Climate Change:

Risks and Opportunities

ADELAIDE

thinkers in residence

Stephen Schneider
Thinker in Residence 2006

Government of South Australia

Climate Change: Risks and Opportunities

Prepared by
Stephen Schneider
Adelaide Thinker in Residence

Department of the Premier and Cabinet
c/o GPO Box 2343
Adelaide SA 5001

December 2006

ISBN 0-9803168-2-0

www.thinkers.sa.gov.au

Climate change: the need to act

The Earth's climate system has demonstrably changed on both global and regional scales since the pre-industrial era. Some of these changes are attributable to human activities, which have increased the atmospheric concentrations of greenhouse gases and aerosols since that time.

An increasing body of observations gives a collective picture of a warming world and other changes in the climate system. Globally it is almost certain that the 1990s was the warmest decade, and 1998 or 2005 the warmest year, in the instrumental record (1861–2006). It's very likely that the past three decades were the warmest in at least 400 years, and likely many centuries longer than that.

There is new and stronger evidence that most of the warming observed over the last several decades is attributable to human activities. Observed changes in regional climate have affected many physical and biological systems, and there is building evidence that social and economic systems have been affected. For example, changes in sea level, snow cover, ice extent, tropical cyclone intensity, and precipitation are consistent with a warming climate. Most plants and animals observed to have undergone change in the past 50 years have changed in the direction expected with warming; and deaths from extreme heat waves and economic losses from other severe events such as major hurricanes have also increased.

Biological and physical indicators of change

Global mean sea level
Duration of ice cover of rivers and lakes
Arctic sea-ice extent and thickness
Non-polar glaciers
Continent ice shelves and sheets
Snow cover
Permafrost
El Niño events
Growing season
Plant and animal ranges
Breeding, flowering, and migration
Coral reef bleaching

Many such changes being observed in Australia are in line with those observed elsewhere.

Recent regional changes in climate, particularly increases in temperature, have already affected hydrological systems and terrestrial and marine ecosystems in many parts of the world.

In Western Australia, water supply catchments have already experienced significant declines in rainfall and runoff. South Australia is also vulnerable to such changes, which would impact on natural and agricultural communities and water supplies from the River Murray and local catchments.

The rising socio-economic costs related to weather damage and regional variations in climate suggest increasing vulnerability to climate change, although the proportion of those escalating damages attributable to climate change versus social factors is still debated. However, the most likely inference is that both contributed, and the proportion due to human-induced warming will increase sharply as the climate warms well above current levels.

Professor Stephen Schneider

Stephen H. Schneider is the Melvin and Joan Lane Professor for Interdisciplinary Environmental Studies, Professor of Biological Sciences, Professor by Courtesy of Civil and Environmental Engineering, Co-director of the Centre for Environment Science and Policy in the Freeman-Spogli Institute, and a Senior Fellow in the Woods Institute for the Environment at Stanford University, California.

Stephen is internationally recognised as one of the world's leading experts in climate change.

He has been actively involved with the IPCC (Intergovernmental Panel on Climate Change), an initiative of the United Nations Environment Program and the World Meteorological Organisation since its origin in 1988.

Stephen has advised the Nixon, Carter, Reagan, Bush Sr, Clinton and Bush Jr administrations and has been awarded the American Association for the Advancement of Science/ Westinghouse Award for Public Understanding of Science and Technology for furthering public understanding of environmental science and its implications for public policy. He was elected to membership in the US National Academy of Sciences in April 2002.

In 1992, Stephen was honoured with a MacArthur Fellowship for his ability to integrate and interpret the results of global climate research through public lectures, classroom teaching, environmental assessment committees, media appearances, Congressional testimony and research collaboration with colleagues.

Stephen founded and is Editor of the interdisciplinary journal, *Climate Change*, is Editor-in-Chief of the *Encyclopaedia of Climate and Weather* and is author of *The Genesis Strategy: Climate and Global Survival; Global Warming: Are We Entering the Greenhouse Century?* and *Laboratory Earth: The Planetary Gamble We can't Afford to Lose*. In addition, he has authored or co-authored over 300 scientific papers, proceedings, legislative testimonies, edited books and book chapters, and over 110 book reviews, editorials and popularisations.

Currently he is advising policy makers about the importance of using risk management strategies to make climate-policy decisions, given the uncertainties in future projections of global climate change. As well, he continues to serve as a noted advisor to stakeholders in industry, government, and the non-profit sectors regarding possible climate-related events and is actively engaged in improving public understanding of science and the environment through extensive media communication and public outreach.

Premier's Foreword

Stephen H Schneider's period as an Adelaide Thinker in Residence has been a success on many fronts.

He has talked to a wide range of people, right across the State. Science teachers; grain farmers; young people; members of the engineering, construction and wine industries; the media; business groups; policymakers working in the fields of transport and the environment: these and many other groups greatly benefited from Stephen's residency, while also providing him with valuable insights.

Stephen made important contributions to a number of ongoing State Government initiatives. For example, he helped shape our groundbreaking *Climate Change and Greenhouse Emissions Reduction Bill* (which was introduced to State Parliament in December 2006) and *Tackling Climate Change: South Australia's Greenhouse Strategy 2006-2020*. He has also supported our proposed "feed-in" law, which will reward people with solar panels by paying them up to double the standard retail price for returning surplus power to the grid.

South Australia is setting the pace on climate change policy, and we are continuing to earn international plaudits. For example, the former Vice President of the United States, Al Gore, commended our State "for in many ways leading the world with visionary proposals to really do the right thing". Still, we in South Australia want to do much, much more in this vital field of policy – which is why we asked Stephen to spend time here.

Stephen's work has culminated in this outstanding report. *Climate Change: Risks and Opportunities* outlines a number of thoughtful and constructive suggestions as to how South Australians can reduce their greenhouse gas emissions. These recommendations are based on several guiding principles, including the need to act now, to get early results and to build partnerships.

I thank Stephen for his energy and ideas, I congratulate him for his emphasis on practical solutions, and I strongly commend this report to all those South Australians concerned about the future of our State, nation and planet.

Mike Rann
Premier
Minister for Sustainability and Climate Change

Thinker's Introduction

I believe that the thinking in South Australia on climate change science and policy in particular, and sustainability in general, is some of the most conceptually advanced that I have come across, anywhere in the world.

The Premier's brief to me as a *Thinker in Residence* was to work with agencies, universities, schools, departments, businesses, environmental groups, and the media, both in this State and elsewhere in Australia, to help fashion ways for South Australia to address climate change. In particular I was able to build from these interactions ideas that help fulfil the low-carbon imperative of the Premier's goal to achieve 60% emissions reduction target in greenhouse gas emissions by 2050, established in the *Climate Change and Greenhouse Emissions Reduction Bill 2006*.

Over the six months we were in Australia, I learnt that many of the ideas I worked on already existed.

The South Australians I spoke to over that period demonstrated to me the commitment and depth of understanding that is a prerequisite to successfully dealing with this challenge.

In particular, the work done in the development of *Tackling Climate Change – South Australia's Greenhouse Strategy* provides a framework for climate change action in this State that many other much larger jurisdictions would be proud of.

In that sense, my role here was as a catalyst as much as a 'Thinker' (or generator of *new* ideas). Nevertheless, in this report I have tried to come up with some relatively new approaches that I hope will spur debate and eventually be reworked into concrete policies to implement the conceptual agenda already in place, ultimately helping to reach the admirable 60% emissions reduction target.

In this report I have outlined a range of concrete initiatives – some relatively easy and some more difficult to implement – that could help South Australia accelerate its existing desire to push beyond the conceptual and towards a successful climate change response. I also suggest a sequencing strategy, highlighting that policy win-wins should come first, with more difficult steps coming later after support for them builds.

The challenge now for the State is in bringing people along – creating the alliances necessary to bring the sustainability and climate change agendas into force.

Table of Contents

I. Summary of Recommendations

1. States United for Sustainability: The Adelaide International Network (SUSTAIN)
South Australia would instigate an international collaboration between states, provinces and cantons that are serious about responding to climate change, with Adelaide to host the inaugural meeting and any emerging secretariat. Membership is international but voluntary, indicating commitment to action. The network is targeted at 'state' jurisdictions with leadership and legislative ability. This would add significant impetus to international action whilst complementing existing agreements at national and local levels. A component of the network would be a Secretariat – hopefully located in Adelaide – that could help member states evaluate their carbon assets and liabilities, learn about credible and cost-effective options, and provide information on funding sources for adaptation activities.

2. 7/11 Paybacks
In order to move towards the 60% emissions reduction target, the State Government would mandate energy efficiency standards in buildings and appliances that produce a cost-effective payback for consumers and businesses. Any higher upfront cost to consumers or businesses from deploying more efficient appliances, buildings or industrial processes would be paid back over time in savings on energy and electricity. A payback period of 11 years or better (equivalent to a return on investment (ROI) of about 7% p.a.) would become the threshold for the mandate. Standards, which would be announced immediately and phased in over time to provide stakeholders an adjustment period, have provided significant economic and environmental benefits to other jurisdictions.

3. Power Parks
Hubs of renewable and low-emission energy should be investigated in regional areas, combining solar, wind, geothermal, and carbon capture and storage (CCS) technologies. The parks would be established in partnership with the private sector, and showcase the State as a centre for innovation in greenhouse emissions reduction and renewable energy development. In order to evaluate the pros and cons of various options, it is necessary to build demonstration plants for competing technologies, and to share the learning-by-doing.

The parks would potentially help to revive regional communities, providing an economy of scale (for example, common use transmission lines) and creating business opportunities. Potential links with other projects – including positioning 'green power' closer to energy intensive mining, water pumping and desalination – would be considered.

4. Cars on a 'diet'
Preference (for example, fees, access to available parking) would be given to efficient cars through a suite of measures (grandfathered to exclude existing vehicles, until resold) including:

- differentiated registration and stamp duty (so-called 'feebates')
- establishment of 'green number plates' for ultra fuel-efficient cars.

5. Rewarding sustainable farmers
Incentives would be established to encourage sustainability practice, emissions reductions, resource efficiency and biodiversity conservation within the agricultural community (for example, green labelling or – eventually – direct payments for soil carbon sequestration after a shadow price on carbon is established).

6. Reshaping research
Expanding from the Chair of Climate Change at Adelaide University, the three major South Australian research universities and the South Australian Research and Development Institute (SARDI) could form a strategic partnership on climate change research, to identify vulnerabilities, adaptation strategies and opportunities for industry and the community. Such a partnership would serve to position the State as a world-renowned centre for climate change response development and help it to compete more credibly for important funding from Federal grants.

7. 'Green with envy' tourism
A showcase would be created for SA green activities via cooperative private/State agency run 'green' tours. For example, a 'Wine, Windmills and Whales' tour in a biofuel-powered vehicle for several days in the Eyre Peninsula might be established. Carbon offsets would be purchased as part of the price of the tour, and the participants could choose which method of offset they prefer, such as bush restoration, wind farm development, solar power, sustainable farming practices or affordable green housing.

8. Education and environmental literacy
All of the ideas in this report are underpinned by education. Not only must we seek to incorporate sustainability into the curriculum at all levels – I'm proposing that students become actively involved in emissions monitoring and the sustainability rationale for projects in their schools or at home. In the training and education sector, South Australia should seek industry supported and recognised TAFE courses for sustainability trades, lest the State propose building standards that are unfamiliar to the professionals who do the work to implement them.

9. Building resilient communities
There are a number of communities particularly vulnerable to climate change in South Australia. To help these communities cope with climate change, and at the same time reduce its impact, I'm suggesting incorporating sustainability building principles into all government-assisted housing developments, building climate change mitigation and adaptation capacity in remote and indigenous communities, and creating renewable energy income for farmers. Such capacity building would help communities to actually take advantage of policies designed to reduce emissions or adapt more efficiently.

10. Analytic frameworks for sustainability: coordination and transparent valuation
Building on the experience of SA Water, government agencies should coordinate analytic techniques so as to adequately value our future, ensure that use of the same language (for example, what is 'cost-effective'?) in different agencies and departments actually reflects consistent analytical assumptions, and incorporate climate change into risk management scenarios.

II. Policy Principles:

A Brief Summary

Act in the face of uncertainty

Climate change contains uncertainty: many aspects are well established whereas others remain speculative. These should not be mixed up, as is common in the media or political debates. Moreover, despite remaining uncertainties, we know more than enough to assert with high confidence that many of the risks are great. In that sense we must frame our decisions simply in a traditional risk-management framework, balancing the costs of action against the risks of inaction, measured not just in monetary units but in multiple metrics – such as lives lost, species driven to extinction, growth in income gaps.

Plan early to avoid getting seriously hurt later

The world is replete with companies and jurisdictions that lack foresight and are failing to take the necessary precautions. These groups will only find it more difficult and more painful when the negative effects of climate change intensify and the inevitable political pressure to impose a steep price on carbon takes hold. Prudent actions sooner can avoid draconian actions later. A politically successful immediate 'victory' for the defenders of the status quo may soon turn into a painful punishment when events such as unprecedented droughts, super hurricanes or massive bush fires mobilise stiff political actions that ultimately threaten the very enterprises that blocked more orderly change at the outset. Such 'climatic policy train wrecks' make little sense to anyone.

Benny the Bio-Diesel bus, Adelaide, South Australia.

Start with the 'win-wins'

Some actions will further more than one objective – for example, efficiency + sustainability, or greenhouse emission reductions + reduced health-damaging air pollution. When these actions have paybacks comparable to or better than normal return on investments, they can be considered as 'no regrets' and are logical to implement first. But 'no-regrets' policies alone will not achieve a 60% emissions reduction target. There will inevitably be a gradual ramp-up to the more difficult steps with higher costs. It is important that the sequencing of policy steps for achieving the emissions target build from obvious win-wins to more difficult steps such as establishing a shadow price for carbon. Such sequencing needs to be part of strategic planning in State government and elsewhere.

Find the 7/11 solutions

Often, insufficient up-front investment can be a barrier to sustainability. However, a higher initial investment will often prove to be economic in the longer term, even without external factors as part of the calculation. If an initiative has a payback period of less than 11 years (roughly equivalent to a 7% return-on-investment and comparable to or better than the average mortgage interest rate), then I call this a '7/11 solution'. These solutions make good economic sense and are good sustainability policies. But to be fully implemented, mandatory performance standards for appliances and inspected building codes are likely to be necessary. This has been the experience in California – the lowest greenhouse gas emitting state per capita in the US – primarily because such 7/11 types of standards were legally mandated and enforced over the past several decades. The economic good news is that these standards are estimated to save greater than ten billion US dollars annually for Californians! That is why they are widely supported across the political spectrum.

Address inequity with side-payments to those most affected

Successfully responding to climate change will create both winners and losers. Equity is an important social value, but the sustainability agenda cannot be held hostage to inequities; rather, good policy should seek to address such inequities through side-payments to those who are most disadvantaged by sustainability policies – at least for an initial adjustment period.

Be transparent, but work within a risk-management framework

Ensure that all decisions – sustainability policies, side payments, and subsidies to promote new technologies – are open and transparent. Analytic methods need to make hidden assumptions and uncertainties clear and thus subject to open debate. In particular, as policies increasingly require the adoption of life-cycle costing, it is important that such calculations be performed in a risk-management framework: that is, prices of inputs such as energy or carbon be varied via scenarios to account for a plausible range of future values, and not just be extrapolations of today's values. In short, many assumptions that we've made in the past will change as our climate changes and perceptions to deal with it intensify.

Build partnerships: 'coalition of the willing'

Climate policy is too big a problem for any single actor to tackle alone. Seek to build a 'coalition of the willing' that can share knowledge and experience, create market-pulling power, find 'low hanging fruit' emission reduction opportunities, and share the risk for any one player relative to acting alone.

II. Policy Principles: A Brief Summary

Promote the good-news stories

The time and space scales of climate change can be daunting and might lead to a 'what-can-I-do' mentality. We need the good-news stories and win-win actions to motivate wider action. Reward those already doing the right things and promote their actions as widely as possible.

Be flexible

It is particularly important that long-lived infrastructure be early adopters of sustainability policies, as power plants, buildings, transmission lines and irrigation systems can last for many decades. If these investments do not anticipate the likely advent of increased energy prices, a shadow price on carbon or reduced net water availability as the climate heats up, then it will likely be more expensive to deal with these issues in the future. In short, avoid locking yourself into infrastructure that is initially somewhat cheaper, but in the long run may be seriously disadvantaged by having not anticipated the impacts of climate change or the coming stringency of long-term climate policies that will be needed if the 60% emissions reduction target is to be met.

III. A Sustainable Climate Policy Framework

The road to sustainability

Our response to climate change must be pursued on multiple fronts and with increasingly effective measures. This is not an issue that we will solve overnight, nor is it an issue where we can afford to wait and see. We need to accelerate our responses with measured actions across many areas. Although some necessary elements might now come into force immediately, many others can be implemented slowly to give various stakeholders and agencies time to adjust to their advent. However, even if slow rates of implementation of some policies and measures are designed to give some stakeholders a 'soft landing', all must perceive that, over time, such policies are inexorable if they are to be effective in achieving sustainable behaviours. A sequencing of policy steps seems most effective if it starts with the politically and economically 'easy' actions first; then we must 'ramp up' their effectiveness over time, if there is to be a realistic hope for achieving the already-articulated broader sustainability goals – especially the 60% emissions reduction target.

The measures that we must take to meet the 60% emissions reduction target by 2050 are challenging in that they reach far beyond the short-term scope of our usual decision-making. These decisions will require a new way of assessing future options, and will require a move towards more integrated assessment across departments, agencies, universities and stakeholders. Ultimately we cannot leave the goals of economic development and environmental sustainability unreconciled.

We must try a range of different responses, testing their efficacy through a learning-by-doing approach. Not everything we try will work smoothly or cost-effectively, but this cannot be an excuse for long delay or inaction. We must not let the 'perfect crowd out the good'. At the same time we need constant monitoring of, and interactions between, appropriate governmental actors and stakeholders as our 'sustainability experiment' matures. And, of course, we must monitor progress towards the sustainability goals and adjust our actions as the science improves and technology and learning become clearer.

All bold leadership that changes the status quo, such as early and concrete steps to sustainability, will take public education and political courage, and we must not be deterred by the size and scope of the task. Lao-Tzu wasn't talking about climate change when he said that 'the march of a thousand miles begins with the first step', but in this case the principle certainly applies.

III. A Sustainable Climate Policy Framework

Decisive initial steps can have great power. Even as a small state, South Australia can influence the sustainability agenda far beyond its own borders. The sustainability questions that you face here are the same questions that we face in my home state of California. Indeed, these are the questions that the whole world is grappling with. How we balance growth and prosperity with equity, sustainability of culture and nature, and greenhouse gas emissions reduction will be the questions we must answer for the sake of future generations of humans – and plants and animals as well. Never underestimate the power of moral leadership and concrete examples of political and economic actions that work. Others will look carefully and adopt what they see as appropriate for their situations.

For emissions reduction to become politically tractable, we must, as noted earlier, sequence sustainability policies to start with the steps that improve efficiency and reduce net costs, and then progress rapidly beyond voluntary programs and incentives, on to mandatory performance standards for activities connected with greenhouse emissions and greenhouse offset programs. The bottom line is that we cannot long continue to use the atmosphere as an unpriced sewer. Greenhouse gas emissions have a cost – through both health and environmental impacts – and so must airborne carbon if a real market is to be established, rather than one with an implicit subsidy in the form of a waived 'sewer-dumping' fee.

Though politically more challenging, ultimately we must move to the inevitable market-restoring policy – carbon emitted into the atmosphere must have a price or a 60% emissions reduction target will likely be unapproachable.

Whether it be through cap-and-trade mechanisms or direct carbon taxes, the price of our energy choices must reflect their full cost to our health and our environment. (This principle of full life cycle costing applies to non-carbon-emitting sources as well.)

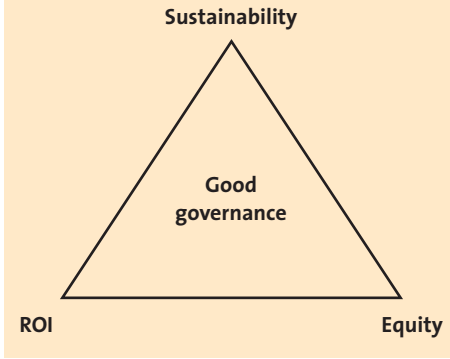
By putting a price on carbon emissions we help to ensure that the sustainability values of our society are reflected in the prices of the commodities that we use.

Values in governance

We elect governments to ensure the collective welfare of our citizens – the greatest-good-for-greatest number – while at the same time maintaining absolute individual rights for education, health, security and freedom of expression. We elect governments to ensure the freedoms, prosperity and security of our society. And ultimately we must elect governments to ensure our sustainability, and our future, including Nature as part of our stewardship responsibilities.

In this way good governance is a dynamic balance across pluralistic values. We can represent some of these values simplified as a triangle. One value, or point on the triangle, is economic: *high rate of return*, a second value: the *sustainability* agenda, and a third: *social equity* (sometimes these three values are called the 'triple bottom line'). Conceptually, good governance sits centrally in between these three points at a place that represents the social values of the citizens, within the constraints of individual rights. Clearly the best outcomes for government, business and individuals are where win-wins – or strategies that can further more than one objective and leave no significant group unfairly disadvantaged without compensation – can be found.

Governance Values Triangle



Recognising the true cost

Table 1 (see over) suggests 'five numeraires'[1] for judging the significance of climate change impacts. These include market system costs in dollars per mega-tonne (million tons) for carbon emitted (C); human lives lost in persons per mega-tonne C; species lost per mega-tonne C; distributional effects such as changes in income differentials between rich and poor per mega-tonne C; and quality of life changes, such as heritage sites lost or refugees created per mega-tonne C. The table posits that one must consider all of these factors to arrive at a fair and accurate assessment of climate change damages. However, it is difficult to assign a monetary value to non-market categories of damages (or benefits, for that matter). Can we, for example, place a dollar value on a human life and the quality of that life? If some policy saved a life today but cost 2 lives in 50 years, should that be discounted or should we simply decide that a current life is no more valuable than a future life? How do we value ecosystem goods and services, let alone the very existence of species, some of which took tens of millions of years to co-evolve with the non-biological environment?

1. a metric by which values are measured, such as gold in the monetary system

III. A Sustainable Climate Policy Framework

Table 1: Five numeraires for judging the significance of climate change impacts

Vulnerability to climate change	Numeraire
Market impact	$ per mega-tonne C emitted
Human lives lost	Persons per mega-tonne C
Biodiversity loss	Species per mega-tonne C
Distributional impacts	Income redistribution per mega-tonne C
Quality of life	Loss of heritage sites; forced migration; disturbed cultural amenities; etc, per mega-tonne C

Note: multiple metrics for the valuation of climatic impacts are suggested.

Typically in economic cost-benefit calculations, only the first numeraire – market sector elements – is included, though for those admirable few studies attempting "non-market" valuations, the methods are crude and controversial. Different individuals, cultures, and governments might put very different weights on these five – or other – numeraires, and thus it is suggested that analysis of climatic impacts be first disaggregated into such dimensions and that any re-aggregation provide a traceable account of the aggregation process so that decision makers can apply their own valuations to various components of analysis. (Schneider, Kuntz-Duriseti, and Azar, 2000).

A traditional cost-benefit analysis (CBA) tends to consider a sole numeraire: market value, and is often viewed as unjust because nature and distributional aspects are rarely explicitly treated. In a traditional CBA, the ethical principle is not even classical Benthamite utilitarianism – that is, the greatest good for the greatest number of *people* – but an aggregated market power form of utilitarianism – the greatest good for the greatest number of *dollars* in discounted benefit-cost ratios. It would follow then that, in the wake of equivalent, climate-induced, physical damage, an industrialised country with a large economy and more absolute monetary units should be rescued or rehabilitated before an unindustrialized nation with a less robust economy and fewer absolute monetary units at risk.

Even more problematic would be the incidence of an industrial northern country benefiting from global warming due to longer growing seasons, while a less developed southern country suffers from excessive heating or drying. Suppose the southern country might lose the same dollar value to its economy as the northern country gained. This could hardly be viewed as a neutral outcome, despite a net monetary welfare change of zero – derived from summing the monetary gain in the north and the loss in the south. Very few would view a market valuation of impacts in which the rich get richer and the poor get poorer as ethically neutral – particularly since the bulk of atmospheric concentration increases to date have come from the greenhouse gas emissions of industrialised countries. In international negotiations, members of the political South often challenge supporters of the use of aggregated market damages as the only numeraire for impacts analysis as irrelevant at best and unethical at worst.

As a society we value a multitude of things; among them sustainability, equity, biodiversity and culture; and yet we often make decisions based only on a single dominant paradigm – short-term market system economics. Through this paradigm only the amenities that can be traded in markets have tangible value. The non-market side effects (for example, extinction of threatened species) of economic business-as-usual are typically not part of the calculations that determine prices of commodities like fuel or electricity.

Incorporating 'externalities' (i.e. factors external to the normal cost-benefit accounting procedures of firms or government finance departments) directly into the cost-benefit reasoning of firms and governments means that climate stabilisation, cleaner water, cleaner air, world leadership, and moral stewardship of the planet, all would have value within a decision-making context and that their benefit will count alongside traditional economic measures when alternative courses of action are being assessed. To leave negative externalities out is tantamount to a large subsidy to business-as-usual activities.

Moreover, the value of future non-market amenities like species or cultural continuity are often discounted at market interest rates (typically between 5 and 10 per cent – occasionally more), but a 'sustainability discount' rate should be much less; some economists and ethicists argue that threats to life, culture or biodiversity imply the appropriate discount rate should be set at zero. Why, to use the earlier example, a life now should be worth ten times more than a life in 100 years is NOT an economic decision, but a moral judgement not determinable by standard cost-benefit practices with market rates of discount. Determining appropriate ways to value the 'pure rate of time preference' is a *political* activity built on the deep values of the citizens, not simply an algorithm typically practised in a market-based computer model.

The decision frontier for the State Government – as part of a wider political judgement – is how much conventional return it is willing to trade off for the co-benefits or 'externalities' of sustainability and equity. There is no 'right' answer, just a collective judgement rooted in the deepest values of the citizens of South Australia as to what is really to be valued.

Win-wins: doing well by doing good

Identifying initiatives that further more than one of the above goals is what I call a 'doing-well-by-doing-good' philosophy. Examples could include energy efficiency standards that produce returns on investment at greater than typical homeowner's mortgage rates, or investments by electricity producers in the form of subsidies to buyers of appliances.

When these extra costs to the utility are paid back by reduced production costs at a better rate of return than the industry standard, it is a win-win policy to fund efficiency incentives. In California, the Pacific Gas and Electric Company, for example, subsidises homeowners to buy efficient light bulbs, windows and appliances, since those investments are less costly to the utility than building peaking power plants for the few weeks a year that heat waves demand that extra power.

Furthermore, replacing air polluting industrial systems with lower emitting plants can provide a health benefit that is greater than the extra cost of the cleaner equipment – though both costs and benefits accrue to different actors. In these cases, such 'win-win' strategies need to be legally mandated, and will not likely be seriously challenged politically once the bulk of relevant stakeholders realize their win-win status; indeed, this has already happened in California.

'Breaking eggs to make an omelette'

However, even the best governance frameworks cannot always produce win-win outcomes. If they did, sustainability would be easy and policies already implemented all around the world. We would not have the blocking coalitions of lower income groups opposing increased commodity prices, nor those of vested interests objecting to stricter standards on vehicle emissions; nor would we have some carbon-based energy companies up-in-arms at the notion of a price on carbon emissions that they traditionally did not have to internalise.

We need to be straightforward here: sometimes the pursuit of a long-term sustainability agenda may at times conflict with other, often short-term, objectives. Sustainability policies may compromise short-term return-on-investment for those who position their assets for a long-term reward that does not explicitly include social costs from their activities – typically unpriced emissions. It may compromise social equity, as those who can already afford sustainable infrastructure – like solar panels or hybrid cars – reap the rewards of cheaper energy and fuel costs, whilst those who can't are left in their wake with higher commodity prices and less capacity to absorb them. Indeed, a sustainability agenda will often create both winners and losers. We must acknowledge this, and set up additional steps to deal fairly with those who are particularly disadvantaged by a sustainability policy. But, at the same time, we cannot hold the sustainability of the planet – and our future – hostage to these special interest concerns, though we need to fashion fair solutions to incorporate them.

Side payments, transaction costs and just transitions

In our pursuit of a societal sustainability agenda, we need to deal with trade-offs and side payments for those who are demonstrably adversely affected.

Such measures, as noted earlier in the 'triple bottom line' Governance Values Triangle conceptual figure, can essentially be viewed as ways of helping people or groups who are most disadvantaged by policy measures, and will likely be necessary to ensure that an equity or sustainability agenda is not held hostage to a return-on-investment paradigm or a claim of inequitable impact. Side payments can help ensure 'soft landings' for the people who are really hurting, but they should also be designed to help all segments of society to adopt and implement more efficient and sustainable technologies or practices.

Take, for example, coal mining companies or manufacturers of gas-guzzling vehicles. Their activities currently are a major fraction of planetary emissions, and Australia is no exception. Yet I have never met a coal miner who dug coal to harm the atmosphere, nor an auto worker who makes a V-8 powered, oversized, petrol-guzzling vehicle in order to create global warming. They do it because that's what they know how to do and their employment is part of social and economic development. We can't just snap in suddenly a dramatic policy that essentially shuts down these industries instantaneously and puts the workers out on the street – we need just transitions for these workers, companies and stockholders. BUT, neither can we grandfather their activities indefinitely if it severely compromises the sustainability agenda. Navigating across this politically treacherous policy conundrum will take political courage and clever policies to both meet the sustainability goals and at the same time allow the 'soft-landing' for those particularly disadvantaged.

In moving towards a 60% reduction in greenhouse gas emissions by 2050, South Australia will need to look at what transition assistance is necessary for those organisations and individuals that are more vulnerable to changes in their business or in their private costs as sustainability policies ramp up. And such policies should try to minimize transaction costs – more popularly known as 'red tape' – by designs that require the easiest enforcement regimes, and the fewest new bureaucracies, and take advantage of existing policy instruments, like the tax system.

‘Crystal balling’: projections and scenarios

Of course we have no crystal ball for climate change. Over the next century IPCC suggests we can expect between one and six degrees of additional warming. And whether it is one degree or six degrees will depend both on how much and what kinds of greenhouse gases we emit, and on how the climate system will react.

Faced with this range of uncertainty, climate change impacts essentially become a risk management problem.

I think we face roughly a 10% chance of truly catastrophic change – greater than 5°C of warming in the next century or two. I don’t know anyone responsible who would think that a change as large as the difference between an ice age and our warm interglacial – but happening at dramatically faster rates – is an overall good thing. Yet people tell me ‘why worry when there’s so much uncertainty and it may only be a small risk’.

Well, take fire insurance for example. How many people that you know have ever had a house fire – less than a few % or so, perhaps? Yet how many have fire insurance? Virtually all of them. People buy fire insurance with about a 1% chance of ever having a fire – and yet some are willing to risk a 10% chance that we’re making the planet dangerously vulnerable (and it could be even higher than that if we are unlucky). It’s incommensurate and, frankly, immoral in my value system, to accept such potentially irreversible risks to our planetary life support system simply to get several times richer a few years sooner.

Choosing the right tools

At a business scale, in understanding the risks of climate change and the potential exposure of assets that may result, we must also recognise that our conventional accounting tools are likely to be inadequate.

Typically, conventional accounting does not adequately account for the business risks of future scenarios – in this case climate change – and therefore underestimates the risk to the enterprise even in conventional terms. As a result the wrong infrastructure could be established that we’ll then be stuck with for another 50 to 100 years.

So, particularly for decisions with lasting impacts, it is absolutely critical to define plausible scenarios within a fan of considerable uncertainty. Once we have an inkling of the relative probabilities of different scenarios, we can then go into risk management mode.

This topic is covered in some depth as Idea No 10: Analytic Frameworks for Sustainability.

Building the drivers

South Australia’s supportive regulatory framework has enabled the State to achieve the lion’s share of the nation’s wind power generation. However, with the Federal Government’s Mandatory Renewable Energy Target (MRET) fully subscribed and a national emissions trading scheme at best a number of years off, new drivers for low-emission energy generation must be established if South Australia is to have any chance of achieving its 60% emissions reduction target.

Whether it is at the State or Federal level, all options must be considered. An additional MRET, a cap-and-trade emissions scheme, direct subsidies to low-emission technologies or, ultimately, a carbon tax – all are options in the transition to a low-emission future. Without any one or a combination of these mechanisms South Australia will fall well short of its ambitious targets.

A climate for change

When I started working on this problem in 1970 there were about 100 scientists worldwide concerned with addressing climate change and its implications; the number of scientists, policy makers and technologists who are more ‘climate aware’ is now more like 100,000. We have come a long way and I have watched as the debate has moved from ‘is climate change real?’ to ‘does it really matter?’, to ‘what could we do about it?’ to the most pressing problem: ‘what should we do about it?’

IV. Ideas for South Australia to help meet sustainability goals

1. States United for Sustainability: The Adelaide International Network (SUSTAIN)

- **South Australia to initiate a state-based climate change network, with the inaugural meeting to be held in Adelaide**
- **The network would seek to:**
  - **develop cost-effective emissions reduction strategies**
  - **trade carbon credits, services and intellectual property**
  - **establish a central service centre for greenhouse accounting and verification, and for advice on effective adaptation.**

During my time in South Australia people have asked me 'What difference can this state make when we're such a small player on the world stage? Why should we act?' This question is fundamental to climate change action the world over, and is worth addressing from three angles.

Firstly, I have heard everyone from US auto industries to fossil fuel giants and even nation states demanding exemption from emissions reduction, claiming that they are, by themselves, too small a slice of *global* emissions. Well, when you have a hundred people who are all one per cent of the problem all demanding exemption, then you have a hundred percent of the problem! Faced with this classic tragedy-of-the-commons, there is clearly a moral imperative for us all to play our part.

Secondly, the principle of learning-by-doing is well established as a key driver for innovation and technology development. By demonstrating what can be done, those who learn the specifics will be at the forefront of innovation, with their knowledge and technology in high demand from a range of firms and jurisdictions. An example of this type of learning is the Norwegian oil company *Statoil*. Rather than pay the $50 per tonne carbon tax that Norway had imposed, the oil company reinjected CO_2 underground in one of its North Sea operations. The experience gained as the first large scale experiment in deep earth CO_2 sequestration driven by climate policy will undoubtedly create an opportunity for *Statoil* to market their knowledge as other actors look for lowest cost techniques to decarbonise.

Other examples include wind power, the unit costs of which have dropped greatly with ten plus years of research and development investments tested by field deployments – the combination of which has produced the significant learning-by-doing benefits. Today, this learning has lowered costs sufficiently to produce a unit of energy roughly equivalent to more traditional, more polluting, conventional energy supply systems. Clearly, though, to have the learning-by-doing benefits one first has to be sure there is doing! At first this may not appear cost competitive with more established conventional systems, but with a mix of public and private investments the learning curves often work successfully – as they have for wind power. This is a tangible benefit of innovation, investment and bold leadership.

Finally, we should never underestimate the power of leadership. I believe that South Australia has the opportunity to influence the climate change agenda far beyond its own borders.

As I've said, I have been enormously impressed by the culture and acceptance of sustainability principles in this State. There is a passion for being ahead of the pack on this issue that I believe leaves the State well positioned to take the moral leadership in responding to climate change. By demonstrating success in your own backyard, I believe the people of South Australia will be able to motivate a critical mass of similar jurisdictions at a global scale – a coalition-of-the willing. But to more rapidly achieve this critical mass will take bold steps.

I recommend that SA initiate a State-based network for climate change action, a network that I have called the *States United for Sustainability: The Adelaide International Network*, or *SUSTAIN*.

This network would effectively fill a void that currently exists in climate change action. At the city level we already have the increasingly successful Cities for Climate Protection (CCP) program, run through the International Council for Local Environmental Initiatives (ICLEI). And at an international level there already exists the UNFCCC process out of which the Kyoto protocol has emerged (despite the fact the Kyoto protocol has been hindered by the lack of cooperation of both your country and mine, the process of policy debate at an international level is a sound one that both the US and Australia still actively participate in). An effective mechanism for action is primarily lacking at a State level. And it is my challenge to South Australia to step forward to fill that breach with a powerful leadership role.

The SUSTAIN Network would involve an international coordination and collaboration between states, provinces, cantons, etc. that are serious about responding to climate change. Adelaide would instigate the network by hosting the inaugural meeting and any emerging secretariat. Network membership would be voluntary, indicating commitment to action, and would be targeted at 'state' jurisdictions with leadership and legislative ability.

IV. Ideas for South Australia to help meet sustainability goals for climate change

An early step down the path to this network has already been taken with the Declaration of States signed by nearly 20 states at the Montreal Conference of Parties to the UNFCCC framework in November last year. This declaration outlined a broad commitment to climate change action – particularly to emissions reduction – through a suite of collaborative measures. However, many more states are needed to give any such collaboration political and economic power to move the climate policy agenda forward at a much faster pace than is evident at the international nation-state level.

In the spirit of the Declaration of States at Montreal, the collaboration would essentially act as a multi-government alliance capable of significant pulling power in the development of adaptive capacity, emissions reductions strategies and appropriate technologies. Politically, the network could position itself to entice national governments otherwise reticent on climate change action. Federal governments, cities, businesses and NGOs would be invited to attend as observers.

The Network would first fashion an agreed upon set of principles, negotiate specific goals for emission reductions and adaptation activities in many sectors, and develop a suite of measures that participant jurisdictions could implement to reach these goals. It would not be likely that all states could sign on to all actions that the Network fashioned because capacities and resources vary greatly across states, but it would seem appropriate for all members to commit to implement a subset (say 50%) of the proposed measures most appropriate to their specific situations.

Participants in the network would have the opportunity to trade carbon credits, services and intellectual property with other participants and develop cost-effective emissions reduction strategies beyond their borders, based on similar principles to those in the Clean Development Mechanisms outlined under Kyoto Protocol.

The Network would agree on a consistent accounting framework to measure greenhouse emissions and reduction, allowing for comparison between states and participating industries across the network. The Network secretariat could employ several analysts to help participants measure and evaluate carbon liabilities and assets, to verify progress and claims, and to lower the transaction costs that states would face if each had to develop their own carbon register and emissions certifiers. This may prove particularly valuable to states or provinces in less developed countries with lesser capabilities for such carbon accounting expertise. Consistent guidelines set by negotiations of all member states would likely short-circuit some of the complicated political obstacles that each state might experience if they tried to implement such activities in their respective countries alone.

Another area the Network could concentrate on is adaptation techniques and funding sources for adaptation activities. The SUSTAIN secretariat could serve as 'extension agents' to member states on key vulnerabilities, successful techniques to adapt, available resources for adaptation – especially for those in less developed countries – and in general foster a better understanding and ability to develop adaptive capacity.

The Network would allow for easy exchange of ideas, learning, and available resources and technologies for participants, ultimately giving Network participants preferential treatment in any agreed multi-states emissions trading regime.

To help promote ideas emerging from the Network, an Innovation Expo could be used to showcase the 'latest and greatest' greenhouse-friendly technologies and initiatives.

Collaboration with *The Climate Group*, a non-government broker of international climate change policy, would help to establish and promote such a network. Given their extensive expertise in climate change policy, and existing links to international networks and business groups, this group would be in a prime position to help build the critical mass that is needed.

I recently had the opportunity to spend a few weeks in Cape Town, South Africa, and discussed this idea with several colleagues for a reaction. All were highly enthusiastic that the Western Cape Province would jump at this opportunity given the vulnerability of the incredible biodiversity of the Cape Town area. Some South Africans even pointed out to me the large number of similarities between the two SAs, including strong intellectual pressure to implement a sustainability agenda, typical blocking special interests and lagging federal efforts. In fact, Western Cape might be a good co-chair for the Network, particularly given its status as an economy in transition.

Adelaide would hold the inaugural meeting of SUSTAIN in, say, October 2007 (two months prior to the Conference of Parties (COP)) in the hope of stimulating greater efforts from nation states by a positive example of cooperative actions.

'Sustainability champions' with high profile visibility could be invited to help launch and/or maintain momentum – people such as Robert Redford, Bill Clinton, Prince Charles, Al Gore, Walter Hewlett, Jeff Immelt (Head of GE), Sir John Brown, Larry Page (Co-Head of Google), Arnold Schwarzenegger, John Coomber (Swiss Re CEO), Mayor of Zurich, Peter Darbee (CEO of Pacific Gas and Electric), Australians Tim Flannery, Robyn Williams and Ian Lowe. Many others like them could likely be enticed.

After the initial meeting and the establishment of a secretariat with a number of technical experts, this group should take on the obvious name: 'The Adelaide Network', thus helping to put Adelaide in as prominent a place as a climate policy city as the Kyoto Protocol has done for the visibility of that city.

IV. Ideas for South Australia to help meet sustainability goals for climate change

2. 7/11 Paybacks: doing well by doing good

- **Mandate energy efficiency standards for buildings and appliances that produce a payback of less than 11 years (roughly equivalent to 7% Return On Investment (ROI))**
- **Require new industries to implement energy efficiencies within industrial processes with better than a 3-year payback.**

Energy-efficient standards for buildings and appliances

Climate change action is a long road. This is a problem that requires action over many years, as well as courage and foresight from decision makers, stakeholders and the public.

Across the world, governments and businesses are beginning to face up to the big decisions around sustainability. How we balance short-term growth and prosperity with equity, sustainability and greenhouse reductions, are the questions that many jurisdictions are grappling with; given the vast scale of climate change, such questions can seem overwhelming.

On many levels we are currently reliant on practices and infrastructures that are ultimately unsustainable. So the question is, where do we begin to reverse the growing emission levels?

Of course, we should start with the 'easy' things – the 'low-hanging fruit'. And the lowest hanging fruit in reducing greenhouse emissions is cost-effective energy efficiency.

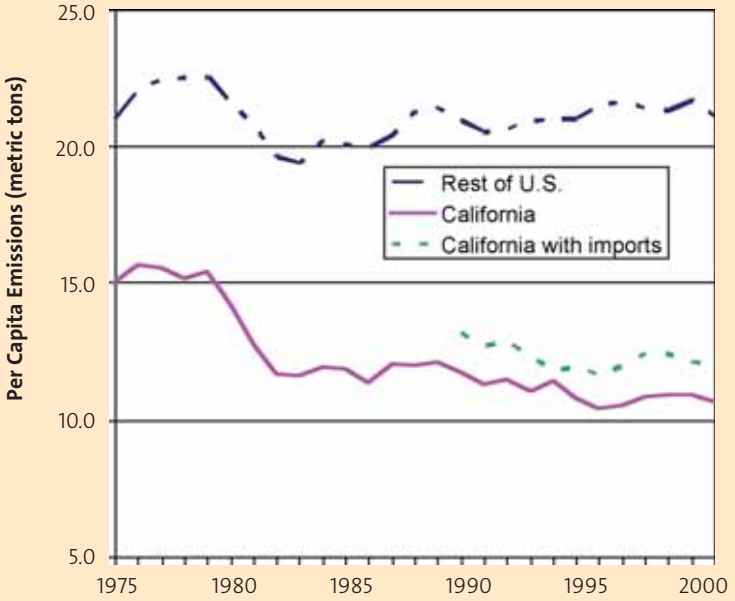
'Low-hanging fruit' – Calafate Bean, Patagonian Andes

My Vice President, Dick Cheney (most recently noted for his bad aim while hunting), has said that energy efficiency is merely 'personal virtue' that doesn't equate to any real energy production. Well, as we will soon see, nothing could be further from reality in the US. Energy efficiency in Australia as well is a largely untapped source of real energy savings and real costs savings. It displaces the need for a significant fraction of current energy supply production and thus presents a classic win-win situation.

These savings are not trivial. For example, in California in 1975 after the OPEC oil embargo we introduced performance standards on refrigeration in an attempt to curb the state's spiralling energy demand. Industry cried foul, claiming that the standards would lead to smaller and more expensive fridges. The result was the opposite, particularly after the US as a whole adopted similar standards some years later. Fridges became larger, cheaper and much more efficient, saving money for consumers as well as saving greenhouse emissions.

The savings from this refrigeration standard, which spread across the whole of the US, was recently calculated at some 20 billion US dollars. The energy saved from *just one appliance* has been the equivalent to one-quarter of the energy produced by the entire nuclear industry in the US.

California Efficiency Standards
Figure 1: Per capita CO_2 emissions in California and the rest of the U.S[2]



California State Policy Establishes Sustainable Energy as a Priority
California's success in energy efficiency has been guided by state policy that places energy efficiency at the top of the state's priorities. The Energy Action Plan[3], adopted by the state's energy agencies, endorsed by Governor Schwarzenegger and updated in 2005, establishes a 'loading order' of preferred energy resources. Energy efficiency is the state's top priority procurement resource, followed by renewable energy generation. This loading order guides all of the state's energy policies.

2. Source: Oak Ridge National Laboratory, 2004

3. California Consumer Power and Conservation Financing Authority (CPA), California Energy Resources Conservation and Development Commission (CEC), and California Public Utilities Commission (CPUC), *Energy Action Plan*, Adopted May 8, 2003 by CPUC; April 30, 2003 by CEC; and April 18, 2003 by CPA. Available online at www.energy.ca.gov/energy_action_plan/2003-05-08_ACTION_PLAN.PDF. Letter from Governor Schwarzenegger to CPUC President Peevey, April 28, 2004. CEC and CPUC, *Energy Action Plan II*, September 21, 2005. Available online at www.energy.ca.gov/energy_action_plan/2005-09-21_EAP2_FINAL.PDF.

IV. Ideas for South Australia to help meet sustainability goals for climate change

California Efficiency Standards
Figure 2: California's annual energy savings from efficiency programs and standards[5]

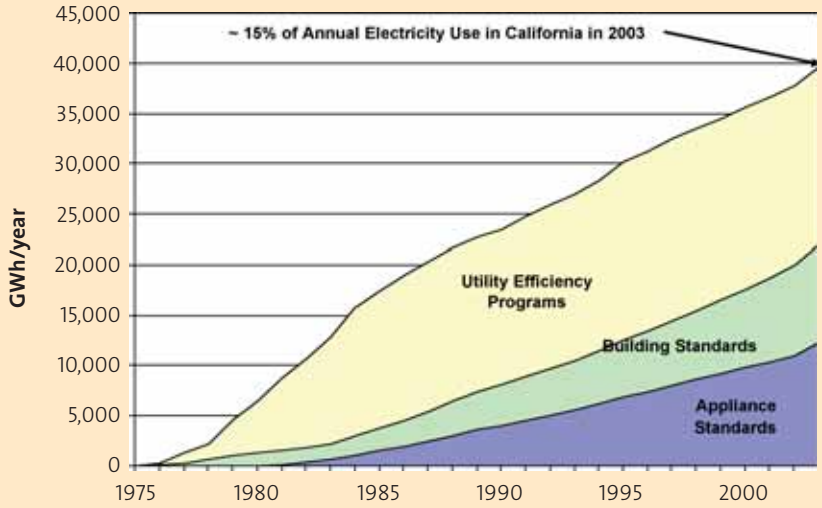


Figure 2 shows the annual savings from California's energy efficiency programs and standards, which represent a few of the Pacala and Socolow 'wedges'[4] that are essential to California's efforts to reduce its greenhouse gas emissions.

Since the mid-1970s, taking into account the effective lives of the measures installed or affected by standards, California has saved a total of 12,000 MW of peak demand, equivalent to avoiding 24 large (500 MW) power plants, and about 40,000 GWh each year[6]. Roughly half of the historic savings have come from ever-strengthening standards, and the other half from utility programs.

4. Pacala and Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, www.sciencemag.org, August 13, 2004 Vol 968 305, pp 968-972.

5. California Energy Commission, *Implementing California's Loading Order for Electricity Resources*, Staff Report, Publication CEC-400-2005-043, July 2005, Figure E-1, p. E-5.

6. California Energy Commission, *Implementing California's Loading Order for Electricity Resources*, Staff Report, Publication CEC-400-2005-043, July 2005, p. E-4.

California Efficiency Standards
Figure 3: United States Refrigerator Performance

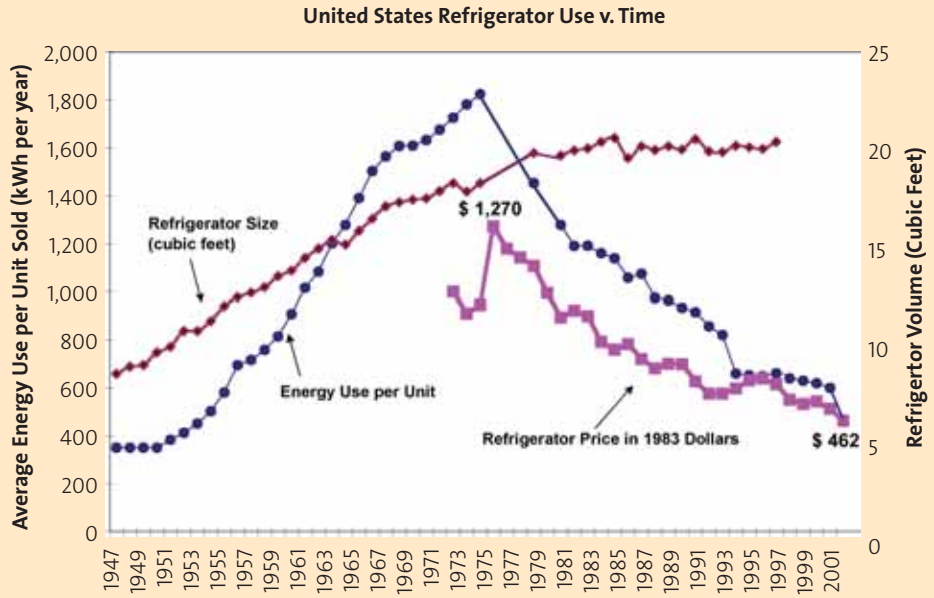


Figure 3 shows improving efficiency of refrigerator units since the 1970s, brought about by setting standards, whilst at the same time these units became larger in size.

IV. Ideas for South Australia to help meet sustainability goals for climate change

California Efficiency Standards
Figure 4: Electricity Use of Refrigerators and Freezers in the US compared to Generation from Nuclear, Hydro, Renewables and ANWR (Arctic National Wildlife Refuge)[7]

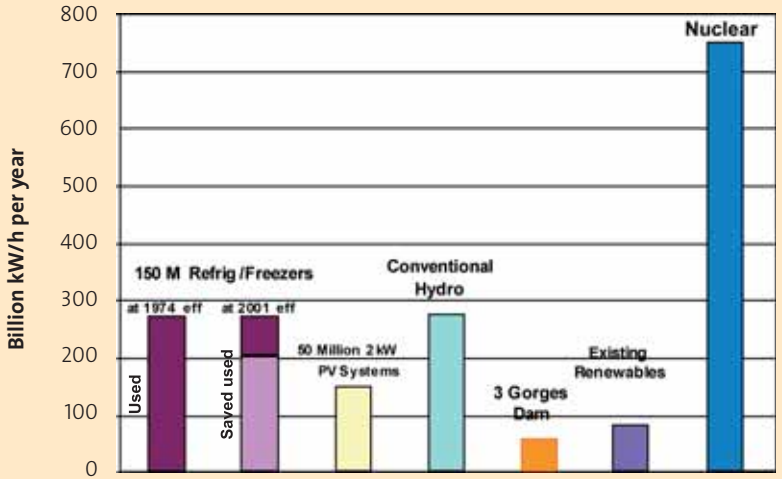


Figure 4 shows how the energy savings achieved since 1977 for the US as a whole through improving the efficiency of refrigerators and freezers equates to more energy than existing renewables, twice the energy potential for the drilling proposed by oil interests and the Bush Administration in the Alaska National Wildlife Refuge (ANWR), and about a quarter of the nuclear electricity generated in the US. Significant savings indeed – and from just one appliance!

In total, the three decades of energy efficiency programs and standards have resulted in energy efficiency savings today equivalent to approximately 15 per cent of California's energy consumption, or an increase of about half a per cent per year over the last 30 years. In reality, the actual state-wide savings are even greater, for two reasons. First, the utility efficiency programs shown here include only those savings reported by the regulated investor-owned utilities in the state, which provide about 75 per cent of the state's load. Secondly, these savings are not all-inclusive; for example, electricity reductions from banned electric resistance heating in the state are not included in the energy saving calculations.

7. Rosenfeld, A, H (Commissioner, California Energy Commission) 2003, *Sustainable Development, Step 1: Reduce Worldwide Energy Intensity by 2% Per Year*, Talk at Global Energy International Prize Presentation and Symposium, 19 November, University of California, Berkeley, viewed 29 October 2006, www.Energy.CA.gov/commission/commissioners/rosenfeld.html.

Vice President Cheney has advocated drilling in the now-protected Alaska National Wildlife Refuge (ANWR) to produce more energy. However, the energy savings in the US alone from just this one efficiency performance standard on refrigerators/freezers has already saved more energy than could be produced by two ANWRs (see Figure 4) – and this without the threats to the fragile ecosystem that oil production might engender. 'Personal virtue' primarily says Mr Cheney about energy efficiency? Energy performance standards are just good policy that saves energy and money and reduces the need for expensive or risky energy supply ventures – and that does constitute personal virtue too, of course.

So the question is how we best achieve the energy gains via energy efficiency?

In my experience, realising these gains needs rules. Despite the fact that energy efficiency is in the interest of consumers and businesses alike, and that information on cost-effective paybacks is readily available to those willing to surf the web, many energy efficient steps are still waiting to be taken.

In the interests of sustainability we need to overcome this gap of information and behaviour. And we must be honest that, although education and awareness-raising are significant first steps towards sustainability, empirical evidence demonstrates over and over again that volunteerism has its limits. Billboards admonishing drivers to be safer undoubtedly reduce accidents somewhat. But imagine the carnage on the highways if traffic lights and speed limits were strictly voluntary!

In addition to knowledge and behaviour gaps, up-front investment can also be a barrier to sustainability. However, a higher initial investment will often prove to be economical in the longer term. If an initiative has a payback period of less than 11 years (approximately equivalent to a 7% return-on-investment and better than the average mortgage interest rate), then I call this a '7/11 solution'. These solutions make good economic and environmental sense.

By introducing performance standards for materials and appliances we use in our homes and buildings, and improving the efficiency of the processes in our industries, government can help homeowners, renters and businesses to overcome the barriers of up-front costs, saving money for householders and businesses in reduced energy costs. This will also reduce greenhouse gas emissions, since less energy is needed to provide the same services: heating, cooling, lighting, transportation, etc. As noted in Box 2, California has saved some 40,000 GWh[8] per year. At $0.10 per kWh, that implies a rough saving state-wide of about $4 billion annually just for consumers!

In a 7/11 solution for South Australia the State Government would mandate standards in buildings and appliances that produce a cost-effective payback for consumers and businesses. The 7/11 criteria could become the threshold for the mandate. Standards would be announced immediately but phased in over time, allowing local industries time to

8. One gigawatt hour is one billion watt hours – meaning the use of one watt of energy for one hour

IV. Ideas for South Australia to help meet sustainability goals for climate change

adjust their supply, and new industries time to sense the opportunity and fill the niche with profitable products like double-paned and other even more energy-efficient windows (e.g., "low-e" glass now a common building material in California, even at mass market building materials chains like Home Depot).

7/11 standards would probably need to grandfather (or exempt) existing businesses, homes and appliance owners so as not to penalise existing inefficiencies that were based on decisions of consumers before there was a sustainability goal. Rather, the standards would apply only to new purchases, new extensions (remodelling projects would need to use new standards for materials and products) or new buildings.

The mandate would potentially apply to, among others:

- air-conditioning
- efficient lighting
- hot-water services
- solar photo-voltaic systems
- small-scale wind generators
- domestic appliances
- double-pane windows
- insulation
- refrigeration
- heating
- stand-by energy
- overall energy consumption.

Payback on renewable systems (such as solar photo-voltaic) could also be encouraged through a time-of-day pricing scheme, which allows consumers to sell electricity back to the grid at a premium during peak times when energy is in short supply. This strategy is being implemented in California by the Pacific Gas and Electric Company – at its own expense for the meters – since the utility has decided that the costs of peaking power plant construction are greater than investments in consumers' energy efficiency and incentives for the feed-in of distributed electrical energy during hot summer daytime hours.

At issue still is whether a consumer could actually receive a payment from the utility when more energy is produced by the consumer than is purchased from the utility, or whether consumer-produced power could only offset energy units consumed when the sun is not shining. South Australia might consider the pros and cons of such a strategy.

All energy-related products would be labelled at point-of-purchase according to their payback period (for example, 18 months for a washing machine), encouraging consumers to purchase efficient appliances with a cost-effective payback period. Of course, precise calculations require detailed knowledge of each particular application's circumstances, but a rough aggregate performance label would be sufficient for most consumers as a reasonable rule of thumb.

The existing processes for the introduction of appliance standards at a Federal level work on mutual recognition principles. In effect this means that appliances from interstate which fail to meet South Australian standards cannot be banned from sale here. Although recent changes in standards through these Federal processes have been encouraging, generally movement is slow.

The most effective way to reach 7/11 energy standards here in South Australia is most likely to be either through the use of building/planning approvals (as per the recent 5-star rating requirement for water heaters in new homes), or through the regulation of licensed tradespeople. Furthermore, training of such workers and other service providers in the advantages of such 'green building' techniques would add further impetus to improving energy efficiency and reducing demands for primary energy – especially in times of peak load in hot weather.

Energy efficiencies within industrial processes

Removing inefficiencies from industrial processes is another win-win for emissions reduction – the less energy used by industry in manufacturing and processing, the better for the industry itself and ultimately the better for the environment.

For industry, however, there are other ways to make money, and the return on other investments can often yield 20% per annum or more. With this in mind, it is more difficult to build the case for a 7/11 return on investment, with the 7% return falling short of other investment potential.

So we need to find a more competitive standard for energy efficiency, and in this instance Victoria seems to have found a successful compromise. The Victorian EPA has recently introduced legislation requiring proponents of new industry, or extensions to existing industry, to implement any energy efficiencies with less than a three-year payback (equivalent to a 23% ROI).

I believe that replicating the Victorian experience and mandating a three-year payback for energy efficiencies within new industries is an important step for the South Australian Government to take – a step that will create savings in costs and emissions, and help set a sustainability tone within South Australia's industry sector.

3. Power Parks

- **Develop hubs of renewable energy and low-emission technologies – promote learning-by-doing operations**
- **Require proponents of large-scale carbon-emitting infrastructure to investigate renewable energy options for proposed expansions**

Whilst we must begin by picking the low-hanging fruit of energy efficiency, we must not shy away from the bigger decisions that are on the horizon.

If South Australia is to have any chance of meeting the Premier's 60% emissions reduction and contributing to leading by example on a global solution, then renewable and low-emission technologies must form the biggest share of your State's energy supply into the future.

South Australia has already done a great job in establishing renewable electricity projects, to the extent that it now provides 51% of Australia's wind power generation, but in the overall context of the State's energy supply the real contribution of renewable energy is still small. As such this represents just the beginning.

IV. Ideas for South Australia to help meet sustainability goals for climate change

Over the next generation South Australia will be faced with a number of important decisions around energy supply. Leigh Creek, your only coal mine and the fuel source of the Port Augusta power station, is due to run out; the expansion of the Olympic Dam mining operation at Roxby Downs will greatly increase the energy demand in the State, as will the underlying growth implicit in your population target.

The important principle here is that in meeting these changing demands we do not repeat the mistakes of the past. We now know the sustainability implication of carbon-intensive dependence. As a consequence, when there is significant new, long-lived energy infrastructure to be built we must ensure that it is low-emission and sustainable.

Hubs of renewable energy and low-emission technologies

To help supply the State's future energy demand I am proposing that the State investigate the idea of Power Parks, or hubs of renewable and low-emission technologies. These Parks would potentially be established in regional areas where they could, to the extent feasible, combine solar, wind, geothermal, and carbon capture and storage (CCS) technologies.

The benefit of combining these renewable and low-emitting sources in a single geographical location would be that an economy-of-scale would be created, ensuring that the often-prohibitive cost of infrastructure, particularly transmission lines, could be shared between the proponents. Proponents could also share their cost of connection to the grid.

Not only would the Parks provide a significant reduction in the greenhouse intensity of your State's energy supply, but they would help showcase the State as a centre for innovation and renewable energy development.

Regional communities would benefit from the increased opportunities and investment that would result. And for successful participants – those who have made these Power Parks work through a learning-by-doing approach – significant business opportunities would result. These people would then hold the intellectual capital on this idea, not to mention the technological capacity. If successful, this could be a model program that the State could export. The learning-by-doing so gained is marketable, particularly as increasingly stringent standards are implemented on carbon emissions all over the world and shadow prices on carbon escalate. Early learners will have many later customers for their skills!

The South Australian Government could bring participants to the table, coordinating efforts to find the least-cost infrastructure solutions for Power Parks.

Cathedral Rocks, Eyre Peninsula

So where in South Australia would Power Parks be a viable option? Siting of the Power Parks would look to optimise the existing potential of wind, geothermal, solar (including solar thermal) and any other sources, in relation to the current high voltage transmission system that runs from Port Augusta and Adelaide, to Mount Gambier in the south-east, and high voltage extensions to Eyre Peninsula, Olympic Dam and Leigh Creek with inter-connectors to Victoria (see map below).

Major electricity transmission across South Australia[9]

The optimal locations in SA for wind generation appear to be coastal and elevated rural areas; for geothermal they are widespread and under exploration; for geosequestration they appear to be in the remote north of the State; and for solar most of the State is quite suitable. Based on a scan of where renewable energy opportunities, demand and access to the grid overlap, I think four potential locations jump out for the siting of these parks:

- the south-east of the State
- the northern pastoral districts
- close to Roxby Downs and other potential major energy intensive infrastructure expansions
- close to existing gas fields in the State's north-west

9. Source: ETSA Utilities *State Distribution Map*

IV. Ideas for South Australia to help meet sustainability goals for climate change

Case Study – Emerging Energy Parks

Scarce water resources on Eyre Peninsula, in the Iron Triangle region, and at Roxby Downs are contributing to projects for seawater desalination and wastewater recycling, with strong linkages to the regions' abundance of wind and solar energy potential. A number of small-scale energy park proposals have been put forward by various proponents to provide renewable electricity and linking to desalination and water supply. Small to medium scale trials, and planning for larger-scale projects, provide employment opportunities in local communities and will assist them to become more sustainable whilst meeting their energy and water needs. Furthermore, with strong links to university research and collaboration, these developments can help South Australia become a world-renowned centre for research and technology deployment in climate change mitigation and adaptation.

Whyalla Solar Oasis Project
The Whyalla Solar Oasis Project is a concept proposed by a consortium of the Whyalla City Council, Wizard Power and United Utilities to use solar energy for electricity and to power a desalinisation plant for the town – leading to a self-sufficient water supply and ultimately reducing reliance on the River Murray.

Eventually, two hundred parabolic dishes of approximately 400m^2 each will collect the sun's heat for conversion to electricity and to desalinate water.

As a first stage of the project, a scaled-down demonstration plant is planned for construction within the next 12–18 months.

Aquasol Port Augusta Solar Desalination
Aquasol is another proponent seeking to build a solar-powered desalination plant in Port Augusta, providing water for the town and contributing to the water needs of the region, including mining operations.

It is too soon to know if all projects can be fully developed but there are obviously opportunities to develop long-term sustainable solutions in rural and remote areas that have scarce water resources yet significant opportunities for growth.

Current renewable energy projects with private sector participation give hope for innovation and greater deployment and use of renewable energy. These should be encouraged and supported by governments wherever possible, with emphasis on collaboration and a diverse mix of energy generation sources and industries.

Investigate renewable energy options for proposed expansions

Why site near mining operations or major infrastructure? Well, from what I've heard South Australia is on the verge of a mining boom. The upcoming expansion of the Olympic Dam mining operation alone is projected to increase the State's greenhouse gas emissions by more than 10%, should this energy demand be met through existing sources.

Although the EIS process is under way, informal calculations projecting the massive use of diesel fuels, fossil fuel powered electricity and desalination have, informally, ranged from around a ten percent to several tens of a percent increase in South Australia's electrical demand and greenhouse emissions.

It would be difficult to even hold the line on State emissions with major mining expansions without a sizeable proportion of the energy coming from green power, let alone having emissions progressing toward the 60% emissions reduction target. This is a prime area for innovation and cooperation if there isn't to be a 'mining-sustainability' train wreck coming down the track.

It will be critical that renewable energy options, such as power parks, are part of the supply of these major projects while there is still time to influence the development strategy.

One way of ensuring that proponents of major projects consider renewable energy options is to make it a requirement of the current planning and approvals process. Proponents would be required by law to assess a range of economically viable options for renewable energy supply and use, and report the results of such an assessment to government. Defining what is 'economically viable' is, of course, a political negotiation on how to value present versus future costs and benefits, etc, but there needs to be some negotiations on the mining expansion issues if long term sustainability targets are to have a remote chance of being met.

4. Cars on a diet – encouraging efficient cars

- **'Feebates': differentiated registration and stamp duty costs to encourage efficient vehicles**
- **Green number plates for efficient cars, entitling them to parking privileges.**

Subway sign

In fifty years time we will look back at our inefficient or inappropriate vehicles as four-wheeled dinosaurs of the age (much like the overweight, tail-finned monsters of the 1960s with 300 horsepower V-8s, epitomized by Elvis' pink Cadillacs) – infamous for their excessive use of fossil fuels for the services they provided.

IV. Ideas for South Australia to help meet sustainability goals for climate change

The imperative of reducing our greenhouse emissions, reinforced by impending 'peak oil', ultimately means that it will be illogical to use our increasingly precious fossil fuel allowance in driving the kids to school, parents to the office or down to the shops in 3-tonne 4wds appropriately designed to ford meter-deep outback floods!

Whilst 4wds will continue to be important and necessary for those who really need them – such as farmers, tradespeople and outback recreational drivers – their use as urban people movers will be outdated, if not already anti-social.

But where does this leave us in the short-term? We can't go punishing people who already own 4wds – like the coal miners mentioned earlier, they didn't buy a 4wd on purpose to damage the climate. But damaging it they are indeed doing, so the question is how to convert to more sustainable transportation systems? On the one hand, urban design – including mass transit alternatives that are safe and attractive – is part of the solution. On the other hand, a revolution in personal transportation vehicles towards dramatically improved efficiency is simply *required* if the 60% emissions reduction target is to be approached. In connection with the latter, we can begin to create a social message about personal responsibility via vehicle choice around the use and purchase of 'urban people movers', or alternatively a sense of social good around the use of smaller, lighter and, in any case, more efficient cars.

In California we already have such incentives for fuel-efficient cars. I own a hybrid vehicle and in recognition of the social good implicit in my using a fuel-efficient vehicle – reduction in greenhouse emissions, air pollution and our reliance on imported oil – I am rewarded with a ~$2500 rebate from the State government. By giving people a cash incentive they are being rewarded in a way that makes a social statement reflective of the value system in the State.

But let's be honest, encouraging these types of shifts is challenging for those with a vested interest in the manufacture and sale of large passenger vehicles. As an egregious example of the wrong direction my federal government is taking on vehicle efficiency – in addition to foot-dragging on gas mileage standards – incredibly, a person wealthy enough to buy an over 3-tonne 'car' can deduct $25,000 from his/her Federal income tax return (compare that to the mere $2500 State rebate for driving a hybrid)! What an amazingly perverse incentive to sustainability this big deduction implies. And it is inequitable too, as only wealthier citizens benefit – while causing social harm in the process. California has opposed this by its own law regulating tailpipe emissions, and at the moment that is in court – sued by the Bush administration and the auto industry. Now, several other states have passed similar rules and it is my hope that Detroit runs out of lawyers trying to head off all this passionate disdain at automobile inefficiency and perverse subsidies for non-sustainable vehicles. Too bad it is so far all from progressive states and none from Federal regulations – the much more efficient way to do this.

Failure to recognise that a change toward fuel-efficient vehicles is inevitable will result in long-term harm to the automotive industry. Stalling for too long will mean that it hasn't the right kinds of efficient vehicle to sell when the demand for efficient cars soars – as it is currently in the US, given the near-doubling in gasoline prices over the past year (resulting from supply/demand conditions, and having little to do with environmental policies). This has now happened in Detroit where the automobile industry has successfully resisted the fuel standards for years. As these standards are imposed as a result of social and environmental imperatives, the industry is in no position to respond quickly enough to avoid a major loss. What is most sad is that this 'self-inflicted wound' by the big three automakers in the US will both delay our achieving emission cuts and lead to serious economic problems for auto workers – created in large part by their managers' resistance to adapt to the sustainability imperative. Hopefully, such a 'train wreck' will be avoided in Australia, but early signs are not encouraging.

In the US it has taken the tragedy of Hurricane Katrina to create a social 'tipping point' around climate change action and to loosen the grip of vested interests over the debate. Perhaps it will take similar climate-related events to change the landscape in Australia – drought, bushfires or cyclones hitting major cities? But I hope not. Being anticipatory is a much better pathway in my view. Before we face a dramatic shift in public consciousness, there are some steps that we can take now to begin to reward low-emission vehicles and behaviours.

To help South Australia begin the transition towards a low-emission fleet I am proposing a suite of initiatives that encourage fuel-efficient cars, bearing in mind the need for this transition to soften the impact on vulnerable people and vulnerable stakeholders.

'Feebates' to encourage efficient vehicles

Feebates are an incentive to encourage motorists to switch to fuel efficient/greenhouse efficient vehicles over time. The feebates approach applies greater fees for inefficient vehicles and reduced fees for fuel-efficient vehicles, structured in such a way as to ensure cost-neutrality for consumers and government. The feebates concept would be applied to sales stamp duty as well as annual registration and on-road costs. There would be a slow transition to any increasing duties on current vehicle categories so as to allow a transitionary period for car manufacturers and time to adjust for consumers.

How feebates could be applied

Feebates could be applied using the different vehicle categories that already exist (based on the number of cylinders), and in time these categories could be revisited to better reflect fuel efficiency, not cylinder counts or engine displacement standards.

It is also possible to introduce a new category of ultra fuel-efficient vehicles, whilst allowing the current vehicle category types to remain. This would reduce additional red tape and enable new opportunities to reward owners of the most fuel-efficient vehicles.

IV. Ideas for South Australia to help meet sustainability goals for climate change

- **Differentiated stamp duty**
  Currently, stamp duty is paid on the sale of new and second hand vehicles based on their financial value. The charge is proportional and stepped, such that the duty on a new $30,000 vehicle is approximately $1100 whilst the duty for $3000 vehicle (likely to be second hand) is $60.

  Increasing the differentiation of this charge will have a greater impact on new vehicles, creating an opportunity to influence the purchase of more fuel-efficient vehicles.

- **Annual registration and on-road costs**
  Currently, there is a range of annual cost components including registration, third party bodily insurance, stamp duty on bodily insurance, the Emergency Services Levy, and administration fees.

  These costs vary by approximately $170 per year between the smallest and largest passenger-type vehicles, based on the number of cylinders. The idea of feebates would be to review and revise the cost differences to create a greater incentive for fuel-efficient vehicles.

Green number plates

Owners could be provided with a new category of 'green' number plates, entitling them to rebates and visible publicly as a 'sustainability champion' recognising their decision to purchase a fuel-efficient vehicle.

In addition, the least efficient new passenger vehicles would receive an orange plate at standard (or elevated) cost unless a premium was paid for an alternative plate.

Parking and other privileges

Those cars rewarded with a green plate would then gain incentives in terms of priority parking and other privileges that would be worked out over time. For example, parking privileges could allow priority access to the lower floors of multi-story car parks, or to selected green parking zones throughout the CBD and metropolitan centres. During rush hour, green-plated cars may gain access to priority lanes through the city (perhaps existing bus lanes). In California, my bumper sticker from the Motor Vehicle Bureau allows me to drive solo in the carpool lane – a considerable reward for getting better than twice the state average gas mileage via my hybrid vehicle. If we want to see social change towards sustainability, and if we are serious about achieving the sustainability targets, we must find ways to encourage good practice and discourage inefficient practice.

5. Rewarding sustainable farmers

- **Create a green recognition symbol to reward sustainable farming practices**

So far the ideas that I've outlined in this report have dealt strictly with greenhouse emissions reduction. However, the reality is that, even if we successfully reduce our emissions, some degree of climate change is already locked in.

Ultimately this means that, as well as reducing our emissions, we must be adapting to the impacts of climate change – building resilience into our natural systems so that they can cope with the changing climatic conditions.

As part of my residency I was able to visit the farming communities of Jamestown and Orroroo in the Mid-North of South Australia. Such is the nature of the climate in these areas that farmers may only make a profit three years in every ten. These communities are well versed in dealing with climatic variability, and the people that I spoke to demonstrated a strong awareness about the risks of climate change to primary producers.

Indeed, many farmers were already committed to sustainability principles, and some were even taking steps to reduce greenhouse emissions from their operations.

One Orroroo farmer, Wayne Byerlee, showed me the minimum-till seeding machinery that he and his father Malcolm had purchased to enhance the long-term sustainability of the family farm. The till that they had purchased dropped seeds into a knife-like furrow, ensuring minimum topsoil disturbance; this not only reduces emissions from tillage but helps to maintain the integrity of the topsoil and the long-term viability of his cropping.

But, of course, sustainability measures like the one that the Byerlees are using come at a price, and this can prove prohibitive to many. These farmers are providing a service to the South Australian community and we need to look at rewarding their best-practice, to help spread awareness and uptake of these behaviours. I believe that it is government's role to help make sustainability more appealing to farmers and to reward those willing to take the lead.

Orroroo farmer Wayne Byerlee shows off his minimum-till seeding/chemical applicator machinery, purchased to enhance the sustainability of the family farm.

IV. Ideas for South Australia to help meet sustainability goals for climate change

Ultimately such assistance may take the form of subsidies for sustainable farming (in particular, if there were a cap-and-trade system and a shadow price on carbon, farmers could be directly paid for such carbon-saving or carbon sequestering practices), but initially an incentive can come in the form of recognition and promotion for those doing the right thing.

A recognition symbol for produce of farmers certified as meeting agreed sustainability targets might help provide recognition and promotion for their efforts. A 'sustainability' or 'greenhouse-friendly' label could reward best practice on:

- biodiversity and revegetation
- greenhouse emissions
- water quality protection and efficient water use.

There is an assumption that a consumer premium for sustainability products would be passed on to the farmer via the market chain. However, in the short-term, support could be provided so farmers could create co-ops to verify and sell to sustainable suppliers and manufacturers, to help ensure that the rewards are realised.

There are already a number of labelling success stories in Australia, including 'Australian Made', 'Dolphin Safe', 'The National Heart Foundation' and 'Organic' labels. Such schemes not only help to promote a consumer-driven demand for sustainability, but they have wider benefits in terms of education and awareness-raising on an issue. Promotion of a 'greenhouse friendly' or 'biodiversity friendly' recognition symbol would need government and industry support for consumer education.

Case Study – Eastern Hills and Murray Plains Catchment Group

The Eastern Hills & Murray Plains Catchment (EH&MP) in the eastern Mount Lofty Ranges covers about 250,000 ha. The higher rainfall areas are mainly used for grazing and the plains for dryland cropping, but there is also a growing diversity of activities. The EH&MP Group is an umbrella for several Landcare groups and has a good record of community involvement in on-ground action, all guided by a Local Action Plan.

These landholders' activities include traditional grazing and cropping, piggeries, sustainable firewood production, eco tourism, dedicated revegetation and various combinations of these.

Large areas have already been revegetated and watercourses fenced off, but there remains an enormous challenge to reverse trends of land degradation, improve biodiversity, and make farms more sustainable. EH&MP farmers have asked themselves the question: 'You do all this environmental work on the farm, but how do you know that it has really made a difference?'

To measure progress and answer the above question, fourteen members of the Catchment Group recently completed the first stage of an Environmental Management System (EMS). This required each landholder to plan, implement, evaluate and review sustainable land management on their farm. Each of these farmers has now had the planning component of their EMS audited and has moved on to the implementation phase. The model they chose is the catchment-based Australian Landcare Management System (ALMS). Everyone in the catchment can participate, regardless of the enterprises on their farm, and information about the condition of the catchment can be shared.

ALMS has the added benefit that it requires attention to biodiversity, setting high standards for environmental management; it links to the local Catchment Management Plan and conserves native vegetation, which also helps to increase carbon storage in plants and the soil.

ALMS represents a big step forward for landcare, providing motivation for landholders who have taken the first steps but lack commercial incentives to go further. Farmers comply with the ISO 14001 Environmental Management Standard, and all have been subjected to second-party audits. Third-party audits and full certification could be a future step, depending on costs. Spokesperson Bruce Munday explains, 'When the EH&MPCG first became interested in EMS we were perhaps a bit starry-eyed about possible market benefits that might (and probably should) arise from being seen to 'do the right thing' by the environment. We are now a bit more worldly wise, but nonetheless, recognition is still one of the key drivers for those taking on this challenge'.

These farmers are proud of what they are doing and want others to know they are looking after our environment. They need carrots to make it easier to join this movement.

IV. Ideas for South Australia to help meet sustainability goals for climate change

6. Reshaping research

- **The three main South Australian universities and SARDI to form a climate change mitigation and adaptation research partnership:**
  - **responding to needs of South Australian agencies and stakeholders**
  - **being more competitive on Federal grants.**

Climate change is a fast-growing field of research. Every day we are learning more about the climatic changes we might expect and their impacts at a global level.

However, this research doesn't necessarily help us to answer the most pressing questions at a local level. For example, what will climate change mean for irrigation and water supply in SA? Which areas will be most susceptible to rising sea levels and storm surges? How should our agricultural communities be looking to adapt? And where are the greatest gains in energy efficiencies for our local manufacturers?

To inform these types of questions we need State agency and stakeholder-driven research programs in South Australia, and South Australian researchers accessing Federal research grants.

To help make this happen I am proposing a strengthening of the strategic partnership that we have already begun between the three major South Australian universities and the South Australian Research and Development Institute. This should focus on climate change research that identifies vulnerabilities, adaptation strategies, and opportunities for industry and the community for more cost-effective ways to meet the State's sustainability target.

A partnership on climate change would be structured to respond to both agency and departmental priorities and to stakeholder needs in South Australia, and to coordinate bids for Commonwealth research funding.

Such a partnership would expand from the existing chair of climate change at Adelaide University. I suggest this could help to build an argument for a 'COAG Climate Change Centre on Vulnerability' to be located in South Australia.

The Department for Further Education, Employment, Science and Technology (DFEEST) may be in a good position to initially coordinate such a partnership, given the promising work on collaboration that has already been undertaken through their *Constellation* SA program.

Responding to needs of South Australian agencies and stakeholders

Collaborative research to meet agency and stakeholder needs in South Australia would not likely happen unless research grants or 'Requests for Proposals' (RFPs) can be redefined; this will involve supplementing the typically narrow and competitive research grants process, with a process that rewards grant proposals that are both cross-institutional and cross-disciplinary, as well as involve in a direct way both stakeholders and agencies.

Starting with the State Government and moving into industry and community more widely, reshaping climate change research in this State would require:

- a commitment to identifying cross-agency research needs
- a commitment to redefining RFPs to ensure cross-institutional and cross-disciplinary outcomes
- seed funding for RFPs from the State.

Potential South Australian Request for Proposals (RFPs)

Research will be required to answer the climate change mitigation and adaptation questions that are emerging from governments, businesses and communities. Potential proposals would have a problem-solving focus and crosscut normal agency or stakeholder boundaries, for example:

- changing irrigation and domestic water infrastructure and use in South Australia as a result of climate change
- identifying obstacles (like a manufacturing log jam of a mandated component) and exemplifying cost-effective energy efficiencies in building and appliances in South Australia (to meet 7/11 demand created when mandatory performance standards are finally implemented)
- regional development and rural adjustment – opportunities for new industries and managing risks for existing industries
- identifying ecological, infrastructure and water supply risks to the River Murray, including the lower lakes, Coorong and barrages (see RFP example over for more detail)
- improving energy and water supply capacities and efficiency in remote and indigenous communities.

IV. Ideas for South Australia to help meet sustainability goals for climate change

Research Proposal: South Australia's vulnerability to climate change regarding the River Murray, lower lakes and Coorong.

Whilst the potential impacts of climate change on the River Murray are broadly understood and are being refined, there could be more research to understand South Australia's vulnerability in terms of exposure to reduced flows, quality of water supplies and risks of algal blooms.

There are also potential physical risks associated with reduced flows to the lower lakes, rising sea levels, storm surges and greater sand movement.

During my residency, I travelled across all five barrages in the lower Murray lakes that separate marine salt water from fresh Murray water at the downstream edges of Lake Alexandrina and Lake Albert. As water already was seeping over the roads in spots at high tide, I was immediately conscious of a potential vulnerability to changing sea levels anticipated over the next 100 years and beyond.

The Goolwa, Mundroo, Boundary Creek, Ewe Island, and Tauwitchere barrages, which were constructed between 1935 and 1940, actively prevent reverse flow of salt water into the lakes from the Coorong during low flows and high tides, resulting in fresh water being available for water supply and irrigation. They are designed to withstand tidal pressure but not to obstruct floodwaters.

With diversions for irrigation and water supply, flows across the barrages are intermittent. In the past five years, flows have been so minimal that the barrages are mostly closed, and manual dredging of the Murray Mouth has been required to keep the Coorong ecosystem on life support. Recent crashes in populations of aquatic food plants and many other species including migratory birds indicate how vulnerable the ecosystem is to further change. The Coorong barrier dunes and lagoon system may also be vulnerable to rising sea levels. Restoring habitat inland may help some species adapt to changes.

The River Murray, lower lakes and Coorong are important for human settlements and are of international environmental significance listed under the Ramsar Convention. It is fitting therefore that this be a high priority for university collaboration, supported by government agencies.

Bolstering the case for federal grants
Currently there is a range of research grant opportunities for climate change through Federal grant schemes (including the National Collaborative Research Infrastructure Strategy (NCRIS)[10], The Low Emissions Technology Demonstration Fund[11], and Natural Resource Management funding programmes[12] etc.). However, anecdotal evidence suggests that South Australia has not been altogether successful in securing these grants, and may have missed opportunities for research money through a lack of coordination and collaboration on funding proposals.

A strategic partnership, coordinated by research 'brokers' within each university, would be a critical tool in helping to create the linkages between institutions, ensuring cross-disciplinary proposals that are more likely to succeed through the Federal grants process.

10. The National Collaborative Research Infrastructure Strategy is a Federal Government initiative aimed at providing researchers with access to the infrastructure and networks necessary to undertake world-class research www.dest.gov.au/sectors/research_sector/policies_issues_reviews/key_issues/ncris

11. The $500 million Low Emissions Technology Demonstration Fund is a flagship initiative of the Australian Government's Energy White Paper: www.dpmc.gov.au/publications/energy_future/index.htm *Securing Australia's Energy Future*. www.greenhouse.gov.au/demonstrationfund/

12. The Australian Government Department of Agriculture Fisheries and Forestry, has a range of funding programs for Natural Resource initiatives www.daffa.gov.au/natural-resources/funding-programs

7. 'Green with envy' tourism

- **Showcase SA 'green assets' tours based on sustainable principles.**
- **Create a menu of voluntary carbon offset programs for tourists.**

Sturt's Desert Pea

Throughout my residency I have been lucky enough to visit a great portion of South Australia. I have seen a number of natural gems – among them Kangaroo Island, the Eyre Peninsula, the mallee conservation parks and the Flinders Ranges – as well as beautiful (and tasty!) wine growing regions of Clare, the Barossa, McLaren Vale and the Coonawarra.

These are regions well worth showcasing as tourist attractions on their own. But, why not make tourism to these regions consistent with sustainable and 'green' principles, creating a tourism niche that I have called 'green with envy' tourism. I suspect that many visitors would choose the green option for their visits, if such a program were created, understood, and not too incrementally expensive.

IV. Ideas for South Australia to help meet sustainability goals for climate change

Showcase SA 'green assets' tours based on sustainable principles

By ensuring that tourists to these regions stay in energy-efficient accommodation, use low-emission transport (powered by bio-diesel or CNG, for example), eat locally-produced food and even offset – as an embedded fee in the price of the trip – some of their environmental impact with a contribution towards carbon savings, South Australia could create a whole new industry in yet another example of leadership in the doing-well-by-doing-good category.

Examples of 'green with envy' packages might include:

'Wine, Windmills and Whales'
A few-days trip from Adelaide in a bio-diesel bus visiting the McLaren Vale wine region (in particular, green wineries), the Starfish Hill wind farm at Cape Jervis, and the Southern Right Whales around Victor Harbor. Local experts in green production or buildings might be lined up for demonstrations of local sustainable activities.

'Red and Green Tours'
Tour of the Barossa and Clare wine regions, visiting wineries that strive for sustainability, the Barossa Bush Gardens run by Chris Hall, staying in eco-cabins, and indulging in local sustainable produce from the region. For the other 'red' part, a visit to southern Flinders Ranges could be included.

'The Eco Range'
Bike and/or hike tour of the Flinders Ranges, staying at the Rawnsley Park Eco Cabins (possible operator could be Tim Spurling of Barking Gecko Tours). Evening talk on the replacement of Leigh Creek coal with green power could be a part of the program. Of course, this, as the others, would be in vehicles using bio fuels to the extent possible and with carbon offsets as part of the package price (see over).

Green tourism carbon offsets

For 'green with envy tours' to include greenhouse offsets, it will be necessary to approximate the additional carbon dioxide emissions associated with the tour, but without becoming too precise in quantifying the emissions to a third decimal place – that would be 'crackpot rigor'!

Example: A Green with Envy tour for two people within Australia

Activity	Quantity	Greenhouse Intensity	Greenhouse emissions (tonnes CO_2-e)
Interstate Jet Plane Travel	1500 km Sydney to Adelaide (return)	1 tonne per person	2
Car travel (shared)	1000km	2.5 kg CO2-e/L and 100L @12L/100km	0.3 (would be less than half or this in a compact hybrid car)
Electricity (accommodation)	10 nights and days	1 tonne MWh and 0.5 MWh used.	0.5
Total Greenhouse Gas emissions	2.8 tonnes CO_2-e		

At $25/tonne CO_2 emitted 'shadow price' of carbon, the approximate costs would be $70 – very affordable – and in any case embedded in the package price, not explicitly listed (or it could be sponsored by willing businesses for the publicity of their participation).

Tourists would be able to choose from a number of accredited options to offset their greenhouse gas emissions and improve the State's environmental assets. For example, 'tick your preferred option':

- revegetation carbon credits
- renewable energy credits
- carbon credits for green building projects
- carbon credits for vouchers for helping less-well-off citizens buy efficient cars.

For travel within Australia, the additional cost to achieve a carbon neutral holiday is **not** a large premium when incorporated into the package. If travelling from overseas[13] then emissions will naturally be greater; however, offsets are likely to still be feasible – only a small percentage of the package price.

13. Emissions for air travel can be calculated using these online tools:
www.climatecare.org/britishairways http://www.chooseclimate.org/flying/mapcalc.html

IV. Ideas for South Australia to help meet sustainability goals for climate change

Create a menu of voluntary carbon offset programs for tourists

Carbon offsets would be purchased as part of the price of the tour, and the participants would get a special opportunity to express their preferences (see page 49) for offset methods by choosing which method of offset they prefer (such as carbon credits from bush restoration or renewable energy credits). The offset program could also be extended to a wider range of sustainable initiatives, with tourists potentially given the option to support more efficient building materials, affordable green building projects, or deep earth CO_2 sequestration, to name some options. And, as mentioned, some businesses might be willing to sponsor – or at least match – the tourists' contribution.

Giving each tourist the option to offset their greenhouse gas emissions for the trip via their favourite project would be a major component and innovation for the SA 'green with envy' tours approach. At first only a fraction of tour operators might sign up, but as success grows it is likely that many others will clamour to get involved. Getting tourism magazines, travel agencies and SA tourism offices (some of these initiatives already fit well with the vision of the South Australian Tourism Commission) to promote this would also be a necessary strategy, as creative ideas often do get media involvement early, rather than later on after others copy the innovators and it becomes 'old news'.

8. Education and environmental literacy

- **Extend Department of Education and Children's Services (DECS) sustainability education programs.**
- **Involve students in efficiency design and in emissions monitoring in schools.**
- **Create industry supported and recognised Technical and Further Education (TAFE) courses for sustainability trades.**

A community that is aware of climate change, educated for sustainability and equipped with the appropriate skills to respond will underpin all of the ideas covered in this report.

We must look to further integrate sustainability values and principles throughout the curriculum to ensure that these ideas are not merely a throwaway line in science or environmental studies classes, but permeate areas of learning as diverse as economics, architecture, agricultural studies, and social sciences.

Extend DECS sustainability education programs

In South Australia I feel that it will be important to further extend the good work currently being undertaken through the Sustainable Schools and Children's' Services Initiative (SSACSI), and to strengthen the important ties between the departments of Education and Children's Services (DECS) and Environment and Heritage (DEH), and the mentoring skills development for sustainable schools.

Involve students in efficiency design and in emissions monitoring in schools

Part of this integration of sustainability into teaching will once again be through a learning-by-doing approach. A great way of teaching important concepts around sustainability – in particular the use of energy, water and waste – is by consciously involving students in the rationale, rules, design and monitoring of the sustainability of the systems in schools. Outside advisors – perhaps students in TAFE classes on sustainability – could come in and help teachers with technical aspects. DECS, in cooperation with the Sustainability and Climate Change Division (or agencies like SA Water), might try to fashion some teaching materials to help teachers innovate in this area – one in which they were not likely to have been trained.

Create industry supported and recognised TAFE courses for sustainability trades

As the sustainability agenda grows there will be an increasing need for new skills across all levels in the design, building and maintenance of our built environment. Conscious steps need to be taken now to ensure that South Australia has the capacity to meet the demand for tradespeople and technicians with the skills to design and build 'green', and to understand payback criteria and social benefits as well as private benefits. The former two are not in the province of most businesses, but are the business of government. Thus, the TAFEs must also include a component of social sustainability motivation in their curriculum and not just reflect for-profit industrial paradigms.

I am proposing that TAFE courses be supplemented or created for a new generation of sustainability technicians and tradespeople. Currently industry helps determine the content of the courses accredited through the TAFE system and as such it may take government foresight and intervention to ensure that such sustainability courses are offered by TAFE. This could be accomplished either by education of the boards that approve curricula or, if necessary, by rule changes to insure that both industrial and social benefits are understood by those who must implement the sustainability agenda. Critical to this are rules such that sustainability courses cannot be vetoed by narrow interests.

Helping to understand and deal with 'Mediarology': The roles of South Australian journalists and scientists in debunking climate change myths

In reporting political, legal, or other advocacy-dominated stories, it is both natural and appropriate for honest journalists to report 'both sides' of an issue. 'Got one side? Better get the other!'

In science, it's different. The polar opposites are often the least likely scenarios. There is, however, a spectrum of potential outcomes, accompanied by considerable scientific assessment of the relative credibility of these many possibilities.

IV. Ideas for South Australia to help meet sustainability goals for climate change

Climate science is often compacted into one of two boxed storylines: 'we're worried' or 'it will all be OK.' And sometimes, these two 'boxes' are misrepresentative – so to the uninformed, each position seems equally credible. This is all part of the problem I have, somewhat whimsically, called 'mediarology.'

South Australians need to beware of opposing views presented as being equal in merit and probability if they are to make good decisions. It is not desirable to be side tracked by those advocating a position that is not based on sound science and subjected to peer review by the scientific community who are experts in that field, such as the Intergovernmental Panel on Climate Change (IPCC).

Interviews conducted in Adelaide's Rundle Mall showed that South Australians realise that we need to address climate change by reducing emissions, but it was also evident that many are confused by the mixed messages and there is less knowledge on whether climate change is caused by human activity, or what the risks might be and by when.

I have developed some 'rules' I apply to myself; if followed in South Australia by all parties, including the media, government, industry and other lobby groups, they could enable debate and negotiations to occur within plausible scenarios and be more productive and collaborative – part of South Australia's desire to become world-renowned for climate change mitigation and adaptation activities:

- make your values and biases conscious – use the relevant scientific/technical communities to help you overcome your own dogmatism or denial
- make your values and biases explicit and separate them from your scientific beliefs on probabilities and consequences
- struggle not to let personal value positions distort your subjective assessments on the probabilities of various outcomes or 'facts'
- defend value positions separately from assessments of probabilities and consequences
- encourage popularisers who follow responsible practices, and chide those who are unclear, obscure or biased, which harms efforts to educate and elucidate.

Government and journalists need to properly inform the public. Literate citizens must also take responsibility for educating themselves about all the implications of the climate change debate. They need to see past biased media opinions, or the bipolar 'duelling scientists' model that copies the political reporting style of equal time and credibility to each party, even if the world of scientific assessment holds different 'sides' to have a vastly different likelihood of being right.

9. Building resilient communities

- **Incorporate sustainability building principles into all government-assisted housing developments on publicly owned land.**
- **Build climate change capacity in remote and indigenous communities.**
- **Improve the efficiency of providing essential infrastructure (water, energy and transport) to remote and indigenous communities.**
- **Create renewable energy income for farmers.**

Ultimately, as we near our sustainability goals, we will all benefit. In the short-term, however, as we transition away from our existing infrastructure and historical ways of doing things, we must acknowledge that our response will produce both winners and losers. In evolving to a more sustainable society we need to be acutely aware of the implications of our response for our communities, and take steps to ensure our responses to climate change do not increase the divide between the 'haves' and the 'have-nots'.

Some communities and groups are not only more vulnerable to climate change, but will be more vulnerable to the changes in the price of commodities, the availability of resources and the accessibility of services that may result from our responses to the prospect of climate change.

Clearly the implications for communities are widespread and I have not attempted to cover all potential aspects in this report. However, I have identified three communities in particular whose relative equity situations will need to be considered as part of our climate change response: low-income, indigenous and rural communities.

Incorporate sustainability building principles into all government-assisted housing developments on publicly owned land

Adelaide's previous Thinker in Residence Rosanne Haggerty came to the State to look at 'Housing the Homeless' and ideas on low-income and disadvantaged communities. She and I had discussions on how to address the potential conflict between sustainability objectives and disadvantaged communities, and have proposed incorporating sustainable building standards and principles into all government-assisted development on publicly owned land. Such projects would demonstrate how sustainable new developments would improve the living standards and ongoing costs for residents.

Immediate opportunities exist through the State Government's Land Management Council to ensure that the upcoming developments at Playford North, Cheltenham Racecourse and Port Adelaide are designed around 7/11 principles, whereby the building design and standards create both a cost-effective payback for government as well as cost-savings and improved wellbeing for residents.

IV. Ideas for South Australia to help meet sustainability goals for climate change

These demonstration programs could use 7/11 principles to boost building efficiency, make it easier to achieve renewable energy systems, water recycling and other sustainability outcomes on both community and household scales.

The success of such demonstration projects will create many copycats – that, at least, is a prime measure of their success. The paybacks for such sustainability and equity projects should not be based on business-as-usual return on investment comparisons with for-profit industries – like 20% ROI.

These sustainability projects have major social benefits that private businesses do not measure nor strive to achieve – until required by law. These include: learning-by-doing to bring down costs of future green projects, education of residents and the public in sustainability practices, reduction in wastes, example setting and leadership on the values of cost-effective sustainability practices.

These benefits are not necessarily free, and account for the difference between businesses' expectations of returns and a 7/11 criterion, which is better than a mortgage rate for families but not at some industrial return standards. However, the higher ROI some businesses expect are not always achieved and some riskier investments actually produce negative returns – losses – whereas the 7/11 criteria are always a positive return on investment and thus a low risk venture. The size of the 'insurance premium' for social change and social benefit is a value judgement that the State has to make, but it is not in the behaviour of most firms to put a value on sustainability or social benefits – that is the job of governments.

Build climate change capacity in remote and indigenous communities

Remote and indigenous communities will face increasing challenges around water and energy supply as climate change takes hold. These communities are often more exposed to increasing transport and energy costs, so it is important that they are supported with essential infrastructure, and equipped with the skills to respond and, where possible, to achieve self-sufficient infrastructure.

Small-scale renewable energy parks will help to minimise dependence on diesel-powered generators, reducing vulnerability to fuel cost rises, allowing for more autonomy, and reducing greenhouse emissions. As participants in these renewable energy projects, people within these communities will be part of a learning-by-doing experience that builds skills within the community and creates opportunities for those involved as credible 'extension agents' to other such projects, which will need to develop if the sustainability agenda is to diffuse among indigenous communities – which I believe it must.

Recognising the cross-cutting nature of the sustainability agenda in remote communities also creates the opportunity for more coordination within the existing services such as providing drinking water supply, wastewater treatment, electricity supply and roads. These services are currently delivered by a number of government agencies and contractors in some communities, by local government and progress associations in other communities, and by mining companies for some mining communities near their operations.

Responsible agencies and organisations should consider the best way to streamline service provision, build infrastructure management skills within communities, and meet adequate infrastructure standards (this is a research topic listed under Reshaping Research and would involve investigating options such as delivery through a coordinating authority or agency council).

This will not only reduce the cost of delivering water, wastewater management, electricity and roads, but has the potential to provide more policy coherence for communities.

Create renewable energy income for farmers

As discussed in 'Rewarding Sustainable Farmers', agriculture is clearly a climate-dependent industry, and in some areas of South Australia variable rainfall already makes it a tough way to earn a living.

On top of this, climate change has the potential to add to the stresses on many rural communities as increasing temperatures, changing rainfall patterns and more extreme weather challenge the viability of existing production, most likely through increased water stress.

Farmers told me that they have been trying to diversify to maintain viability – into tourism in a few cases, for example. With this in mind we need to look at ways of giving farmers some income assurance to increase the viability of communities on the land, and one of the best ways to do this, they said, is by looking at ways of diversifying farmers' income.

Earlier in this report I outlined the idea of Power Parks, or hubs of renewable energy. Well, what if these parks were located in areas where they could also help to provide an alternative source of income for farmers? For example, rents to farmers for windmills on their properties would be a steadier source of income than crops, I believe, but there are economies of scale to overcome, like transmission lines costs. Here is an opportunity for agencies to work together: development agencies and primary industries with energy agencies to fashion ways to get sufficient scale of wind power on farmers' lands to justify transmission lines or storage equipment. This would not only help to diversify income for rural communities, but at the same time would reduce the greenhouse-intensity of the State's electricity supply.

IV. Ideas for South Australia to help meet sustainability goals for climate change

10. Analytic frameworks for sustainability

- **Building on the experience of SA Water, government agencies to coordinate analytic techniques that adequately value our future and incorporate climate change into risk management scenarios.**

Valuing our future

Is it right to value a human life now at a hundred times the value of a life in the future? And what gives us the moral authority to increased profits now to the detriment of our children and grandchildren later – to say nothing about endangering wild species not part of our decision-making processes but certainly subject to the impacts of those decisions?

For sustainability to have a chance, we must value equity, such as environmental services and wellbeing, across as well as within generations. For this reason we must give the future an appropriate value in the decisions that we make today.

Too often, economics-as-usual is the dominant paradigm in many of the decisions that we make. Standard financial accounting evaluates initiatives in terms of Net Present Value (NPV). Essentially this means that the future costs or benefits of a project or policy are discounted over time at rates that are typical of a business' cost of money (such as an interest rate of >7%). Ultimately this means that the future is devalued in decision-making and that immediate returns on investment become the over-riding consideration. It is important to recognise that environmental sustainability cannot be achieved by discounting long-term environmental and social benefits or costs in the same way as cash flows.

Sustainability 'versus' financial values

Take the hypothetical example of a current project whose greenhouse emissions would contribute to a threat to the future of the West Antarctic ice sheet, though its disintegration, however irreversible, could take 200–400 years to accomplish. Anyone adhering to conventional discounting might think it perfectly rational to proceed with the project, since the potential likelihood of even six metres sea level rise in 300 years will have no significant present value. However, as a society we believe in the wellbeing of our future generations, and recognise the ethical dilemma of leaving a legacy of extra wealth versus irreversible environmental degradation or the disruption of natural communities. When costs to mitigate these threats occur now and in the coming two decades but sustainability benefits are delayed for five to ten decades, then the discounting paradigm is, frankly, an unsustainable practice. The sustainability agenda is NOT a business decision or a cost-benefit analysis, plain and simple, but an ethical judgement about moral behaviour. It is politically negotiated, not the consequence of an algorithm of accounting based on business principles that violate sustainability principles. It is not always easily done politically, but a balance of business principles and sustainability principles must be politically negotiated, targets and standards set – and after that, cost-effective business practices brought in to achieve those targets at lowest costs. In this framework, the appropriate discount rate for such things as the well-being of communities, environmental protection, climate stabilisation, greenhouse gas avoidance, etc. could well be, it is often argued, set at zero.

How many people would consider it ethical if an economically efficient policy action using a market discount rate saved one life today but cost 3 in fifty years. The morality of such a decision is in the political realm much more so than in the techniques of cost-benefit analysis using high discount rates. Clearly, how to discount potentially irreversible or inequitable long-term outcomes is not an economics decision per se, but a political value judgement as to how much priority we give to current cash returns over future potentially irreversible environmental losses.

Sustainability and analytic tools

In decision-making practice, it is important to coordinate the analytic tools across government agencies and departments to ensure that the State's joint goals of economic growth and sustainability can be adequately reconciled.

During my residency, I have noted variation in the way different agencies have used different analytic tools to deliver sustainability benefits. Inconsistency can lead to irrational and inefficient trade-offs at the Cabinet level. A thorough interagency review, fashioning common tools for sustainability analysis, seems warranted. This could draw on the recent very positive steps being taken by SA Water as they try to reconcile business and sustainability principles.

At a minimum, language of analysis, expressed via analytic tools results, must be homogenised so that the same words mean the same assumptions were embedded in the tools of different agencies or departments. We cannot have one department using a 10% discount rate and another one using zero (neither visible to the outside world) and both discussing the 'cost-effectiveness' of some policy in the same language when their underlying assumptions are so radically different that the comparisons are meaningless – or worse, a distortion.

Incorporating climate change into risk management scenarios

As if valuing the future wasn't difficult enough, then along comes climate change...

Incorporating climate change scenarios into our decision-making frameworks means acknowledging that the price of carbon, the availability of water, the distribution of commodities and the productivity and viability of our natural systems are likely to change.

IV. Ideas for South Australia to help meet sustainability goals for climate change

Strategic, corporate, health and security planning already make considerable use of scenario analyses to try to bound risks and make a reasonable risk-management evaluation. Though defending any set of precise values for important future variables is difficult, simple extrapolations based on current values are more likely to lead to poor decisions and an uncomfortable chance of higher operating costs – or even worse – stranded assets.

Scenario analysis leading to a risk management framework that brackets a range of plausible futures is often the most effective approach. Financial decisions on which projects go forward, and how energy intensive they are, need to be informed by such analyses. Strategic planning in the military and corporate worlds, as noted earlier, already use such scenario approaches, as does the climate change research analytic community.

The most problematic aspect of scenario analyses is often the subjective estimation of the likelihood of various projected values of important components of the decision process. But this is a better hedge than simply to assume the most implausible projection – continuation of current values of important factors like carbon price, fuel price, water demand, price of renewable energy, income growth, etc.

Once again, in the case of SA Water I have observed first hand how they are re-thinking the robustness of previous decisions by using longer-term, more comprehensive decision analysis.

One example under review was regarding a major pipeline extension. The question was, should there be big pumps and small pipes (high energy demand/lower-cost pipes), or big pipes and small pumps (lower energy demand/higher cost pipes)? If you use current costs for the analysis, the higher-energy solution wins out, causing more carbon dioxide emissions. But, when considering scenarios of increased prices of energy and other potential carbon constraints, the previous benefits are revealed to be short-term, diminishing over the life of the asset. When the longer-term is considered the lower-energy decision is more plausible, but still not yet a winner.

However, if the increased need for water in a warmer world is also considered in the scenario, then the increased flow rates that would be needed could well lead to selection of the larger pipe size – the lower energy-use option.

This is not a critique of previous decisions, but an exemplary case that the SA Water analysts and I worked on to help the agency hone its tools and become better positioned for both cost and sustainability values in future projects.

Case Study: A changing climate at SA Water

As the State's major water provider, SA Water's business is wholly dependent on the availability of water, a scarce natural resource. Because of sparse water resources and the extensive major pipelines across a large part of South Australia, supplying water is already highly energy intensive, making SA Water one of the largest electricity users in the State. The nexus between water and energy means that the long-term commercial viability of SA Water and the State of South Australia is extremely vulnerable to climate change-induced impacts and changing energy use expectations.

Defined climate change risks include scenarios of lower water availability, upward demand pressures to adapt to climate change, greater threats of algal blooms in storages, salinisation of source waters, and physical effects of sea level rise on low-lying infrastructure. SA Water already recognises its challenge to meet increasing demand for water, achieve tighter water quality requirements, increase the use of recycled water, manage decreasing water availability and reduce energy consumption – all at the same time.

Thus SA Water must navigate a particularly complex and interconnected set of conditions when seeking to respond to changing climate, business needs and community expectations.

Risks of climate change for SA Water and their response

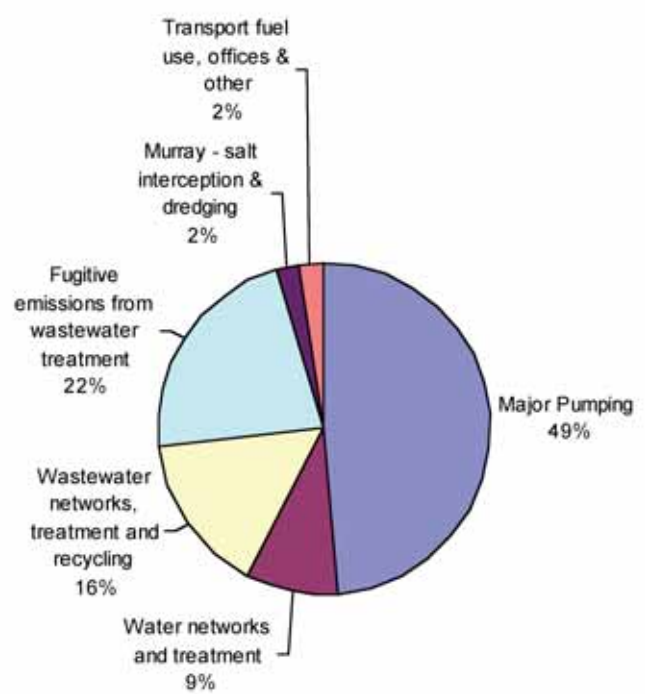
During this residency, SA Water asked me to participate in a series of workshops targeting multiple levels across the corporation, from Board to Executive to Senior Management to general staff. These workshops provided opportunities for key business areas, such as Systems Planning and Finance, to engage in discussions on business risks arising from climate change and in developing forward plans for action.

Looking at how climate change impacts may translate into business pressures, can prepare decision makers for higher stakeholder expectations and tighter regulations in line with the Government's 60% emissions reduction target by mid century.

From the workshops, it is clear that both adaptation and mitigation planning are considered as necessary by SA Water to protect business profitability and the wellbeing of the State.

IV. Ideas for South Australia to help meet sustainability goals for climate change

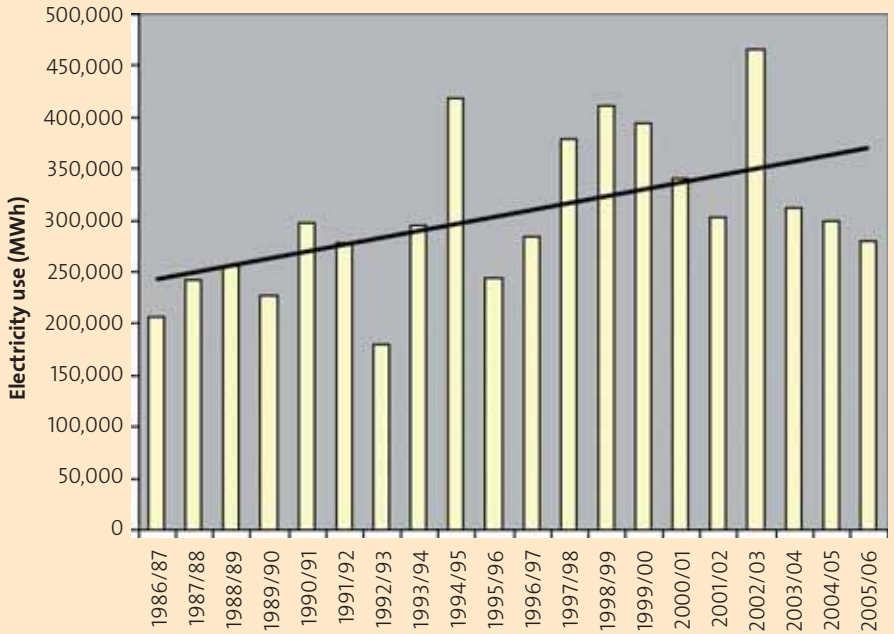
Greenhouse gas emissions by key Activity



Percentage of greenhouse gas emissions by activity[14]

14 Source: SA Water

Electricity Consumption for SA Water



20 year electricity consumption[15]

15 Source: SA Water

IV. Ideas for South Australia to help meet sustainability goals for climate change

Building climate change ready infrastructure
SA Water's engineering, finance and commercial staff are reviewing their infrastructure evaluation processes to better incorporate future risks and opportunities posed by climate change.

Other actions

Increasing greenhouse offsets from revegetation
SA Water is increasing its carbon offsets through bio-sequestration, or the capture of carbon dioxide from the atmosphere in woody vegetation. This in turn provides multiple benefits such as the protection of water quality in catchments and improved biodiversity.

Increase renewable energy use from self-generation and purchased sources
SA Water established a mini hydroelectric system in 2003 to recover energy from its network. Through this initiative, approximately 6000 MWh of electricity per annum is now being recovered for sale or use.

To increase its use of renewable energy, SA Water is now using analytical tools that factor in sustainability and future carbon costs to assess the feasibility of different options. These options include purchasing renewables and establishing more self-generated renewable energy systems by using mini hydro schemes and increasing the use of biogas (methane) at wastewater treatment plants to produce electricity.

Adaptation
Building from Water Proofing Adelaide, a foundation strategy that will help Adelaide meet its water needs to 2025, and with growing awareness of climate change risks, SA Water is looking to scenario planning and vulnerability exposure at the local level to assess its climate change risk exposure, whether these be physical, regulatory, stakeholder driven or cost related.

Understanding business risk thresholds is as important as understanding the climate change science. For example, SA Water is best placed to determine the point at which water source deterioration in a catchment could trigger the need for additional treatment or for distant water supplies to be considered. This question cannot be answered by climate scientists, and requires that SA Water collaborate with the research community to understand such scenarios and their probabilities.

Acknowledgements

There are so many thanks due to so many people, it is hard to know how to begin. First, thanks to the sponsors of my residency – the Department of the Premier and Cabinet (DPC), SA Water, Sustainability and Climate Change Division (DPC), CSIRO, Department of Education and Children's Services, Primary Industries and Resources of South Australia, South Australian Research and Development Institute and the University of South Australia. I would particularly like to thank the representatives of these agencies who worked as members of the Partner Reference Group, designing and leading my residency.

Second, my thanks go to the Adelaide Thinkers in Residence office, so ably run by Brenda Kuhr, and to Pamela James-Martin, Joanna Hughes and the support staff who organised and administered my residency program. These people have been both incredibly supportive and essential to any successes a Thinker might have. As the Adelaide Thinkers in Residence office is within the Department of the Premier and Cabinet, it is important to point out that I enjoyed easy access to top officials such as Warren McCann, Tim O'Loughlin and the Premier, Mike Rann, himself. This bodes well for the potential implementation of some of the ideas in this report.

Not least, I am thankful for the incredible assistance of my two 'catalysts', Chris Hotham and Tim Kelly, whose contribution was paramount. Not only did they help to interpret and brief me on each event I participated in – literally hundreds – but they then did much of the drafting of this report, allowing me to concentrate on the larger ideas.

Finally, my wife, Terry Root; not only was she always there to keep me from overdoing it – well, at least pointing out (not meekly) when I did go too far – but also was a partner in ideas, presentations, meetings, dinners and myriad bush adventures.

The residency was probably the most intense four-month adventure of my life, and (thanks to all of those involved) may have sustainable and tangible benefits for the people and government of South Australia.

Note: Internet URLs were accurate at time of publication.

Adelaide Thinkers in Residence

bringing world-class thinkers to Adelaide to assist with the strategic development and promotion of South Australia

adelaidethinkers@saugov.sa.gov.au
www.thinkers.sa.gov.au