating with the Fiji to move their entire population of 110,000 people to the small island nation. If we cannot treat the people of our own nation with dignity and respect then the people of the South Pacific should not look too Australia of the leadership on climate change or extreme weather events. With extreme weather events increasing in frequency we should expect not only more impacts of these events at home we should also expect impacts from our neighbors as well.



(b) based on global warming scenarios outlined by the Intergovernmental Panel on Climate Change and the Commonwealth Scientific and Industrial Research Organisation of 1 to 5 degrees by 2070:

17 out of the last 18 years have been record man made CO₂ emissions on earth. The exception is 2009 after the GFC however we recovered. At the current rate of increase we should hit 450ppm of CO₂ in the atmosphere in 12-14 years. 450ppm will represent an average earth temperature increase of 2°C which will represent a 30% species extinction and an increase in extreme weather events. One possible event is the collapse of the coral triangle in the next 5 to 10 years due to increasing tropical water temperature, ocean acidification and man made ocean pollution. 110 million people in our region depend on this eco system for food, water and their lively hood. Australia should expect to see an increase in numbers of climate refugees in 5 years or after the collapse of the coral triangle.

By 2020 Australia's food production should be starting to decrease due to more running days of over 40°C heatwaves. (Alice Springs just had 15 days in a row of over 40°C). While Australia should be actively identifying under ground water aquifers that we can store water in for these longer periods of drought and higher temperatures, we are currently engaged in an act of willful destruction and vandalism of our underground water aquifers that will be needed for food production in the near future. Coal seam gas extraction will not only destroy our existing underground aquifers for up to 1000 years but will also degrade our existing farmland, creeks, and river systems for short-term monetary gain most of which will go overseas to overseas investors. (This is an act of treason by our governments).

450ppm of carbon dioxide in the atmosphere is a possible point of irreversible climate change.

That means enough ecosystems will have collapsed and positive feedback loops in the earth's climate system will have kicked in taking the climate system beyond human control. The planet will continue to warm on its own after that and not a thing can be done by humans to stop it.

With a 3°C rise Australia may be able to adapt and support a population of 1 to 2,000,000 people. However millions of people from overseas countries will start to head towards Australia and we will use up the rest of our resources and food either taking them in or fending them off. Pakistan, India and China will descend into war over food and water by 2030. Southeast Asia will descend into anarchy by 2030.

With a 4°C rise Australia will be uninhabitable due to the collapse of ecosystems to provide services needed for human survival. This includes Tasmania.

With a 5°C rise in Australia don't worry about it you won't be here and neither will your children.

(ii) the costs of extreme weather events and impacts on natural ecosystems, social and economic infrastructure and human health, and (iii) the availability and affordability of private insurance, impacts on availability and affordability under different global warming scenarios, and regional social and economic impacts;

The cost of extreme weather events are already impacting just ask any insurance company. With the deregulation of the insurance market insurance companies have inserted causes in the small print of their contracts which allow them to get out of paying insurance claims. I expect this will continue into the future and so I expect that the Australian taxpayer will be left with the bill while the insurance industry will reap millions in profits. Climate change will provide the excuse for unreasonable increase the cost of insurance. Profiteering and cheating on claims will become the norm if it is not already.

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Roads, Rail and the Electricity grid will fail with more frequent running days over 40°C. I have added below the expected impacts in my local town Parramatta below.

(c) an assessment of the preparedness of key sectors for extreme weather events, including major infrastructure (electricity, water, transport, telecommunications), health, construction and property, and agriculture and forestry;

I suspect these reports and studies have already been done but have not been acted on. le: Saibai Island

(d) an assessment of the preparedness and the adequacy of resources in the emergency services sector to prevent and respond to extreme weather events;

By 2020 I expect all emergency services in Australia will be overwhelmed by extreme weather events. For a number of reasons.

1st volunteer emergency workers will have to return to work or risk being sacked.

2nd lack of investment and in action by governments in order to cope with the huge demand in the future

3rd government failure make tough decisions on real action on climate change.

(e) the current roles and effectiveness of the division of responsibilities between different levels of government (federal, state and local) to manage extreme weather events;

So far local governments have been the only governments willing to act on climate change however local governments face funding problems to implement adaption recommendations as well as locally elected politicians with low IQ levels unable to understand the science of climate change. This of course is not just restricted to local government state and federal government is full of politicians with low IQ levels who have surrounded themselves with advisers and bureaucrats with equally low IQ levels.

Lobbyist in Canberra and State governments are greatest thread to action on climate change and have managed to convince governments to leave the health and well being of the Taxpayer to them.

(f) progress in developing effective national coordination of climate change response and risk management, including legislative and regulatory reform, standards and codes, taxation arrangements and economic instruments;

Their as being to date no effective national coordination to the climate crisis in Australia. It has been a complete and total failure of the Australian and State governments and politicians to carry out the oath they took when taking office. They have comprehensively failed in their duty of care to the Australian people as well as failure to comply with the constitution of Australia. By letting lobbyists, business and industry groups write taxation laws, environmental laws and the terms in which statutory bodies distribute money for renewable energy projects is a complete and total failure of state and federal governments at all levels to act on behalf of the people it represents. Indeed criminal behavior by politicians and bureaucrats alike is highly likely according to the constitution. Due to the grip that the business has over state and federal governments it is highly unlikely that any effective or co-ordinated action will be taken in the near future to protect the Australian people against the effects of climate change little lone any body else.

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It is possible to turn this around however the response would have to be immediate and wide reaching.

- Start building the concentrated solar thermal power station at Port Augusta in South Australia immediately as per the plan Repower Port Augusta by Beyond Zero Emissions
- Stop all coal seam gas operations in Australia immediately
- Stop free permits to the polluters under the carbon tax legislation immediately
- Immediately drop gas from any funding available from arena or the CEFC or any other source of public funds.
- Immediately develop a transition plan away from coal and gas for Australia and implement the Zero Carbon Australia stationary energy plan by Beyond Zero Emissions.
- Governments do not have to go cap in hand to banks for finance to build large infrastructure projects. Under the Constitution - In Section 51 – 4, 12 +13 - they already have the power to create real money with no interest - for Government projects.
- Make a national address to the people of the Australia that everybody will have to pay \$20 a week more in tax including business which should raise enough money to pay for the rollout of renewable energy over 10 years along with the carbon tax money.
- The removal of overseas offset permits from any scheme in Australia.
- Make it illegal for politicians, bureaucrats and staff members to meet with lobbyists or their staff more than once every 10 weeks.

(g) any gaps in Australia's Climate Change Adaptation Framework and the steps required for effective national coordination of climate change response and risk management; and

I have met with politicians and bureaucrats from state and federal governments as well as ministers and shadow ministers who could not tell me what the current level of CO₂ in parts per million was in the atmosphere. How can you possibly devised risk management when you don't even understand what the problem is. The time has passed to claim ignorance as a defense. The immediate rollout of large-scale renewable energy and phasing out of the fossil fuel industry as soon as possible is the 1st step in risk management. Drastic steps are required now to keep the earth in a habitable state because of you have failed to act and implement risk management for over 20 years. A complete dereliction of duty.

I think we are too far down the track for adaptation. I think a full scale roll out of renewable energy across Australia as well as immediate action on transport, land use and agriculture is required just to give ourselves a 50% chance of survival.

Plan for Parramatta.

Emergency services and infrastructure

We have to be careful with infrastructure. Most air conditioning units are only designed to an outside ambient temperature of 35°C. Most large buildings air conditioning units are designed to an outside ambient temperature of about 38°C. While these units tend to run at higher than their maximum design, 100% faith should not be put into these systems in the event of a long and sustained heat wave. They will fail especially if the power supply becomes erratic. The following is what I consider needs to be addressed in the adaptation plan.

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In the immediate future

Identify sites that have diesel generation backup power. Identify their capacity to run for long periods of time. IE 2 hours 10 hours 20 hours 36 hours. Identify where diesel may be collected to run back up power in case of an extended power outage. For instance Council fuel depot. Identify that all emergency fuel holding tanks are gravity feed. This requires no power or pumps. If this is not possible then local solar power with battery backup to run pumps. This will allow you to keep some buildings air conditioning systems running and maybe the hospital online. It will also allow emergency services to keep operating such as ambulance, SES, Fire Brigade, police, Bush Fire Brigade and some council workers.

A plan to move large numbers of elderly to hospital if required or if their A/C systems fail to buildings with backup power.

A plan for people trapped in building lifts in case of power failure.

ACTION REQUIRED NOW.

Heat waves & extreme temperatures

Projected impacts

In the event of a long and sustained heat wave it is possible that hospitals will be overrun with patients suffering from heat stroke, strokes, heart attack, dehydration, exhaustion and higher instance of personal violence. It would also be reasonable to assume that many patients will come from outside the Parramatta local government area. It is also possible that due to high temperatures transformers and/or substations could fail causing widespread blackouts. The blackouts may last for several days. Certain buildings, services and businesses should be identified as part of the adaptation plan as to whether or not they would put a strain on emergency services during extreme weather events. These places would include nursing homes, old age homes, retirement villages and hospitals. In the event of a sustained power outage during a heatwave what would be the emergency services capacity to move hundreds of elderly and frail people to hospital and where would they put them in the hospital. What if the hospitals systems had also failed because of their reliance on the power grid. Where would emergency services then move hundreds of elderly people as well as hundreds of patients from hospital too.

First step identify the places and buildings that need to keep running under this possible scenario.

Second step investigate the condition of their air-conditioning systems and find out what their maximum ambient design temperature is.

Third step developed mandatory regulation around the sites identified, to upgrade their A/C systems to higher ambient temperature design. Install a power supply system that can run for a few days off the grid. When a emergency is declared 24-hour access is given to the general public. For example to government buildings and shopping centres.



4th step work with government and business to set up so called cooling centre's.

Cogeneration or tri-generation should be the first option in preparing for possible extreme events. This is because it is a mitigation as well as adaptation strategy. An immediate investigation should be undertaken to find out what the possible effects are on the supply of gas in the event of a long sustained heat wave. If it turns out that the gas supply in a heat wave or extreme weather events is reliable. Steps should be taken to make sure that certain places have cogeneration or tri-generation, whichever is more efficient and has the minimal carbon footprint for that application. Examples of these places would be nursing homes, old age homes, retirement villages, hospitals, mental institutions, some emergency services facilities and some shopping centres. Cogeneration or tri-generation of buildings should be kept to a minimum as gas over its life cycle has the same carbon footprint as coal. It should happen in buildings only deemed essential.

The regulation below is based on the following scenario.

Long sustained heat wave. 5 - 10 days over 40°C.

Knocks out the grid power supply for unknown period of time. Large numbers of the population are without air conditioning in their own homes. Government buildings and shopping centre systems are without power. People will look to go to a place where they can cool off.

ADAPTATION ACTIONS

Cooling Centres

Large shopping centres should also be looked at for co generation or tri-generation. Regulation should be developed around these centres to make it mandatory to them to have cogeneration or tri-generation. Regulation should also extend that when an extreme weather events are deemed to be in effect, emergency powers override shopping centre management. The shopping centre halls are made available to the general public 24 hours a day until the emergency event is over. This will mean the use of the hallways in large shopping centres for people to sit down on the floor and possibly sleep over for short periods of time. Example 2 - 14 days.

There are economic advantages for large shopping centres to use co generation or tri-generation technologies, as there is an economic advantage over the existing way power is supplied. Cogeneration or tri-generation of buildings should be kept to a minimum as gas over its life cycle has the same carbon footprint as coal. It should happen in buildings only deemed essential.



Introducing energy efficiency measures and covering their car parks with solar panels will also help shopping centres adapt to fit in co generation or tri-generation technology. It will also reduce their carbon footprint. This should also cover any large council buildings that has large hall space or possibly town halls. They would also have the look at upgrading the number of toilets located in the buildings.

Risk evaluation ; Likely with major : High 2

Time frame; likely to happen after this EL nino event finishes. Next 2 – 8 years.

Is action urgent; YES

Education

Education of the local population on where to go and what to do. How to keep cool. Warned public about excessive water use.

FLOOD.

PROJECTED IMPACT

It would appear from your report that due to already existing measures the impacts of flood would be minimal. However I cannot see flash flooding. There is more likelihood in the coming years of flash flooding events. I would like the council to assess the areas that are most flood prone to flood and how they could handle a flash flood.

Hail

How will also be a problem in the future it can block drains and cause flash flooding. It is also expected that hail will increase in size in coming years.

Adaptation actions

Lessons to be learned from local councils in Brisbane from their flood events.

Inform locals that they live in a potential flood area.

Education

Educate them on where the high ground is. Run workshops on when you should move the car. how long should you stay in the house for. when you should leave.

Biodiversity

Adaptation actions

Council sets aside more money for Landcare and Bush care groups to increase their membership hence increasing the amount of bush regeneration and weed control.

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Education

Parramatta council holds public workshops and education forums in conjunction with local land care and Bush care groups.

Food shortages

Projected impact

Climate change is already having an impact on food production. It is not unreasonable to predict that wars will break out overseas in the near future over food and water. Initially this should have little effect on Australia. However climate change will impact us with drought and higher temperatures. Even GM modified crops cannot handle constant high temperature and the crops will fail. If you add lack of water to constant high temperature then it is not unreasonable to think that food supply could become erratic in the foreseeable future.

Adaptation actions

Community gardens should be encouraged by Parramatta council there are a few reasons for this.

First; due to possible huge food shortages in the future encouraging local community groups to grow their own food could help alleviate this problem should it arise.

Second; if food shortages are a reality and the price of food goes up. Community gardens can be a supply of cheap food to those who cannot afford high food prices in the community.

Thirdly; it teaches a large number of people within the Parramatta local council area to grow their own food. This knowledge can be useful in future should a food crisis becomes a reality.

Fourth; community gardens have a good social impact on the community.

Parramatta council should also identify what parks are close to water supplies in the local area that can be used to grow food if need be. Like dams and weir's. (Parramatta Lake) In the unlikely event that Parramatta council has to grow their own food for the local population. Regulation around those parks should be made so they cannot be sold for development. Assessment of soil quality and ability to grow food in those areas and what needs to be done to bring those levels up to standard.

What type of food.

If areas around Parramatta's Park's have been identified to grow food. That food should be the most suitable and productive for that soil type to grow on. It should not be based on what we want or what we want to eat.

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Risk evaluation ; Likely with major : High 2

Time frame; likely to happen after this EL nino event finishes. Next 2 – 8 years.

Is action urgent; YES

Accelerated deterioration of assets

Adaptation actions

Upgrade existing buildings to at least six star rating

New development should be set to a high building code as to minimize the impacts of climate change.

Planning and design uncertainty

Projected impacts

Unshaded roads and footpath is in high-temperature events helped to keep the temperature high especially at night time. . I just watched a school get a footpath all the way around it so the poor dear's didn't get their feet dirty. The hard surfaces do not absorb water and help with flooding. The unshaded surfaces readmit the heat they absorb during the day at nighttime.

Adaptation actions

No unnecessary building of a new footpath is in suburban streets.

Road design where possible should be made so the median strip in the middle is wide enough for trees to grow. With tree-lined roads this can reduce the amount of heat re- emitted at night time in a local area.

All rooftop car park is should be covered with solar panels. This stops the concrete from heating up and keeping the local area hot at night time. It also allows for a passive income to the owners of the car parks.

Water supply shortages

Projected impacts

Could have a major impact on parkland and later on your ability to grow your own food.

Adaptation actions

Identifying areas where storm water can be siphoned off after rain and stored with minimum impact on the environment



Look at raising some dam and weir levels, subject to environmental impact studies.

Look at installing some small weirs or dams to capture storm water subject to environmental impact studies

Increase the minimum size of rainwater tanks on any new housing. Encourage people to install rainwater tanks if they have already not got them on their house.

Bushfire danger

Projected impact

No doubt at some stage in the future some of the bushland in the local Parramatta area will dry out enough and a bushfire may start.

Adaptation actions

Parramatta council should seek the advice of experienced people in the bush fire brigade on the risk to housing that Borders bushland within the local government area.

Organise a meeting between the Fire Brigade SES police and the Bush Fire Brigade to draw up a plan on how major bushfire would be handled in the Parramatta area. Should a bushfire occur I imagine it would look something like this Bush Fire Brigade goes in to put fire out. The SES handles emergency calls. Police direct traffic away from the affected area. Local Fire Brigades put out spot fires in urban areas as the hot ash and embers falls.

(h) any related matter.

Develop and implementation plan for the establishment of Concentrated Solar Thermal Power Station with Molten Salt Storage at Port Augusta South Australia

The CEFC became legislation in order to provide funds for the building of Large Scale renewable energy projects, reduce Australia's greenhouse gas emissions and to find ways of funding and starting a renewable energy industry in Australia. Thus the South Australian government should consider what opportunities are available to it in order to gain access to the money available from the CEFC and possibly ARENA.

Our Visionary Past

The Snowy Mountains Hydro-Electric Scheme is by far the largest engineering project ever undertaken in Australia. It is also one of the largest and most complex hydro-electric schemes in the world.

The system's construction is seen by many as a defining point in Australia's history, and an important symbol of Australia's identity as an independent, multicultural, resourceful and a country capable of delivering large engineering projects using its own talents. A Renewable Energy Supply revolution is no different to the visionary Snowy Mountains Hydro-Electric Scheme. This scheme would not have been possible if not for public funding. IT IS THE ROLE OF GOVERNMENT



to provide funds to enable the necessary infrastructure to be built when that infrastructure is too expensive or difficult for private enterprise to build.

Our Future vision

A renewable energy revolution in South Australia will be seen by the rest of the world as a state of Australia that is courageous, capable and industrious. A good and reliable place to invest in with a CAN DO attitude. Port Augusta already been slated in the Zero Carbon Australia stationary energy plan as a 3500 MW energy hub as the major link between Eastern and the western seaboard. This would be an extremely important link in Australia's renewable energy future. South Australia's future vision should be based on current local and international events happening today. The future vision should be based on long-term prosperity for all South Australian people, impacts on people's health, impacts on the environment that provides the services we need for survival and latest climate change science.

Under current policy settings, South Australia has already meet it's own 20% Renewable Energy Target for State based renewable energy, four years ahead of schedule. This is an outstanding effort for which the SA Government's leading role is recognised. 450ppm commends South Australia for its vision and courage. The following briefing paper sets out how South Australia can continue to be a world leader in the implementation and integration of renewable energy. This paper outlines how the government can build the first 300 MW of concentrated solar thermal power (CST) with dispatchable storage, which will open the door to private enterprise to build the remaining 3200MW. Building 300 MW of concentrated solar thermal with storage will complement the existing wind generation assets enabling a constant renewable generation supply profile to South Australia. The State may also gain from the tourism industry surrounding the exciting roll out of concentrated solar thermal power technology. In a dynamic and changing industry that is affecting more and more people locally and nationally, early adoption of CST technology will attract people from all over Australia as well from all over South East Asia, China and New Zealand. If done correctly this could not only make South Australia the world leader in renewable energy it also has the potential of bringing significant capital investment and tourism input to South Australia as well as exporting our expertise into Asia.

Building more coal/gas fired power generation will leave South Australia vulnerable to significant increases in electricity costs due to higher prices for coal and gas, and uncertainty in fuel costs as Australian markets align with international prices.

This document is complimentary to the *"Replacing Northern & Playford B Power Stations with Renewable Energy"* document produced by BZE before the announcement on the Clean Energy Finance Corporation. In that document 760MW of brown coal power would be replaced with CST with molten salt storage or a mixture of both wind and CST+. This would be financed by a mix of grants, feed in tariff and other financial mechanism's. This paper will look at the CEFC and opportunities available to the South Australian State [Government](#).

ZCA2020 provides a bold and visionary strategy to stabilise Australia's clean energy future by making significant investments in renewable energy technology over the next ten years, while ensuring a stable and reliable electricity power supply now and into the future. This proposal has been specifically developed for SA based on the detailed research. However, while it is far more modest in its aspirations than ZCA2020, it does provide the SA Government with a platform from *450ppm is an environmental group dedicated to the education of the general public on all global warming issues. In raising awareness of the growing climate emergency, 450ppm endeavours to bridge the gap between scientific facts and common misconceptions and misinformation.*



which it can subsequently build a more ambitious renewable energy plan for the State should it decide to do so in Port Augusta.

*The following proposal to construct 300 MW of baseload solar thermal for SA will complement existing generating capacity in the State, and instead of compounding grid stability and supply profile issues will alleviate them as solar thermal is complimentary to wind generation. **Successful implementation of this proposal poses no threat to actual or projected government revenue from coal mining or gas extraction.***

The Australian Government's progress with implementing the Clean Energy Legislation and complementary policy measures will support the ability of the SA Government to access funding for the construction of the first large-scale solar thermal power stations in the State through the proposed Clean Energy Finance Corporation. Were the SA Government to implement such a strategy, it would provide the foundations for a new high-tech industry with enormous export potential, while sending a strong signal to investors and the electorate of its commitment to lead SA's and Australia's renewable energy industry. Proactive investment in this game-changing technology will also help drive down the costs of construction, thereby minimising the long-term costs of implementation, and a platform from which to build energy security for the people and businesses of SA over the next few decades.

The history of technological development clearly indicates that those countries and/or regions that are early adopters of new technology tend to be the ones that benefit the most (the so-called 'first mover advantage'). Other jurisdictions in Europe, India, China, Middle East and North America continue to set increasingly ambitious renewable portfolio standards which they consistently achieve before the target year. In addition to meeting their carbon emission reduction obligations, policy makers in these jurisdictions realise that ambitious renewable energy targets generate distinct economic advantages in the medium- to long-term. According to Deutsche Bank, those countries with more transparency, longevity and certainty in their climate policy frameworks are attracting the kinds of investment that will enable them to build new clean-tech jobs and industries far more rapidly than their policy-lagging counterparts.¹ For example, the province of Ontario in Canada is currently on track to shut down all its coal-fired power capacity by 2014 (around 6,400 MW). The province plans to generate a total of 10,700 MW from wind, solar and biomass conversion of coal-fired power plants by 2018: enough electricity for 2 million households.

Zero Carbon Australia 2020 Stationary Energy Plan

In June 2010, the independent, not-for-profit research and education organization, Beyond Zero Emissions (BZE), together with the University of Melbourne's Energy Research Institute, released the *Zero Carbon Australia 2020 Stationary Energy Plan (ZCA2020)*. It provides a detailed blueprint for how Australia can make the transition to 100% renewable energy within 10 years, using our existing labour force, natural resources and technical expertise, drawing on technology that is already commercially available.

¹ "This is particularly evident in countries such as Germany and China, who have emerged as global leaders in low carbon technologies and investment in recent years. In stark contrast, a politically divided US Congress and vast budget deficit has resulted in very little significant regulation at the Federal level, with substantial implications for emerging clean technology industries in the US." See Giles Parkinson, 'A cut above', *Climate Spectator*, 29 July 2011: <http://www.climatespectator.com.au/commentary/cut-above>



ZCA2020 has had no government or private enterprise funding and has been created by professional engineers and scientists working *pro bono*. It clearly demonstrates that there are no technical barriers to a ten-year 100% renewable energy transition in Australia.

The political stability, size and climatic diversity of the Australian continent provide ideal conditions for renewable energy generation and the exploitation of its geographically dispersed wind and solar resources. In order to optimise the availability of those resources and to fully utilise the distributed nature of the power generated, ZCA2020 requires a comprehensive upgrade to Australia's transmission infrastructure. This involves creating a national grid linking the Western Australian to the eastern grid, using high-voltage DC and AC links similar to those already in use in various parts of the eastern grid. High voltage DC lines reduce energy losses through transmission to 3.5% to 6.6% per 1,000 km and allow the efficient exploitation of a 2-hour daylight difference between the east and west coasts of the continent.

The forecast demand of ZCA2020 is 40% greater than current demand. This allows for a switch to electrified transport and heating, as well as a 33% per capita gain in efficiency for current services.

A strategic blend: wind and solar thermal

Wind power is a mature technology with well-understood characteristics whose costs have fallen dramatically in recent years as the amount of installed capacity worldwide has grown exponentially. In the United States and Europe, the cost per kilowatt hour for electricity generated by wind power is either close to parity, or at parity, with the cost of new build coal- and gas-fired electricity. Actual growth in installed capacity continues to outstrip forecasts.

SA has a total of 1,150MW² of wind generation assets in the state, with several more identified by AEMO in various stages of planning. The wind generation industry is experienced in South Australia and has contributed significantly to the local economy.

Concentrated solar thermal with molten salt storage ("CST+") is an ideal complementary technology to wind power that is predicted to achieve construction cost parity with new build coal- and gas-fired power stations within the next five years. The heat storage medium accumulates surplus energy at 95% conversion efficiency, enabling it to continuously generate electricity for 24 hours. The plants can operate at 60-100% of maximum turbine output for up to 90% of the year, with very few maintenance shutdowns. Furthermore, air cooling of the power cycle reduces water consumption to less than 12% of a conventional coal-fired power plant.

A study by AECOM demonstrates that solar thermal is the cheapest and most efficient solar technology.³ BZE's submission to the Solar Flagships program outlines why investment in large-scale photovoltaic plants is an inefficient allocation of funds given the alternative of CST+.⁴

Modeling of the wind and solar resources across Australia reveals that the peak solar resource complements the wind profile in the prime locations for the construction of CST plants and wind

² <http://www.renewablessa.sa.gov.au/files/110622-ministerial---renewable-energy-.pdf>

³ <http://www.environment.nsw.gov.au/climatechange/renewableenergy.htm>

⁴ http://beyondzeroemissions.org/sites/beyondzeroemissions.org/files/docs/BZE-Solar_Flagships-Technology_Overview_07Aug09.pdf



farms. The ability of CST+MSS to be rapidly ramped up to full generating capacity means that it is a significantly better complement to the first dispatch variability of wind power than coal-fired power stations with their long ramp-up times, and will soon provide financially viable competition with new-build gas-fired power stations.

The 'baseload' capability of CST+MSS is achieved by matching the missing complement of the electricity demand from the wind farm output. Each CST plant has additional capacity designed into the plant in order to capture 260% of the maximum power output of the steam turbine peak per day while storing 160% of that total capacity in the storage tank. The heliostat field is sized to provide the 260% heat storage on a lower-than-average insolation day to guarantee daily supply during most of the year. Storage can be matched to the total energy collected in excess of the rated turbine generating capacity during the sunny part of the day.

Torresol's 20 MW Gemasolar CST+ plant in Spain allows for 15 hours of heat storage, and several similar plants with 100 to 150 MW capacity are either under construction or have received approval in the United States. Wind and CST+MSS make a natural partnership. Wind power is cheap but intermittent. The heat collected by a CST+MSS plant can be turned into electricity immediately or stored for hours (or days) until needed.

Scenario for the development of a concentrated solar thermal industry in SA

The SA component of the ZCA2020 plan involves the construction of 6 geographically distributed wind farms (14,000MW) and 1 solar thermal region (3500MW). The solar thermal region would supply, on average, 3500 MW at maximum capacity and require significant grid upgrades. However, under the more modest scenario proposed of replacing existing capacity, it is not expected that there will be a requirement to upgrade the electricity grid due to the size of the transmission network in this region.

Under this scenario, it is proposed that four 75MW concentrated solar thermal power stations with molten salt storage be built in SA over the 6 year period from 2013 to 2019. The construction of these 75MW plants would be staggered so that the different phases of manufacture and installation can operate as a continuous roll-out, thus providing certainty for those companies involved in the program.

The proposed ramp-up time for construction of the plants is intended to enable the orderly expansion of manufacturing capacity and workforce skills within the State.

It should be noted that this proposal will only achieve 10% of the recommended output from CST+MSS in SA under ZCA2020. The final cost per unit of electricity generated is therefore higher under this proposal because the larger 220 MW plants proposed under ZCA2020 would be more cost efficient due to economies of scale. Nevertheless, were this proposal to be adopted, it would constitute the early stages of ZCA2020 and assist in developing the resources needed for the larger plant construction. Once the relevant manufacturing and construction expertise has been established, these capabilities can be expanded relatively quickly should domestic and/or international circumstances require more CST capacity to be built.

It is noted that there is a new research and demonstration concentrating solar thermal project currently underway in Whyalla which is based on new technology. The plant is intended to verify new technology in the path to commercialisation. This report is based on existing proven CST technology which has already been deployed successfully on a commercial utility scale around the world.

Cost

Based on the estimated construction cost of a comparable plant proposed by Brightsource under the Solar Flagships Program in 2009, the first 75 MW plant proposed under this plan is expected to cost \$10.60 per watt of installed capacity (or around \$795 million in total), falling as the other three plants begin construction.

It should be noted that if the technology was rolled out on a larger scale (either here in Australia or overseas), economic modelling by US energy consultants Sergeant and Lundy indicate that the cost curve is expected to drop to \$3.40 per watt after the first 8400 MW of CST of installed capacity worldwide.

Each 75 MW plant under this scenario is conservatively estimated to generate profit revenues over and above construction costs during its anticipated thirty year operating life, based on a wholesale price of electricity of 6c per kw/h.

Funding

In the absence of financial incentives such as government loan guarantees or a solar feed-in tariff, it is expected that the private sector will initially be reluctant to invest in this technology due to the high initial construction cost for the first CST+ plant. It is therefore suggested that the SA Government should commission and operate the first four 75 MW CST+ power plants, drawing approximately 80% of the funds required for construction from the Australian Government's recently announced Clean Energy Finance Corporation (CEFC) and possibly the Australian Renewable Energy Agency (ARENA).

Because SA business and people will pay the proposed carbon tax, it would not be unreasonable for the SA Government to expect that it should be able to secure \$200 to \$300 million a year from the \$1 billion that is expected to be made available annually by the CEFC to get innovative renewable energy projects up and running.

Under the financing scenario, around 27% of the annual funding available from the CEFC would be sought to help finance the four plants, for a total of \$2.43 billion between 2013 and 2022. It is also proposed that the SA Government would borrow an estimated \$660 million over nine years, or an average of \$73.3 million a year. At a total project cost of \$3.09 billion, the SA Government would be borrowing around 21% of the total project cost from outside the CEFC. It should be noted that the construction timeline can be compressed. SA government can repay the dept from revenue generated by the operating power stations.

It should be noted that the estimated total cost for the construction of the four plants is very conservative, and would most likely be significantly lower than the figure quoted as more capacity is built in Australia and worldwide. Also should the government decide to build 110MW towers the cost will reduce.



The estimated fuel cost of a 700 MW gas-fired power plant over its life is about \$15 billion if we add on a possible carbon tax bill of about \$4 billion then we see that the cost of building concentrated solar thermal at Port Augusta will eventually cause power prices to plateau as there is no import fuel cost. This in the long-term will make South Australia a very good place to do business.

Federal political environment

Although the federal opposition party has made threats to repeal the Clean Energy Legislation if they take power at the next election, BZE believe they will simply retain and rebrand it. This will be largely due to the intense international pressure on the Australian Government to do more to address climate change, as well as business sector leaders seeking certainty in the economy. It is expected that overseas governments may also consider sanctions against the Australian Government if they repeal the legislation while our international counterparts are under their own financial pressures while still investing in renewable energy that follow from their commitments to climate change. We therefore suggest that the South Australian government seek legally binding contracts before the next Federal election to get funding for at least the first two 75MW CST+ projects. These contracts will allow the South Australian Government to lock in funding ahead of the next federal election.

Commissioning process

It is envisaged that once the details of the project proposal have been finalized, initial expressions of interest (EOI) would be called for from companies with the relevant technical expertise. Those companies with relevant expertise include, but are not limited to, Abengoa Solar, BrightSource, eSolar, General Electric, Preneal, Sener, Siemens, SolarReserve, Torresol and Worley Parsons/Parsons Brinckerhoff.

Following the initial EOI process, a shortlist of these companies would then be made and those companies invited to bid for each plant through a government tender process. It is recommended that a stipulation for successful bids would be that bidders source a significant proportion of the component manufacturing and labour force for construction within the State, and that those most likely to succeed would involve joint ventures or consortia of Australian and international companies with the relevant technical expertise.

A detailed assessment would need to be made by the SA Government as to whether tenders would be requested for all four CST+ plants, or for each plant individually. The States of California, Nevada and Arizona have commissioned new solar thermal projects to be undertaken to learn from their experiences.

Existing power stations

The existing coal-fired power stations can apply to be shut down from funding provided by the federal government's Clean Energy Future plan. Expressions of interest were called on 30 September 2011.

Regional employment

Due to the geographical location of those areas in SA with high solar insolation, the people and businesses of regional SA stand to benefit greatly from the development of a solar thermal



industry in the State. It has been seen from recent wind generation projects that local industry and trade has benefited significantly from regional investment.

There are twice as many permanent jobs in the operation and maintenance of solar thermal plants than in conventional coal-fired power stations. The 20 MW Gemasolar CST+ plant recently completed in Spain generated 800 construction job-years and 45 permanent jobs in operations and maintenance.⁵ Additional employment over the longer term will be generated through grid and network upgrades throughout SA as renewable energy capacity is expanded throughout the State. Further expansion of the renewable energy industry in SA will have long-term social benefits, creating clean, healthy jobs in regional centres which will have a flow-on effect to the well-being of neighbouring smaller towns and regional economies more generally.

Regional development

An essential element of building a solar thermal renewable energy industry in SA involves skill development and retraining. Workers from a wide range of different backgrounds can be trained and retrained as specialist construction workers, component manufacturers, metal workers, welders, electricians, electrical fitters, wind and solar thermal technicians, project managers, OH&S inspectors, systems managers, software designers, civil, mechanical and electrical engineers, and many other trades and professions.

The State's regional workforce in key locations have already demonstrated that a skills shift into wind generation projects, including construction and operation, is not only possible but welcomed by communities. As most on going employment in wind farms has not replaced existing employment but built on it, it is expected that the roll out of a solar thermal industry will grow rather than displace or replace existing jobs.

Water

Water supply is a critical and controversial issue in Australia and especially in South Australia. This proposal utilises air cooled generation plant which uses significantly less water per MWh generation as existing coal fired power stations and it is recommended that an independent study is commissioned by the SA Government as part of the planning process to verify.

Risk management

The SA Government has made good progress securing a clean energy future for it's residents with the proactive local renewable energy policy implementation in the recent years. As such SA electricity prices will be more resilient to fuel price uncertainties and inflation. However, the SA electricity market faces new challenges, identified since he is as:

- managing the intermittent nature of wind generation
- the need for better information about transmission availability
- the effect on investor returns of the current soft market for Renewable Energy Certificates
- a higher price for carbon impacting on existing fossil fuel generation assets, particularly the Torrens Island Power Station which is a gas fired existing asset supplying an estimated 25% of the State's power
- inexorably rising fossil fuel prices due to the peaking of oil, coal and gas production;

⁵ http://www.nrel.gov/csp/solarpaces/project_detail.cfm/projectID=40



- the likelihood of international trade sanctions on carbon-intensive industries which are large electricity consumers;
- higher costs for building renewable energy capacity the longer such investment decisions are delayed; ie: rising cost of oil and gas
- difficulties in securing investment finance for renewable energy infrastructure projects in the medium- to long-term as the effects of climate change and peak oil substantially affect the world's economies and the availability of credit.
- international financial turmoil affects the ability of private enterprise to gain credit to build new power stations.

NSW, Queensland and Victoria continue to subsidise coal to privatized power generators. In NSW and Queensland, the extent of these subsidies was estimated in 2006-07 as somewhere in the vicinity of \$1.1 to \$1.9 billion annually.⁶ If these governments continue to follow the advice of the fossil fuel industry and the electricity generators to invest in gas-fired power as a 'transition fuel', they will undoubtedly expose themselves to pressure from generators and the mining industry to provide higher and more extensive subsidies for gas as a fuel, along with the infrastructure required to extract and transport it. It is highly recommended that the SA Government continue to define themselves as leading Australia's policy and implementation of renewable energy generation to prevent these issues locally.

Climate risks for existing electricity infrastructure include:

- water shortages for coal-fired and gas-fired power plants following extended periods and increased frequency of drought;
- the increased incidence of storm, flood and bushfire damage;
- extended periods of peak demand during heat waves and cold snaps.

Governments also face the political risk of backlash at the polls due to voter dissatisfaction at the slow pace of action on renewable energy and climate change.

By way of contrast, the primary risks associated with substantial investment in renewable energy generating capacity are:

- lobbying pressure from the fossil fuel industry, large electricity consumers, electricity generators and retailers to maintain the status quo;
- spending more on construction in the short-term on relatively new technologies such as CST+ than may be the case were such investments be delayed.

However, these latter risks can easily be offset by those they avoid.

Technical Aspects

Site choice

⁶ Chris Riedy, "Energy and transport subsidies in Australia (2007 Update)", Institute for Sustainable Futures/Greenpeace Australia Pacific, 2007, pp. vii, 13-15.



The proposed solar region for SA is Port Augusta. This proposal involves the construction of 4 x 75 MW plants on degraded, low commercial or low ecological value land. Each construction scenario has its advantages and disadvantages, and the SA Government is in the best position to develop a suitable strategy following further studies.

Port Augusta has the advantages of being part of the existing energy transmission infrastructure, having access to adequate water resources. The first step would involve identifying and purchasing an appropriate construction site at Port Augusta that is close to the grid and water. Ideally, the site chosen would be marginal farmland of low commercial and ecological value that is not prone to flooding. The chosen site would need to allow for expansion at a later date to a 3500MW solar if region.

Port Augusta would have to be accessed for manufacturing and technical expertise within their local areas. Port Augusta may have manufacturing industry base that could be retooled relatively quickly. Port Augusta should not be over looked for local employment and manufacturing and very effort should be made to include the town.

Construction and civil engineering works

The land required for a 75 MW plant is 5.5 km² and should be reasonably flat to minimise costs for civil engineering works. Four such plants co-located at the one site would require approximately 24 km².

Each solar thermal plant's 'power tower' will be between 150m and 200m in height, requiring a construction time of around 2.5 years for the first plant and 1.5 to 2 years for each subsequent plant.

The construction of these plants is far less complex than building a new coal-fired power station and primarily rely on existing and well understood technologies.

There are several large civil engineering and construction companies in SA which are capable of constructing the proposed CST plants.

Heliostats

A heliostat is a flat mirror mounted on a frame that is attached to a pedestal with a concrete foundation. Computer controlled motors drive the mirror to track the sun in two dimensions throughout the course of the day, reflecting the sun's rays onto the receiver located at the top of the solar tower. Each 75 MW CST+ plant will require approximately 9230 heliostats of 148 m² each.⁷ Each plant would have a total mirror surface area of around 1.37 million m².

Over half of the total cost of construction, most of the raw materials (i.e., concrete, steel and glass), and nearly all the land footprint of a CST+MSS plant is in the heliostat field. The layout of the heliostat field is the key to the plant's overall efficiency.

In order to generate local employment, 2 or 3 glass processing companies would be initially identified to manufacture and supply the heliostats. Future manufacturing plants could potentially

⁷ A smaller mirror would be less efficient in total cost per area of mirror, while a larger one would result in much of the reflection missing the target.

be constructed at Port Augusta, i.e., in close proximity to the proposed 75 MW plants as well as a large port facility in anticipation of future export potential. A number of engineering firms in Port Augusta and surrounding areas already carry out large engineering works for the mining industry and can be retooled to produce the steel pedestals and frames for the heliostats.

Turbines

It is recommended that standard supercritical double reheat steam turbine and generator sets be used in the proposed CST+ plants as they are currently specified for the most efficient coal plants and are commercially available today. They achieve close to maximum efficiency with over 45% thermal to electricity conversion at temperatures above 565°C. Siemens and General Electric have ten to fifteen years of international experience in manufacturing super-critical steam turbines, and would be the logical choices of manufacturer.

Molten salt storage tanks

As noted previously, molten salt is used as the energy storage medium in CST+ plants. It is a mixture of 60% sodium nitrate and 40% potassium nitrate, and has a melting point of 220°C. Molten salt has an advantage over steam, oil and other working fluids in that it can reach higher temperatures and retain its thermal stability at temperatures up to 600°C. Molten salt is recommended as an energy storage medium primarily for its low losses, low-cost, material stability, raw material availability and safety, as it is currently in common use as an agricultural fertiliser.

In a CST+ plant, the salt is stored in a 'cold' tank at around 290°C and pumped to the top of the receiver tower where it typically attains temperatures above 570°C. It is then stored in a 'hot' tank at temperatures between 565°C and 600°C.

The tank construction is similar to those found in oil refineries, with the important difference that it is heavily insulated, much like a huge thermos flask. The energy stored can be held for weeks at a time with losses averaging less than 1% of stored heat per day.

Grid access

Electranet is the transmission network operator in SA responsible for high voltage transmission. It admits new works on the basis of an economic test as a regulated asset. We recommend that the test for new infrastructure should include an assessment of the emissions that will be generated by that asset.

In many countries, transmission and distribution companies are obliged to connect renewable energy to the grid in a timely fashion. Due to the high penetration of wind projects in the state, Electranet has significant experience in the connection of renewable energy projects to the grid, which removes an obstacle, which can typically hold up projects in other areas.

A particular difficulty in funding grid access arises when a somewhat remote location is suitable for multiple wind farms and/or solar plants which may have been built by independent consortia. In such circumstances, the first project at that particular location bears the bulk of the grid connection costs. Government policy reform is required to surmount this hurdle and there have been advances in the proposal of a Scale Efficient Network Extension framework, however this has not been ratified yet. This is likely to involve co-ordination between the consortia and a degree of



risk guarantee for the grid operator. Alternatives might be to offer investors in large-scale renewable energy projects government incentives for fast tracking grid connection, waiving grid connection costs for renewable energy projects (with the cost borne by the government), or recouping those costs over the life of the plant through transmission charges.

For this reason, Port Augusta is a prime location as the typical hurdles presented above are minimised due to the large Electranet assets in the region.

Regional Tourism

Since the opening of Torresol Energy's Gemasolar CST+MSS plant there has been a large amount of interest from the public. This type of visually impressive structure, coupled with the changing energy generation environment is generating huge interest. However the owners and builders of the plant had not anticipated that there could be a tourist aspect to the plant. We suggest the SA government takes advantage of the potential tourism and integrates it into the planning of the CST+. This will help with a faster payback period to the South Australian taxpayer as well as creating ongoing jobs in the tourism industry in SA for at least five to possibly 10 years. This will benefit the whole SA tourist industry. This is a spin off to those who invest new technology first (the first mover advantage).

RECOMMENDATIONS

With respect to this proposal for the construction of four 75 MW CST+ plants in SA over the period from 2013 to 2019, it is recommended that the SA Government:

1. South Australian government to put together a business case to secure funding from the Clean Energy Finance Corporation as soon as possible.
2. Undertake negotiations with the Australian Government and Clean Energy Finance Corporation about accessing funding for such a project.
3. Begin negotiations with private sector construction and engineering firms with the relevant technical expertise to confirm the financial and resource commitments required;
4. Following completion of the above studies, endorse a plan to undertake construction of four CST+ MSS plants drawing on funds from the Clean Energy Finance Corporation and/or other low interest debt vehicles.

Liabilities

The World Bank (no less) released a report recently titled; Turn Down the Heat. In which it claimed that the world was on track for a 4°C rise in average earth temperature by 2100 however could rise by that much by 2060. This has massive implications for all South Australians in terms of water security, food production and security. This also has massive implications for businesses invested in South Australia in terms of water availability for production and a degrading environmental system to supply that water as well as health problems for its employees. It also will mean increased demand on the existing electricity infrastructure. (More and larger air conditioning systems). A 4° rise would also put into question the viability of Adelaide itself and its ability to support a large population.



The constant stream of information available on climate change as well as credible reports and warnings from credible scientists on climate change. Warnings coming from large Conservative institutions such as the International Energy Agency and the World Bank. Also recent studies into the health impacts of coal, coal dust and the fallout from burning Coal may leave the government and/or private enterprise open to future litigation and /or criminal action. It could be argued that knowingly continuing to burn Brown/black coal in areas next to or near towns, villages or cities causing the early deaths of people in those areas maybe in the future be determined as a criminal action. This would be due to the government/private enterprise failure to uphold its duty of care to the people it was elected to protect. To allow this situation to continue in Port Augusta is completely unacceptable and indefensible.

There is now an updated version of this plan at

http://media.beyondzeroemissions.org/Repowering_PortAugusta.pdf

to build 700MW's of CST.

RECOMMENDATIONS

Build renewable energy ASAP

Terry McBride
Convener of 450 ppm