

Natural Resources Management Plan 2015–2025

Have Your Say

Discussion paper No 6: Climate Change



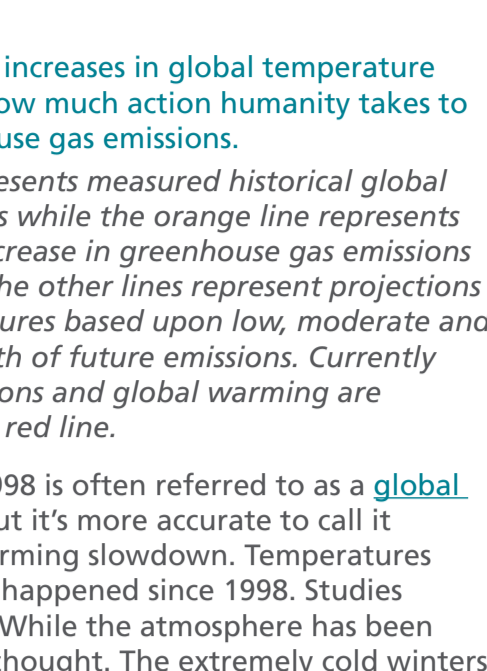
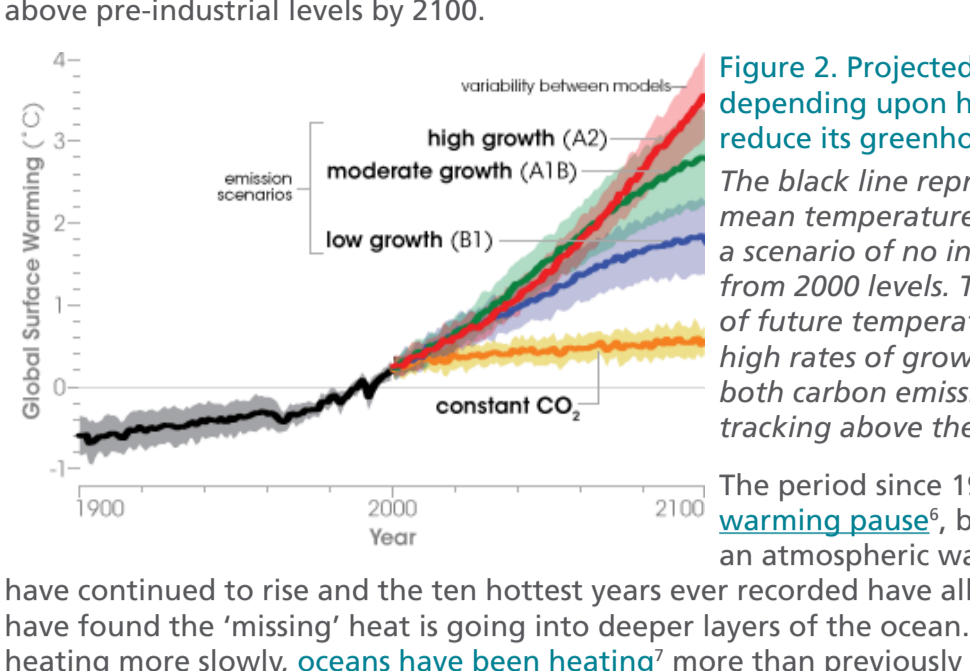
This discussion paper is part of a series covering all of the 'Big Issues' raised by the community during meetings and workshops about the new Kangaroo Island NRM Plan. It provides a summary of the current state of knowledge about the issue, suggests courses of action and identifies who might work together with us in addressing it.

We now invite your comments, suggestions, criticisms and ideas.

Introduction

Human activities, largely burning fossil fuels, cement production and land clearance, have raised atmospheric carbon dioxide (CO₂) levels from 280 parts per million to over 400 parts per million¹ in the last 150 years. Levels of other gases such as methane, nitrous oxide and chloro-fluorocarbons have also dramatically increased. The resulting greenhouse effect², predicted by scientists as far back as the mid-1800s, has seen the Earth warm at a rate unprecedented within the past 10,000 years or more. Averaged over all land and ocean surfaces, temperatures warmed roughly 0.85°C from 1880 to 2012, according to the [Intergovernmental Panel on Climate Change \(IPCC\) Summary for Policymakers](#)³, though some areas such as the Arctic, Africa and Australia have warmed faster than others.

In 2013 the [Global Carbon Project](#)⁴ released its [annual report card](#)⁵ showing global CO₂ emissions from burning fossil fuels and cement production reached a new record of 36 billion tonnes, and were predicted to have grown by a further 2.5% in 2014.



¹ <http://www.esrl.noaa.gov/gmd/ccgg/trends/global.html>

² <http://www.environment.gov.au/climate-change/climate-science/greenhouse-effect>

³ Working Group I Contribution to the IPCC Fifth Assessment Report Climate Change 2013: The Physical Science Basis Summary for Policymakers.

⁴ <http://www.globalcarbonproject.org/>

⁵ <http://www.globalcarbonproject.org/carbonbudget/>

Annual CO₂ emissions from all sources were more than 40 billion tonnes. There were about 65% more fossil fuel emissions than when international negotiations to reduce emissions and address climate change began 25 years ago. If nothing changes, global average temperatures will rise between 3.2°C and 5.4°C above pre-industrial levels by 2100.

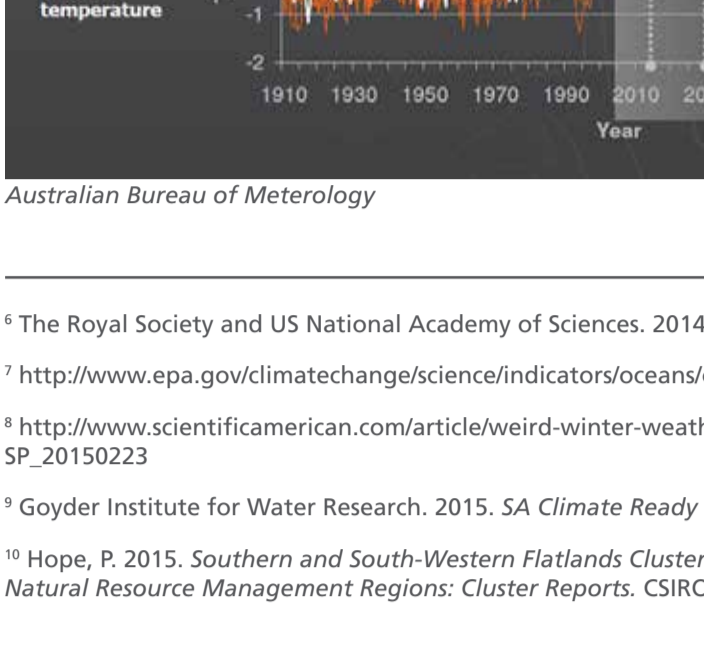


Figure 2. Projected increases in global temperature depending upon how much action humanity takes to reduce its greenhouse gas emissions.

The black line represents measured historical global mean temperatures while the orange line represents a scenario of no increase in greenhouse gas emissions from 2000 levels. The other lines represent projections of future temperatures based upon low, moderate and high rates of growth of future emissions. Currently both carbon emissions and global warming are tracking above the red line.

The period since 1998 is often referred to as a [global warming pause](#)⁶, but it's more accurate to call it an atmospheric warming slowdown⁷. Temperatures have found the 'missing' heat is going into deeper layers of the ocean. While the atmosphere has been heating more slowly, oceans have been heating⁸ more than previously thought. The extremely large sea ice experienced recently in parts of the northern hemisphere are due to rapid warming of the Arctic and resulting [changes to the polar jet stream](#)⁹.

What does this mean for Kangaroo Island?

Recent work undertaken by the Goyder Institute provides climate projections for the [KI region](#)⁹. Work undertaken by CSIRO considers the [Southern and South-Western Flatlands](#)¹⁰, of which KI is a part. They suggest that by 2100 average annual rainfall could decline by 8.2–18.8%, average annual maximum temperatures could increase by 1.5–2.8°C, and average annual minimum temperatures could increase by 1.2–2.4°C. KI is better off than many mainland areas as it is surrounded by cool seas.

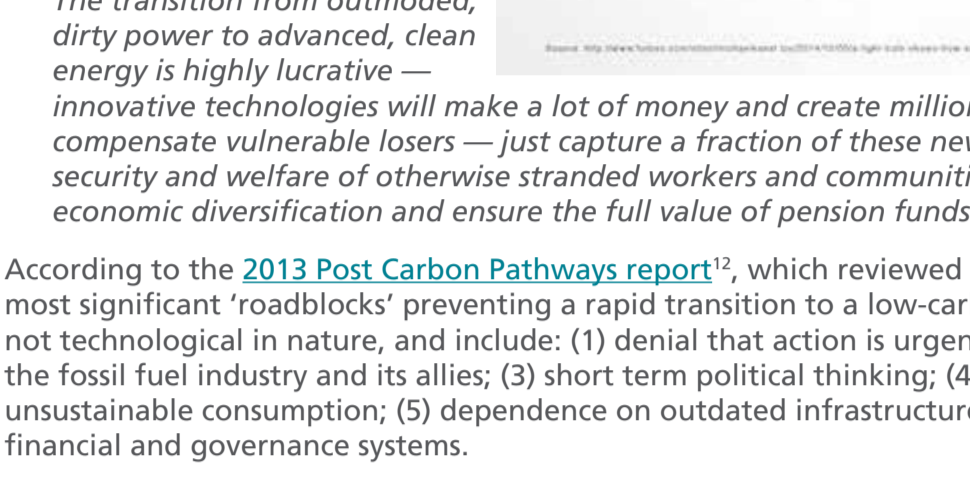


Figure 3. Projections of Australian annual temperature

What does a 2, 3 or 4 degree increase in average temperature actually mean? The graph shows projections of Australian annual temperatures for the medium emissions (RCP4.5) scenario. The white line shows temperatures to 2010 whilst the orange lines show the range of projected temperatures. The red and blue stars indicate that the unpleasantly hot weather of 2010 will become the unusually cold weather of 2080!

⁶ The Royal Society and US National Academy of Sciences. 2014. *Climate change: evidence and causes*

⁷ <http://www.epa.gov/climatechange/science/indicators/oceans/ocean-heat.html>

⁸ http://www.scientificamerican.com/article/weird-winter-weather-plot-thickens-as-arctic-swiftly-warms?WT.mc_id=SA_SP_20150223

⁹ Goyder, P. 2015. *Southern and South-Western Flatlands Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions: Cluster Reports*. CSIRO and Bureau of Meteorology, Canberra

¹⁰ Hope, P. 2015. *Southern and South-Western Flatlands Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions: Cluster Reports*. CSIRO and Bureau of Meteorology, Canberra

We have two ways in which we can respond to climate change and both are necessary if we are to avert serious environmental, economic and social damage.

Mitigation refers to actions to reduce the future magnitude and rate of climate change. Adaptation refers to measures we can take to prepare for climate change impacts.

Mitigation

The global addition to fossil fuels must end and new technologies and innovations are rapidly offering viable alternatives to the 'business as usual' approach. Ways of facilitating this transformation need to be considered and according to [Carl Pope](#)¹¹:

The transition from outmoded, dirty power to advanced, clean energy is highly lucrative — innovative technologies will make a lot of money and create millions of new jobs. Winners should compensate vulnerable losers — just capture a fraction of these new profits and we can protect the security and welfare of otherwise stranded workers and communities, provide investment capital for economic diversification and ensure the full value of pension funds.

According to the [2013 Post Carbon Pathways report](#)¹², which reviewed many international studies, the most significant 'roadblocks' preventing a rapid transition to a low-carbon economy are political and not technological in nature, and include: (1) denial that action is urgent and necessary; (2) the power of the fossil fuel industry and its allies; (3) short term political thinking; (4) unquestioning acceptance of unsustainable consumption; and (5) dependence on outdated infrastructure; and (6) entrenched and inflexible financial and governance systems.

While there remains strong resistance from vested interests to the overwhelming body of evidence on climate change, some countries are already or will be [100% renewable powered](#)¹⁴ within the next few years. With significant investment into new technologies (as well as older ones that have previously been [suppressed](#)¹³), Kangaroo Island has the opportunity to present itself as a suitable pilot site and be a showcase for innovation and transformation.

A US government report [The Cost of Delaying Action to Stem Climate Change](#)¹⁶ states the following:

Firstly, although delaying action can reduce costs in the short run, on net, delaying action to limit the effects of climate change is costly. Because CO₂ accumulates in the atmosphere, delaying action increases CO₂ concentrations. Thus, if a policy delay leads to higher ultimate CO₂ concentrations, that delay produces persistent economic damages that arise from higher temperatures and higher CO₂ concentrations. Alternatively, if a delayed policy still aims to hit a given climate target, such as limiting CO₂ concentration to given level, then that delay means that the policy, when implemented, must be more stringent and thus more costly in subsequent years. In either case, delay is costly. These costs will take the form of either greater damages from climate change or higher costs associated with implementing more rapid reductions in greenhouse gas emissions. In practice, delay could result in both types of costs. These costs can be large:

- Based on a leading aggregate damage estimate in the climate economics literature, a delay that results in warming of 3° Celsius above preindustrial levels, instead of 2°, could increase economic damages by approximately 0.9 percent of global output. To put this percentage in perspective, 0.9 percent of estimated 2014 U.S. Gross Domestic Product (GDP) is approximately \$150 billion. The incremental cost of an additional degree of warming beyond 3° Celsius would be even greater. Moreover, these costs are not one-time, but are rather incurred year after year because of the permanent damage caused by increased climate change resulting from the delay.
- An analysis of research on the cost of delay for hitting a specified climate target (typically, a given concentration of greenhouse gases) suggests that net mitigation costs increase, on average, by approximately 40 percent for each decade of delay. These costs are higher for more aggressive climate goals: each year of delay means more CO₂ emissions, so it becomes increasingly difficult, or even infeasible, to hit a climate target that is likely to yield only moderate temperature increases.

Second, climate policy can be thought of as "climate insurance" taken out against the most severe and irreversible potential consequences of climate change. Events such as the rapid melting of ice sheets and the consequent increase of global sea levels, or temperature increases on the higher end of the range of scientific uncertainty, could pose such severe economic consequences as reasonably to be thought of as climate catastrophes. Confronting the possibility of climate catastrophes means taking prudent steps now to reduce the future chances of the most se-vere consequences of climate change. The longer that action is postponed, the greater will be the concentration of CO₂ in the atmosphere and the greater is the risk. Just as businesses and individuals guard against severe financial risks by purchasing various forms of insurance, policymakers can take actions now that reduce the chances of triggering the most severe climate events. And, unlike conventional insurance policies, climate policy that serves as climate insurance is an investment that also leads to cleaner air, energy security, and benefits that are difficult to monetize like biological diversity.

¹¹ <http://ecowatch.com/2015/03/18/carl-pope-shift-to-renewables/>

¹² Wiseman, J., Edwards, T. and Luckins, K. 2013. *Post carbon pathways. Towards a just and resilient post carbon future: Learning from leading international post-carbon economy researchers and policy makers*. Melbourne Sustainable Society Institute, University of Melbourne.

¹³ <http://makewealthhistory.org/2012/07/09/countries-with-100-renewable-energy/>

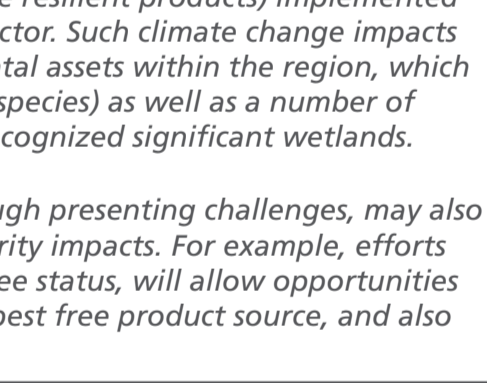
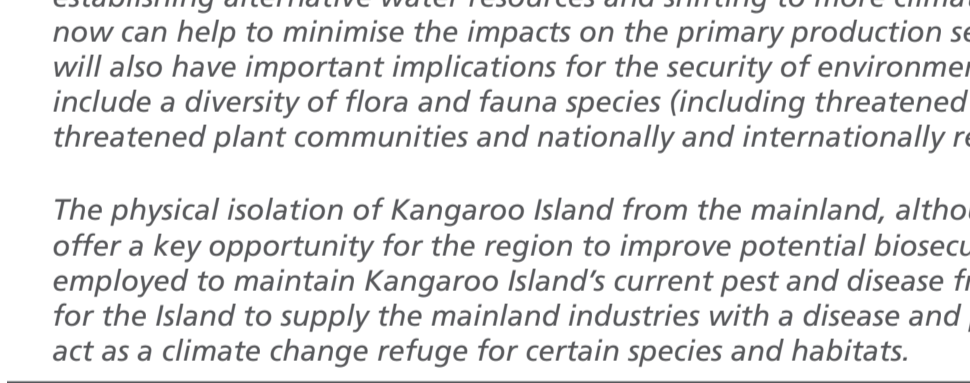
¹⁴ <http://ecowatch.com/2015/01/09/countries-leading-way-renewable-energy/>

¹⁵ Saunders, KM and Levine, L. 2004. *Better, Faster, Cheaper — Later: What Happens When Technologies Are Suppressed*. Michigan Telecommunications and Technology Law Review 11 (1) 23-69.

¹⁶ Executive Office of the President of the United States. 2014. *The cost of delaying action to stem climate change*.

According to a report by the [Climate Council of Australia](#)¹⁷:

The country is highly vulnerable to increasing coastal flooding because our cities, towns and critical infrastructure are mainly located on the coast. Sea level is likely to increase by 0.4 to 1.0 m through the 21st century. Strong action to reduce greenhouse gas emissions could constrain sea-level rise towards the lower end of that range, while a business-as-usual approach to burning fossil fuels would drive it towards the upper end. A seawall rise of only 0.5 m would, on average, mean that a 1-in-a-100 year flood (a very rare event today) would occur every few months. It could also involve a potential retreat of sandy shorelines by 25 to 50 m. If the threat of sea level rise is ignored, the projected increases in economic damage caused by coastal flooding are massive. More than \$226 billion in commercial, industrial, road and rail, and residential assets around Australian coasts are potentially exposed to flooding and erosion hazards at a sea level rise of 1.1 m, a high end, but quite plausible, scenario for 2100.



¹⁷ Steffen, W., Hunter, J. and Hughes, L. 2014. *Counting the costs: climate change and coastal flooding*. Climate Council of Australia.

Recent research that has [gained international attention](#)¹⁸ shows that much of the world's fossil fuel reserves will have to be [left in the ground](#)¹⁹ if we are to prevent dangerous climate change. It supports a global drive to [divest from fossil fuels](#)²⁰ and [end subsidies and tax concessions to fossil fuel industries](#)²¹. The research highlights the contradiction of governments seeking to maximise fossil fuel extraction, while simultaneously pledging to limit global warming to 2°C.

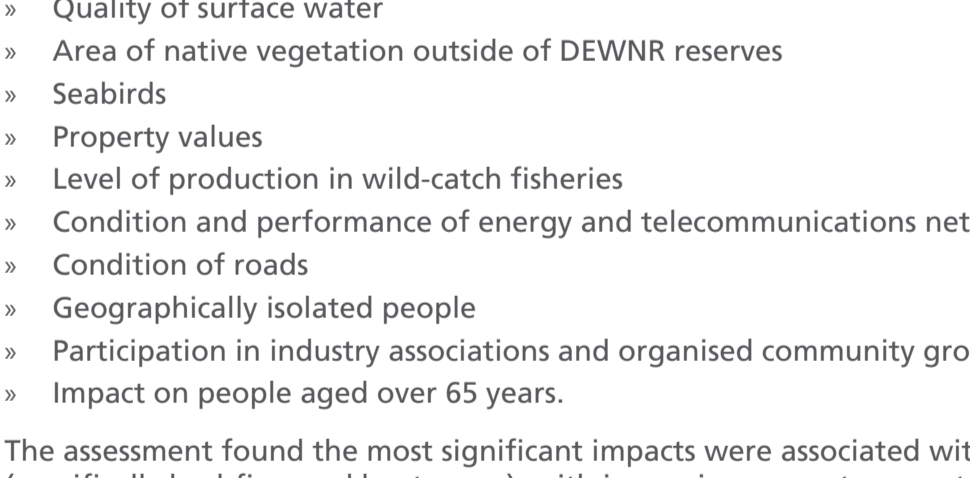


Figure 4. Australia's emissions by sector 1990–2012

Australians are one of the highest per capita emitters of CO₂ in the world. The graph indicates how these emissions are made up by sector, with electricity generation being the highest, followed by agriculture.

Treasury and Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

Reducing carbon emissions and changing the way we do business can happen at every level of society, and small steps in the right direction add up. South Australia is committed to addressing climate change and is currently leading Australia in the shift to renewable energy. Kangaroo Island is well placed in many ways to build on this approach and to lead by example in working towards becoming [carbon neutral](#)²². There is also overwhelming community support for KI to become 100% powered by renewable energy.

Adaptation

The three cornerstones of adaptation ([Adger, et al. 2005](#)²³) are:

- reduce sensitivity to climate change (e.g. increase reservoir storage capacity, plant hardier crops, or ensure that new buildings in flood plains are constructed with a floodable ground floor)
- alter exposure to climate change by (e.g. invest in hazard preparedness and undertaking climate change mitigation activities), and
- increase resilience to cope with change (e.g. increase access to resources or insurance, or assisting specific populations to recover from loss).

There is a growing recognition of the role that healthy ecosystems can play in increasing resilience and helping people adapt to climate change through the ongoing delivery of a range of ecosystem services. [Ecosystems-based Adaptation](#)²⁴ uses the sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to climate change. It aims to maintain and increase resilience and reduce vulnerability of ecosystems and people to adverse effects of climate change. The focus of this approach is on [working with nature](#)²⁵, rather than on costly engineering solutions to problems.

¹⁸ <http://www.theguardian.com/environment/2015/jan/07/much-worlds-fossil-fuel-reserve-must-stay-buried-prevent-climate-change-study-says>

¹⁹ McGlade, C. and Ekins, P. 2015. The geographical distribution of fossil fuels unused when limiting global warming to 2°C. *Nature* 517, 187–190.

²⁰ <http://www.theguardian.com/environment/2014/oct/08/fossil-fuel-divestment-a-brief-history>

²¹ Bast, E., Makhijani, S., Pickard, S. and Whitley, S. 2014. *The fossil fuel bailout: G20 subsidies for oil, gas and coal exploration*. Oilchange International.

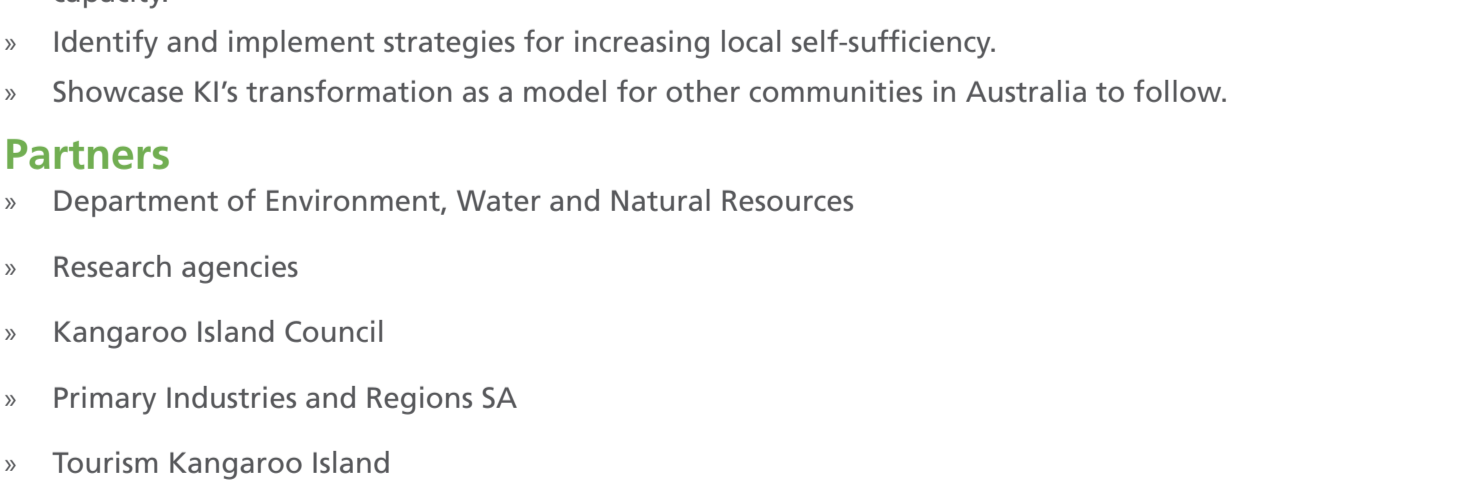
²² http://mpegmedia.abc.net.au/rn/podcasts/2010/11/ftc_20101111_0830.mp3

²³ Adger, WN, Arnell, NW and Tompkins, EL. 2005. *Successful adaptation to climate change across scales*. *Global Environmental Change* 15 (2), 77–86.

²⁴ http://cmsdata.iucn.org/downloads/iucn_position_paper_iba_september_09.pdf

²⁵ http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_publications/items/6227.php

The ['Adaptation Pathways'](#)²⁶ approach aims to phase decision making in a step wise manner that is partly determined by the life span of the decision (e.g. infrastructure investments are generally costly and have a lifespan of decades) and that attempts to take into account uncertainties about the future and ensure that 'maladaptation' is avoided. However, in order to be effective, adaptation planning needs to appropriately mix incremental change (responding to immediate challenges) with the systemic or transformative change that is really needed.



The recently completed [Knowledge Audit](#)²⁷ for the Adelaide Hills, Fleurieu Peninsula and Kangaroo Island region will provide the information needed to develop a climate change adaptation plan, consistent with the state government's [South Australian Adaptation Framework](#)²⁸. It summarises the human, social, financial, physical, and environmental resources of the regions, outlines regional climate change projections, and discusses the ability of key sectors in the region to adapt:

The residents of Kangaroo Island maintain a community with a high level of social connectedness, as is evident from their rate of volunteering which is the highest in the region, and nearly double the average rate for the whole State. A major challenge on the Island, and also in the mainland's coastal townships, will be ensuring energy, water and communications infrastructure, as well as emergency services, are able to withstand climate change impacts, particularly sea level rise and storm surges.

Predicted increasing tourism to ... Kangaroo Island, will particularly facilitate this challenge by acting as a catalyst for the creation and upgrading of essential services, facilities and infrastructure. The predicted tourism influx also presents one of the best opportunities for future job creation in the region, which is likely to help decrease unemployment rates and also decrease the need for some workers to commute outside of the region for work.

The region's horticulture, agriculture, fisheries and aquaculture, and forestry industries will also face significant challenges, particularly from increasing temperatures, decreasing water availability, and increasing bushfire risk. However, carefully considered mitigation and adaptation actions (e.g. establishing alternative water resources and shifting to more climate resilient products) implemented now can help to minimise the impacts on the primary production sector. Such climate change impacts will also have important implications for the security of environmental assets within the region, which include a diversity of flora and fauna species (including threatened species) as well as a number of threatened plant communities and nationally and internationally recognised significant wetlands.

The physical isolation of Kangaroo Island from the mainland, although presenting challenges, may also offer a key opportunity for the region to improve potential disease free status. For example, efforts employed to maintain Kangaroo Island's current pest and disease free status, will allow opportunities for the Island to supply the mainland industries with a disease and pest free product source, and also act as a climate change refuge for certain species and habitats.

²⁶ Wise, RM, et al. 2014. *Reconceptualising adaptation to climate change as part of pathways of change and response*. *Global Environmental Change* 28, 325–336.

²⁷ Resilient Hills and Coasts. 2014. *Knowledge audit for the Adelaide Hills, Fleurieu and Kangaroo Island RDA Climate Change Adaptation Plan*. Seed Consulting Services for Regional Development Australia Adelaide Hills, Fleurieu and Kangaroo Island.

²⁸ Department of Environment Water and Natural Resources. 2012. *Prospering in a changing climate: A Climate Change Adaptation Framework for South Australia*.

An [Integrated Vulnerability Assessment](#)²⁹ (IVA) for Kangaroo Island was undertaken with input from stakeholders during interviews and (in) workshops held in Kingscote, was supplemented with additional information from the project team and relevant literature. It found that the areas of highest vulnerability to climate change included:

- Impact of pest plants and animals on the terrestrial environment
- Abundance and diversity of cover
- Area of native forest vegetation
- Quality of surface water
- Area of native vegetation outside of DEWNR reserves
- Seabirds
- Level of production in wild-catch fisheries
- Condition and performance of energy and telecommunications network infrastructure
- Condition of roads
- Geographically isolated people
- Participation in industry associations and organised community groups/activities
- Impact on people aged over 65 years.

The assessment found the most significant impacts were associated with increasing extreme events (specifically bushfires and heatwaves), with increasing ocean temperatures and ocean acidity being most significant for the marine environment. However, the knock on effects of these impacts and their cumulative impact will require further consideration. The development of a Climate Change Adaptation Plan for the region will be the next step in this process and should be completed by the end of 2015.

Transformation

While climate change presents an global and local threat, every step in the right direction makes a difference. [Think global, act local](#)³⁰ needs to be our motto in responding to this challenge. There are many examples emerging from around the world that show us how we can do things differently. While change can be challenging, without positive change there can be no progress.

In order to thrive and not just survive, we need to think and act in new ways. Transformation is needed as the 'business as usual' approach is leading us to catastrophic outcomes. We need to move immediately and collectively towards a carbon-neutral future whilst simultaneously reducing our ecological footprint and living within the [planet's means](#)³¹. Taking advantage of our iconic small island status and brand value, we can leverage financial and intellectual investment in transformation, serving as a model for others to follow.

The QUANT e-sportlimousine features an innovative drive-train concept with four electric motors (one per wheel). It draws power from nanoFLOWcell, an electrolyte flow cell power system that works on the principles of the redox flowcell, which was developed in 1976 for NASA. The vehicle delivers a driving range of up to 600 km, and is powered exclusively by salt water. Packed with a 912 horsepower engine, the EV Hypercar also reaches blistering performance figures of 0-100 km/h (62 mph) in 2.8 seconds, and a top speed of 380 km/h.

²⁹ Resilient Hills and Coasts. 2014. *Integrated Vulnerability Assessment for Kangaroo Island*. Seed Consulting Services for Natural Resources Kangaroo Island.

³⁰ Nathan, G. 2015. *Potential opportunities in clean energy technology for Kangaroo Island*. University of Adelaide.

³¹ Steffen, W. et al. 2015. *Planetary boundaries: Guiding human development on a changing planet*. *Scienceexpress DOI 10.1126/science.1259855*

Strategies and priorities

It is important to note that the NRM plan is intended to guide and coordinate the efforts of all stakeholders in the region and responsibility for its implementation is a joint one.

- Establish a process for building capacity and knowledge about climate change and its impacts across all sectors of the community and the Island economy and work together to determine suitable responses at multiple levels to these challenges. The Climate Change Adaptation Plan that is currently under development will serve as a first step in this direction.
- Establish and implement a process for becoming [carbon neutral](#)³² at the whole of Island level. This will include moving towards being 100% powered by renewable energy.
- Identify and implement strategies for increasing energy efficiency and reducing energy consumption.
- Using KI's iconic status as a leverage point, identify funding opportunities and research partner-ships for piloting new technologies and approaches to mitigating and adapting to climate change that could then be rolled out nationally or globally.
- Where appropriate, follow an ecosystems-based approach to mitigation and adaptation rather than opting for expensive engineering solutions.
- Identify and implement strategies for reducing the community's sensitivity to climate change, altering their exposure to climate change, and increasing social resilience and the community's adaptive capacity.
- Identify and implement strategies for increasing local self-sufficiency.
- Showcase KI's transformation as a model for other communities in Australia to follow.

Partners

- Department of Environment, Water and Natural Resources
- Research agencies
- Kangaroo Island Council
- Primary Industries and Regions SA
- Tourism Kangaroo Island
- Industry
- Country Fire Service
- Kangaroo Island Community Education
- Health
- Residents and landholders

³² <http://www.globalcarbonproject.org/carbonneutral/index.html>

What are your thoughts?

- Have all the key issues relating to this big issue been adequately captured and understood?
- Are there any gaps or misinterpretations?
- What is the overall trend in relation to this issue — are matters improving or deteriorating, how fast and why?
- In order to address this challenge, will the 'business as usual' approach work, or is adaptation (substantial change) or transformation (complete rethink of how we do business and how we tackle this issue) needed?
- Do you agree with the strategies and priorities listed and/or do any need adding?
- Who are the partners that need to collaborate to address this challenge?

Images: Earth, www.cdn.zmescience.com/; Coastal erosion at Byron Bay, <http://www.news.com.au/national/rising-sea-erosion-threatens-australian-homeowners/story-fndo4e9s-12264327775/>; Coastal flooding www.climatecouncil.org.au; E-Quant sports car, <http://www.nanoflowcell.com/quant/>; Renewable energy, www.chineseinstitute.com/.

Regional winning painting from the 1998 International Children's Painting Competition by 10 year old Cindy Liu who wrote:

"I wanted to draw something that would catch everyone's attention and encourage the whole world to work together as one to fight against global warming now. An eye surrounded by flags of various countries represents the world working together to control the root causes of climate change and doing something immediately and effectively. Also, I wish that everyone would take action now so that we will have more hope to help our world fight against global warming. I believe that we can make our earth more beautiful if we work together!"

The competition is a United Nations Environment Program activity, which encourages children from all parts of the world to focus on environmental issues and how they affect their communities, and then to express their concerns about the environment through art. The Competition's goal is to increase environmental awareness and action among youth from over 90 countries.

<http://www.sdb.de/The-message-from-the-children-1392.0.html>

FOR MORE INFORMATION

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