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Introduction

SolarShare welcomes the opportunity to make a submission to the Climate Change Authority's first review of Australia's national caps and targets under the Clean Energy Act 2011.

SolarShare (http://www.solarshare.com.au) is community based initiative that is working towards delivering Canberra's first community owned solar farm. At the core of this initiative is a belief in the importance of building connections between people and their energy production, as a way of encouraging sustainability and addressing climate change.

We have recently crossed the threshold of 400ppm CO_2 in the atmosphere, a level likely not seen since the mid-Pliocene, 3 million years ago. Without aggressive global mitigation efforts, we are potentially heading for 4-6°C of global warming towards the end of the century, leaving an indelible climatic impact for many thousands of years.

As one of the countries most vulnerable to climate change - through our exposure to extreme weather events and also a consequence of our fossil-dependant economy - SolarShare recommends Australia take a leadership position in setting ambitious greenhouse targets and an explicit long-term trajectory. By sending a clear, unambiguous signal to the international community, we strongly believe this will prevent a race-to-the-bottom in subsequent climate negotiations and ensure a better outcome for both us and the world. For our economy, this will provide the much-needed certainty (outside the normal political cycle) that will drive investment towards those technologies and businesses that can enable a rapid transformation to occur.

In 2010, the ACT Government passed legislation for the most ambitious greenhouse targets in the country: a 40% reduction from 1990 levels by 2020 with carbon neutrality by 2060. SolarShare believes that Australia's national emissions caps and targets should also be set to levels that properly address climate change and work towards creating a more sustainable future for generations to come.

Summary of Recommendations

While deciding on Australia's CO_2 emissions targets is not an easy task, SolarShare has several recommendations:

Item	Recommendation
1	A long-term carbon budget giving at least an 80% chance of achieving a 2°C global limit on warming (with a view to strengthening this to 1.5°C)
2	Adopt an aggressive emissions reduction target of at least 35% (on 2000 levels) by 2020
3	Set a clear national trajectory to 2050 in 5-year increments, based on smooth-capped trajectories with published parameters
4	Set a goal year for carbon neutrality

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Determining a global budget

Making sharp reductions in greenhouse gases only truly makes sense when consideration is given to current and projected impacts of climate change. Some of the current observations include:

- The acceleration of sea-ice loss in the arctic (including recent reports of major cracking in the Beaufort Gyre region during the Winter refreeze)
- Increasing prevalence of "blocking" events in the polar jet-stream, leading to extreme weather events in the Northern Hemisphere
- Unprecedented fires and flooding events in Australia's recent history
- 9 out of the 10 hottest years (surface temperature) ever recorded were since the year 2000
- Ocean acidification of ~30% since pre-industrial times, due to CO_2 absorption
- The 100-fold increase in area covered by "3-sigma" extreme weather events (i.e. those that exceed 3 standard deviations from the norm) as measured from a 1951-1980 baseline.[1]
- Two Amazon "once a century" droughts within 5 years of each other (2005 and 2010)

These effects are likely to worsen, especially as we have only experienced 0.8°C warming so far, with another 0.6-1°C "committed" due to greenhouse gases already emitted.

Changes in the Arctic and beyond

The extent of sea-ice in the Arctic has seen rapid decline over the last 30 years (see Figure 1 below - thick red line)

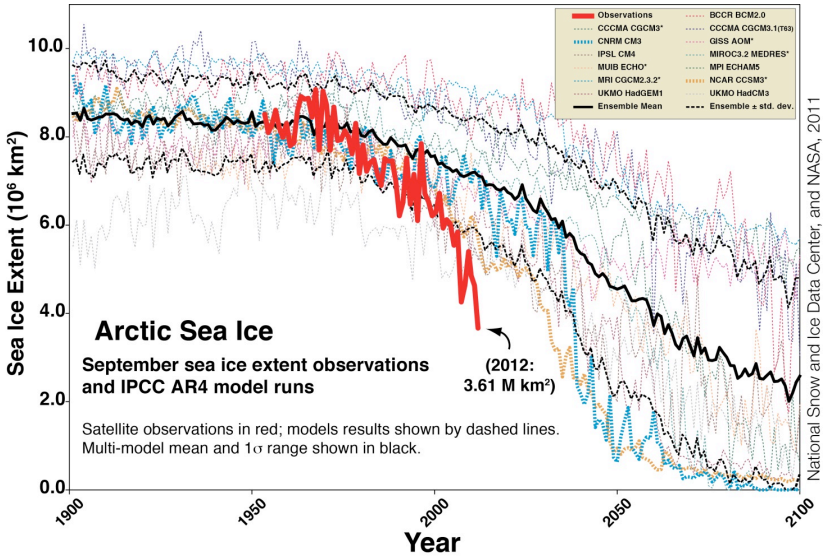

Figure 1 – Arctic sea ice observations vs models. Updated from Stroeve[2]

[1] http://blogs.nasa.gov/cm/blog/whatonearth/posts/post_1321896724591.html

[2] Stroeve, J., M. M. Holland, W. Meier, T. Scambos, and M. Serreze (2007), Arctic sea ice decline: Faster than forecast, Geophys. Res. Lett., 34,

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As seen in Figure 1, observed melting has been more dramatic than IPCC AR4 model predictions, which in all cases expected a slower decline over the course of this century. It is estimated that the volume of sea-ice has declined somewhat faster still, with now approximately 20% of the ice left, from just a few decades ago.

Although there is still disagreement amongst experts over exact timeframes, some, such as Professor Wadhams of Cambridge University, predict the Arctic to be seasonally ice-free before 2020, raising the probability of other positive feedback mechanisms occurring sooner as a result[3]:

> *"As the sea ice retreats in summer the ocean warms up (to 7°C in 2011) and this warms the seabed too. The continental shelves of the Arctic are composed of offshore permafrost, frozen sediment left over from the last ice age. As the water warms the permafrost melts and releases huge quantities of trapped methane, a very powerful greenhouse gas so this will give a big boost to global warming."*

Another effect that is not well-modelled are the observed changes to the polar jet-stream, the fast-moving "river" of air that marks the boundary between cold air to the north and warm air to the south. As the Arctic warms faster than lower latitudes, the temperature differential is decreasing, leading to alterations in the flow of the jet-stream. As Dr Jennifer Francis[4] explains:

> *"As its westerly flow weakens, the waves in its trajectory tend to take larger north-south swings. These waves control weather systems on the surface: conditions tend to be clear and dry in the part of the wave where winds blow from the northwest, and it's generally stormy where winds come from the southwest. As the waves increase in size because of Arctic amplification, they are expected to progress eastward more slowly, which means that the weather associated with those waves lasts longer in any particular location. Larger waves are also more likely to form "blocks," which are like back-eddies in a stream that tend to prevent the jet-stream waves on either side—and the weather associated with them—from moving at all."*

These so-called "blocking-events" are difficult to predict, but can have a profound effect on extreme events. Unusual blocks have been implicated as major contributing factors to several recent disasters such as Hurricane Sandy, the 2010 flooding in Pakistan and the unprecedented heatwave in Russia, also in 2010.

Towards a global carbon budget

The previous section illustrated some aspects of how current IPCC models may have severely underestimated the rate and severity of climate change impacts. A recent study also supports this, finding that new scientific findings are twenty times more likely to support the argument that climate change is more serious than previously thought, rather than less.

Raupach[5] estimates that an 80% chance of keeping within a 2°C temperature rise equates to a post-2010 cumulative global budget of 485Gt CO_2, whilst a 1.5°C limit would be ~180Gt CO_2 (i.e,

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[3] http://www.guardian.co.uk/environment/2012/sep/17/arctic-collapse-sea-ice

[4] http://www.wunderground.com/earth-day/2013/changing-face-of-mother-nature

[5] Raupach M, Harman I and Canadell J 2011, Global climate goals for temperature, concentrations, emissions and cumulative emissions, CAWCR technical report No. 042, September, Canberra.

requiring negative emissions over the long-term.) It is SolarShare's belief that the use of the precautionary principle is justified in determining the long-term global carbon budget, given the scale and nature of the possible impacts on humanity, and the risks of changing to a more stringent trajectory later.

Raupach further suggests that a high probability 2°C target is now impossible due to timeframes, but it is our view that a high level of ambition is needed, even if it is not likely to be achieved fully in practice.

SolarShare recommends the following in terms of calculating a long-term global budget:

Item	Recommendation
1	A long-term carbon budget giving at least an 80% chance of achieving a 2°C global limit on warming (with a view to strengthening this to 1.5°C)

An equitable domestic budget

Australia's national carbon budget must be based on an equitable share of the global effort. To be equitable, Australia's national carbon budget should be based on:

- An ambitious global carbon budget;
- Australia's historic contribution to global emissions;
- Population;
- Our ability to pay; and
- Australia's significant clean energy and energy efficiency resources.

In doing so, Australia will reap extra benefits in terms of technological advantage, and our potential ability to transfer skills and knowledge to other countries that may not have the resources to do so.

It is commonly assumed that ambitious carbon targets will negatively impact the economy, however, the International Energy Agency found that for every year of delay, the cost of inaction in the global energy sector alone is $500 billion of extra investment[6]. The economic case for strong and early action is clear.

The Climate Institute[7] have modelled a range of possible domestic budgets between 4 and 15Gt CO_2 based on a global carbon budget of 1500Gt CO_2 to 2050. Based on SolarShare's global budget recommendation, the lower end of this range is more in line with an equitable share for Australia. At 4 Gt CO_2 between 2010 and 2050, that translates to approximately 133 tonnes per person on a per-capita basis.

Type of carbon budget

SolarShare acknowledges the various strengths and weaknesses of using different time horizons for setting targets and trajectories in isolation. For example, a short-term target by itself does little to

[6] IEA (2009), World Energy Outlook 2009, OECD/IEA, Paris.

[7] The Climate Institute, Operating In Limits: Defining an Australian Carbon Budget, March 2013

strengthen investment certainty, whilst long-term targets by themselves are too far into the future to justify hard decisions in the short-term.

As a result, SolarShare recommends that an explicit, long-term trajectory is calculated, based on an aggressive short-term "kickstart" target and goal year for carbon neutrality. The medium to long-term trajectory should be set-out in 5-year increments to at least 2050 and based on functions similar to "smooth-capped trajectory" curves, with published parameters (such as peak year, mitigation rate etc) for transparency and verification.

Item	Recommendation
2	Adopt an aggressive emissions reduction target of at least 35% (on 2000 levels) by 2020
3	Set a clear national trajectory to 2050 in 5-year increments, based smooth-capped trajectories with published parameters
4	Set a goal year for carbon neutrality