Southern Tasmania
Regional Land Use Framework

Background Report No.3: A Changing Climate

March 2011

This document is detailed supporting information for the Southern Tasmania Regional Land Use Strategy 2010 - 2035.

Please visit www.stca.tas.gov.au or telephone the Southern Tasmanian Councils Authority on 61 3 6270 2242 with any queries.

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1. Global Context

Climate change is happening. With the warming of the climate system the predicted effects include: an increase in sea levels; more frequent warm spells; heat waves and heavy rainfall events; an increase in droughts, tropical cyclones and extreme high tides. The predominant scientific view is that this change can be attributed to increases in greenhouse gas concentrations from human activity, or at the very least, that the potential impacts are so great that it would be irresponsible to assume otherwise. This anthropogenic (human-induced) warming and sea level rise may continue for centuries due to the timescales associated with reducing atmospheric greenhouse gas concentrations and climate feedback processes, even if greenhouse gas concentrations were to be stabilised now (IPCC, 2007).

The State of the Environment Report for Tasmania 2009 (Tasmanian Planning Commission 2009) identifies the likely hazards arising from climate change in the Tasmanian context. These include rising sea levels, changed nature and frequency of exceptional climatic events, changes in short term climate cycles and an increased number of high rainfall events. This may lead to such changes as direct and indirect effects on human health and changes in biodiversity and natural values (including fisheries). Climate change may also result in changes to the frequency, intensity and distribution of weather events currently considered as severe (Garnaut, 2008). Climate change hazards such as storm surge events and coastal inundation have been considered under the Land Hazards Topic Paper.

The natural variability inherent within the Tasmanian climate exists in the absence of climate change. However, climate change may be influencing this natural variability, as the probability that climate change is caused by natural climatic processes alone is very low. Recognised regional drivers of climate variability affecting Tasmania include the El Niño/ Southern Oscillation (ENSO), Southern Annular Mode and the Indian Ocean Dipole, and, to a lesser extent, atmospheric blocking (Risbey et al. 2009).

2. What is Climate Change?

It is widely accepted that the world's climate is changing as a result of human activities though the release of greenhouse gasses such as carbon dioxide (CO2) into the atmosphere. Climate change is an alteration in the state of the climate that can be identified by changes in the mean and/or variability of its properties (such as temperature and rainfall) and that persist for an extended period, typically decades or longer (IPCC 2007). The SoE Report for Tasmania 2009 demonstrates how this definition is relevant for Tasmania's already highly variable climate as changes in this variability, and in the occurrence of extreme events, is anticipated to be one of the consequences of climate change. It is, however, difficult to distinguish natural variability in climate from human-induced climate change. This is particularly the case at local or regional scales such as for Tasmania. Unless concerted action is taken to arrest and reduce greenhouse gas emissions in the near future, CO2 levels in the atmosphere may pass a critical threshold of 450 parts per million. Some of the projected impacts have already been highlighted above, however additional impacts include extinction and/or migration of plant and animal species as a result of changes to habitat conditions, and challenges to infrastructure lifespan and capacity.

The Intergovernmental Panel of Climate Change (IPCC) is the leading scientific body for the assessment of climate change. Established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO), the IPCC reviews and assesses the most recent scientific, technical and socio-economic information worldwide to provide a clear scientific view on the current state of climate change and its potential environmental and socio-economic consequences (IPCC, http://www.ipcc.ch/organization/organization.htm, accessed 17/02/10). The IPCC reports provide the global synthesis of the current state of understanding of climate change science. The IPCC is currently starting to outline its Fifth Assessment Report (AR5) which will be finalised in 2014. The Fourth Assessment Report (AR5) was completed in 2007.

The UN Conference on Climate Change, held in Copenhagen in December 2009, provided an interim update of some of the findings from the Fourth Assessment Report (Richardson et al. 2009). One of the key messages from this conference was that, because of high rates of observed emissions, the worst-case IPCC scenario trajectories as outlined in AR4 are being realised for indicators such as global mean surface temperature, sea level rise, ocean and ice-sheet dynamics, ocean acidification, and extreme climatic events. Greenhouse gas emissions and many aspects of the climate are changing near the upper boundary of the IPCC range of projections.

Other significant reports include:

- The Garnaut Climate Change Review: an independent study commissioned by Australia's Commonwealth, state and territory governments in 2007. Conducted by economist Professor Ross Garnaut, the Final Report was delivered on 30 September 2008 *(*www.garnautreview.org.au/*).* The Review examines the impacts of climate change on the Australian economy and recommends medium to long-term policies and policy frameworks as part of an appropriate international policy response;
- The Stern Review on the Economics of Climate Change: Released on October 30, 2006 by economist Nicholas Stern for the British Government, which discusses the effect of global warming on the world economy;

- The National Climate Change Adaptation Framework: Recognised that national assessments are required in key sectors and regions to support informed decisions on adaptation action by policy-makers, business and industry, resource managers and the community. One of the key actions identified by the framework, and endorsed by the Council of Australian Governments (COAG) in 2007, resulted in the Climate Change Risks to Australia's Coast: a first pass national assessment. This report presents the findings of the first national assessment of the risks of climate change for the whole of Australia's coastal zone. The objectives of the first pass national coastal risk assessment are to: provide an initial assessment of the future implications of climate change for nationally significant aspects of Australia's coast, with a particular focus on coastal settlements and ecosystems; identify areas at high risk to climate change impacts; identify key barriers or impediments that hinder effective responses to minimise the impacts of climate change in the coastal zone; and help identify national priorities for adaptation to reduce climate change risk in the coastal zone.

2.1 Major contributors to Greenhouse Gas

"The earth's atmosphere acts like the roof of a greenhouse, allowing short-wavelength (visible) solar radiation from the sun to reach the surface, but absorbing the long-wavelength heat that is emitted back. This process is referred to as 'the greenhouse effect', and the gases that absorb the emitted heat are known as greenhouse gases. The temperature of the earth is determined by the balance between energy input from the sun and its loss back into space" (Garnaut, 2008).

The main naturally occurring greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide and ozone (Garnaut, 2009). Another significant greenhouse gas is chlorofluorocarbons (CFCs), which are made by humans (SoE, 2009). Some of the natural and anthropogenic sources are described in Table 1 below:

Table 1: Major Contributors to Greenhouse Gas Emission *(Source: Adapted and summarised in SoE 2009 from Garnaut 2008)*

Gas	Natural sources	Example anthropogenic sources
Carbon dioxide	Respiration from living organisms, forest fires, decomposition of dead animals and plants, outgassing from the ocean	Combustion of fossil fuels and cement manufacture (more than 75 per cent of the increase in concentration since pre-industrial times), land-use changes (deforestation and changing agricultural practices)
Methane	Oceans, natural wetlands, peatlands	Fossil fuel mining, vegetation burning, waste treatment, ruminant livestock, landfill
Nitrous oxide	Processes in soils and oceans, Oxidation of ammonia in the atmosphere	Nitrogenous fertiliser use, biomass burning; management of livestock manure, fossil fuel combustion, industrial activities such as nylon manufacture
HFCs	Some PFCs and all HFCs have no detected natural sources	Refrigeration, air conditioning, solvents, fire retardants, foam manufacture, aerosol propellants

PFCs		Aluminium production
Sulphur hexafluoride		Electricity supply industry (switches and high-voltage systems)
CFCs and HCFCs	No known natural sources	Propellants in aerosol cans Refrigerants in refrigerators and air conditioners manufacture of foam packaging

3. Climate

3.1 Current Climatic Conditions

Tasmania's climate is classified as temperate maritime as it is an island with all land within 115 km from the sea. Tasmania has experienced an increase in daily mean, maximum and minimum temperatures since the 1950's (Climate Futures for Tasmania: Special Report for the TPC, 2010). The trend in mean temperatures since 1970 has been between 0.05°C- 0.1°C per decade, with a tendency for smaller warming trends in the west and larger warming trends in the north-east of the state. The rise in mean annual temperature was less in Tasmania than for Australia and the world over this same period. On the coast, the range of daily temperatures is about 7ºC, but inland the range is almost double, indicating a slight continental effect. Mountainous areas cover a large proportion of Tasmania and attain a maximum height of 1617 m at Mount Ossa, which rises from a central plateau. The central plateau includes several peaks in excess of 1500 m (Bureau of Meteorology, 2009).

The dominant climatic processes affecting the Tasmanian coast are successive high and low-pressure systems in the zone of the 'Roaring Forties'. The storms resulting from these pressure fronts occur principally during winter, and are associated with predominantly south-westerly swells. Another important climatic process is the El Niño – Southern Oscillation, which affects the ocean currents off the east coast. Less frequently, subtropical low-pressure systems move down Australia's eastern seaboard and bring storms and heavy seas to the east coast of Tasmania. Storms and swells affect the surface mixing of waters, water temperature, the supply of nutrients, the duration and intensity of sunlight at sea level, and the clarity of the water. The tidal range in Tasmania is affected by both location and latitude: the range is around 3-4 m in the Tamar estuary and less than 1 m in the waterways in the south of the State (Department of Primary Industries, Water & Environment 2000).

Summers are mild and characterised by greatly lengthened days. The sun reaches a maximum elevation of 70-73 degrees in the midsummer with daylight hours reaching 15 hours. In midwinter, the sun's elevation does not exceed 20-23 degrees, and the shortest day consists of about nine hours of daylight. In winter and early spring, westerly winds reach their greatest strength causing a distinct maximum in the rainfall distribution in the west. In the east and southeast rainfall is more evenly distributed throughout the year (Bureau of Meteorology, 2009).

Rainfall varies dramatically across Southern Tasmania with Hobart averaging 626 mm with a mean of 159 days with rainfall recorded, while on the west coast an average of 2,400 mm per annum provides a far wetter environment. In summary, the west coast of Tasmania has the most rain and is one of the wettest places in the world, while Hobart and the east coast region are in rain shadow. Hobart, despite being the second driest capital city in Australia, does not suffer the severe water shortages and restrictions of mainland Australian cities as reservoirs are fed by mountain catchments within the western half of the state. Snow falls in the mountains in winter. However, most people in Tasmania live in towns and cities near the coast, where the ocean has a moderating effect on temperatures. (Bureau of Meteorology, 2009). Observations of rainfall in Tasmania show a reduction in total annual rainfall and a decrease in inter-annual variability of rainfall since 1975 (Climate Futures for Tasmania: Special Report for the TPC, 2010). This reduction in variability is significant. The reduction in rainfall since 1975 has been greater in autumn.

3.2 Projected Climatic Conditions

The Climate Futures for Tasmania presents a set of six model simulations dynamically downscaled for Tasmania under two IPCC emissions scenarios: one high (A2) and one low (B1). Under the high IPCC emission scenario (A2), the average temperature change over Tasmania is 2.8°C over the 21st century. This change for Tasmania is less than the projected global change of 3.4°C. The six models used show a range of temperature rise from 2.5°C to 3.3°C. The projections suggest temperature increases are smaller in the early part of the century, but the rate of change accelerates towards the end of the century (Climate Futures for Tasmania: Special Report for the TPC, 2010). By 2050, the mean temperature under the high emission scenario is expected to be 1°C to 1.5°C higher than the recent period (Climate Futures for Tasmania: Special Report for the TPC, 2010). The temperature change is expected to be even across the state, and consistent between seasons. Under the low IPCC emission scenario (B1), the projections for temperature suggest an average rise of 1.5°C (Climate Futures for Tasmania: Special Report for the TPC, 2010). The temperature change for Tasmania under the B1 scenario is less than the projected global change of 1.8°C (Climate Futures for Tasmania: Special Report for the TPC, 2010).

Both IPCC scenarios give a similar climate response for the first half of the century. The difference between the scenarios becomes noticeable around the middle of the century. After 2070, the spread of the six A2 simulations is higher than the spread of the six B1 simulations. The daily minimum temperature is projected to increase more than daily maximum which is in agreement with the observed changes from the recent past. The projected temperature changes for both IPCC scenarios are less than the Australian and the global average changes for the same period, and are much less, than some individual regions of the globe such as the Arctic, which is projected to experience an average increase of 5.9°C under the A2 scenario (Climate Futures for Tasmania: Special Report for the TPC, 2010). The relatively small projected changes for Tasmania are due in part to the temperate Southern Ocean storing the excess heat and moderating the temperatures of Tasmania.

In terms of rainfall, the projection of total rainfall over the whole of Tasmania under either emission scenarios shows no significant change. However, changes were identified in the spatial pattern of rainfall, and in the timing of rainfall events. Under the high IPCC emissions scenario, the average rainfall shows a steady emerging pattern of increased rainfall over the coastal regions, and reduced rainfall over central Tasmania and in some areas of the northwest of the state. After 2050, changes in seasonal rainfall are much stronger than annual total rainfall. The west coast of Tasmania shows a pattern of strong increases in rainfall events in winter and a strong decrease in summer rainfall that emerges. The Central Plateau district shows a steady decrease in rainfall in every season throughout the 21st century, and a narrow strip down the east coast shows a steady increase in autumn and summer rainfall throughout the 21st century (Climate Futures for Tasmania: Special Report for the TPC, 2010). While some changes become evident later in the century, many of the changes outlined above are very likely becoming evident already. The report details that the projected rainfall trends are caused by systematic changes to large-scale climate features, for example the subtropical ridge or the El Nino Southern Oscillation, within the model simulations. These changes in the climate include a change to the dominant pressure patterns over the region and a change to sea surface- temperatures. There is a projected increase in pressure in the mid-latitudes on either side of Tasmania, and a decrease in mean pressure at higher latitudes. These pressure changes are associated with a southerly movement of the subtropical ridge of high pressure, especially in summer, and an increasing prevalence of the high phase of the Southern Annular Mode, resulting in stronger westerlies to the south of Tasmania (Climate Futures for Tasmania: Special Report for the TPC, 2010). These changes are likely to enhance the seasonality of west coast rainfall, that is, drier in summer and wetter in winter.

Furthermore, the Report projects an increase in sea surface temperature off the east coast of Tasmania of up to 3.5°C caused by a southward extension of the East Australian Current over the 21st century. This southward extension of the current, along with changes to the dominant pressure patterns, are projected to lead to an increase in moisture flux, atmospheric instability and convective processes, especially in the east of the state. These changes, combined with a continuing increase in atmospheric blocking in summer and autumn, are consistent with the increase in rainfall on the east coast margin during these seasons.

4. Climate Change Impacts on Tasmania

4.1 Overview

There will be a number of impacts from climate change on the state of Tasmania. These are broad and far reaching with certain areas likely to be more susceptible than others.

The Climate Futures for Tasmania project provides a detailed analysis on projected changes relating to evaporation, water yields and extreme events. In addition to these variables, cloud cover can be expected to decrease slightly and there are small projected changes in radiation with some seasonal differences in the pattern. Relative humidity is projected to increase around the coasts and decrease in the inland over high-altitude regions of Tasmania.

The increase in temperature over the 21st century is the dominant driver of a significant increase in potential evaporation in all seasons. This is likely to decrease water availability. Preliminary analysis indicates that evaporation will generally increase across the state, although these increases are spatially varied (Climate Futures for Tasmania: Special Report for the TPC, 2010). A comprehensive assessment of future water yield in Tasmania will be completed in 2010 by the Antarctic Climate and Ecosystems Cooperative Research Centre which will provide more data in this regard.

The challenge of achieving deep emissions cuts in the Tasmanian economy is substantial. Overall, our sectors are relatively energy intensive and transport dependent but have limited capacity to pass on higher prices to their customers overseas if they are to remain competitive. At the same time, physical changes in our natural environment as a result of climate change have the potential to significantly impact on our primary industry and forestry sectors. Tasmania's economy is strongly export-oriented, with major exports including minerals, forest products and food. These products are sold primarily into Asia, along with sizeable exports to Europe and North America. Tasmania exports around 9.3 million tonnes of freight to mainland Australia and 8.7 million tonnes overseas (DAPC, 2010). Tasmanian exports are predominately shipped, with around one per cent carried by air. The major manufacturing industries supplying our exports are large users of energy and have limited capacity to pass higher costs onto their customers because of the intensely competitive international markets they supply. Rising electricity costs under an emissions trading scheme will pose particular challenges in this sector, particularly if not matched by similar changes in competitors' jurisdictions.

4.2 Impacts on the Coast

One of the areas where the most noticeable and more pressing impacts are likely to occur is on the coast. Coastal municipalities will bear the brunt of climate change induced sea level rise and associated impacts such as storm surge and inundation. At the regional level, consideration of future storm surge and sea level risk will be critical in determining the settlement strategies under the Regional Land Use Strategy. To assist in this the LiDAR data should be used to more accurately map the risk within the region, in a similar fashion as has recently been undertaken by Clarence City Council. Once a more detailed understanding of the hazard is known, appropriate zoning responses within the new planning schemes can occur.

The State Coastal Policy 1999 provides for the protection and management of the natural and cultural values of the coast. With regard to potential hazards on the coast, the Policy provides:

COASTAL HAZARDS

Areas subject to significant risk from natural coastal processes and hazards such as flooding, storms, erosion, landslip, littoral drift, dune mobility and sea level rise will be identified and managed to minimise the need for engineering or remediation works to protect land, property and human life.

Policies will be developed to respond to the potential effects of climate change (including sea-level rise) on use and development in the coastal zone.

There is a great deal of uncertainty regarding the degree of expected sea level rise, however recent works by Rahmstorf (2007) indicate that the IPCC's Third Assessment Report projections may have under estimated projections of sea level in 2100 by around 0.5 metres.

4.3 Impacts on Fisheries

Climate change is also likely to have a significant impact on the productivity of fisheries. Increasing average temperatures of coastal waters around the State may adversely affect aquaculture production, especially of Atlantic salmon. Wild fish species may migrate to areas where the water climate remains suitable, with both positive and negative implications.

4.4 Impacts on Forestry

Tasmania's forests represent a huge bank of stored carbon. In future, they may provide an opportunity to benefit economically from their potential to sequester more carbon, but this will depend on the rules adopted nationally and internationally on the treatment of the forest sector in relation to climate change. However, some species may be unsuited to future conditions as the climate becomes drier and warmer, and the threat of disease and wildfire increases.

4.5 Impacts on Agriculture

There is likely to be significant climate change impacts on agriculture in Tasmania. Generally, increases in temperature are likely to reduce time to crop maturity, leading to changes in crop species and cultivars. This may result in the relocation of some cropping enterprises and provide a warmer climate for new crops. The spectrum of pests, weeds and diseases is likely to also change in response to the projected warming. Agriculture is one of the most important sectors of the Tasmanian economy. If adaptation to a changing climate occurs, then the agriculture sector has the potential to grow significantly as a result of climate change, and an increasing demand for our fertile agricultural land with access to water. While this growth will be good for our economy, it could also result in growing greenhouse gas emissions unless we also invest in innovation around low-emissions technology and management practices in the sector. The Government's Drought Proofing Tasmania strategy makes $220 million of State and Commonwealth money available for strategic irrigation development in Tasmania (DPAC 2008). Work is already well-progressed on a number of water development projects, through the Government's SMART Farming program, to minimise the short-term impact of the current drought and the long-term impact of climate change on the State's agricultural sector and rural communities (DAPC, 2010). The Tasmanian Irrigation Development Board will further drive the delivery of a suite of major water infrastructure projects that are economically, environmentally and socially sustainable.

Fortunately, climate change will also bring many economic opportunities. International interest in renewable energy and 'clean, green' goods and services will grow, and Tasmania has a wealth of expertise in both areas. Changes in climate relative to parts of mainland Australia may open new opportunities for our agricultural sector, capitalising on our relative abundance of water. Tasmanian businesses focussed on innovation, low carbon products and low-emission technology will also see significant sales opportunities in Australia and overseas

Preliminary results of the Climate Change Futures for Tasmania, suggest that climate change will affect Tasmania through changes in extreme events. While it has been demonstrated that mean temperatures are projected to increase across Tasmania, the projected occurrence of extreme events is likely to change more than the mean climate.

5. The Land Use Planning System & Climate Change

5.1 Overview

Understanding what changes are likely to occur as a result of climate change is a crucial component of our current planning and decision-making processes. The adoption of measurable and agreed climate change indicators such as sea level rise and storm surge events will have profound land use implications for adaptation and mitigation strategies in the future to deal with the increasing threat of climatic change. Municipalities that are likely to be affected by climate change will require strong policy approaches to determine what areas need to be protected from climate change events and how areas most likely to be affected can adapt to climate change events. Furthermore consideration must be given to how future development can use mitigation measures to reduce the immediate impacts of climate change (Aurecon 2009).

Development control measures with planning schemes have a role. Specific use and development should be allowable in areas away from areas at high risk (i.e. dwellings, community facilities, critical infrastructure, schools, etc).

Climate change considerations will influence planning control measures such as building setbacks, minimum floor levels, appropriate engineering assessments, appropriate construction techniques (i.e. piled buildings, flood resistant materials).

Setting standards for new development within planning schemes will not address the risk for existing property, however. Governments and Councils will need to consider a number of management/adaptive measures as risk increases. For example, in terms of erosion, technically feasible options include hard protection (i.e. seawalls) and soft protection (i.e. sand nourishment, revegetation). Emergency planning is also a further option for existing development in risk areas. While emergency planning will not protect property and assets, it will ensure that risk to human life is minimised. Emergency planning type measures are outside the scope of strategic land use planning, however.

As detailed further below, strategic land use planning has the more significant role in addressing climate change. In terms of adaption, areas at risk from the impacts of climate change (e.g. coastal erosion and inundation) can be identified and omitted from consideration for new development expansion areas. In terms of mitigation, measures can be put in place to progress towards a more efficient and sustainable settlement pattern by, for example, reducing the need for travel, energy use and infrastructure extensions, and by increasing the use of public transport through hider densities and creating multi-use transit oriented development nodes.

5.2 Management Responses

The planning system can help to respond to climate change by employing both mitigation and adaptation strategies. The pattern of land use determines where people live relative to places of work and recreation. This in turn determines the extent to which people have to rely upon transport systems to travel and has an impact upon the amount of energy used and, subsequently, the potential greenhouse gas emissions. The design and siting of buildings influences the ability to make use of passive solar design for heating and cooling. This again has an impact on the amount of energy used. Planning is also concerned with risk management issues such as the potential inundation of coastal properties as a result of sea level rise and storm surge and the potential for greater bushfire frequency and intensity. The two response strategies are considered further below.

5.2.1 Mitigation Responses

Mitigation strategies seek to reduce the rate of climate change by emission reductions or offsets. This needs to be part of a coordinated global approach, which has not yet materialised.. Whilst Southern Tasmania’s contributions to the world’s green house gas emissions is minute, it is important to be seen to be contributing in order to build pressure on all jurisdictions to do likewise.

The Garnaut Climate Change Review Interim Report emphasises the climate change task is an urgent one with a need for an international regime to address climate change. The Report recommends the setting of a global ‘budget’ for greenhouse gas emissions to be apportioned between the major emitters countries (Garnaut 2008). Countries would then work to keep emissions within their own budget through mechanisms such as emissions trading scheme or a carbon tax.

Ganaut’s interim recommendation for Australia is for the development of an emissions trading scheme (ETS). Under such a scheme, permits would be purchased by an independent authority to emitters. The overall quantity of permits issued would be tied to the country’s emissions ‘budget’. Such a system would work by increasing the price of high carbon emitting goods and services and encourage consumers to seek out goods and services produced with low carbon emissions (Garnaut 2008). Further more, such a scheme would generate market rent as the scarcity of permits drove the market value of permits up beyond their face value.

With the potential to generate approximately 90 per cent of our electricity needs from renewable resources, and tremendous natural stores of carbon, Tasmania is already well-positioned to make the most of the opportunities presented by climate change mitigation strategies.

Climate change is a global challenge and it requires a global response. Views on the most appropriate international, national and local responses to climate change are evolving rapidly as our understanding of the associated challenges and opportunities continues to improve. It is already clear that we will need to adapt to more than just environmental changes. National policy developments will have a significant impact on Australia’s economy and the way we live and work, requiring adjustment across all sectors of our community.

Garnaut identifies two possible targets for stabilising carbon dioxide emissions. The first is a target of 450 ppm of CO_2, which is widely accepted by academics and in which case would require dramatic reductions in global emissions. The second target is 550 ppm of CO_2 which carries a much higher risk of dangerous climate change impacts. Garnaut’s preliminary view favours the setting of a global emissions ‘budget’. This identifies the upper volume of emissions which would enable achievement of an agreed stabilisation concentration. This could be amplified by targets prescribing certain percentage cuts in emissions by 2020 or 2050. Garnaut in 2007 stated the following:

> *Only an international agreement on distributing the abatement burden across countries has any chance of achieving the depth, speed and breadth of action that is now required in all major, including developing countries.*

The Garnaut Climate Change Review and the Federal Government’s Green Paper seek to address mitigation issues. The main thrust at the national level is to determine an upper limit for concentrations of greenhouse gas in the atmosphere and use this limit as the target for an emissions trading scheme. The aim of the scheme is to introduce incentives for consumers to move to low carbon emission goods and services and for producers to move to low carbon emission technologies.

The role of climate change mitigation strategies is to reduce overall greenhouse gas emissions. Land use planning has a crucial role to assist in this process through facilitating local changes in land use, energy use, and transport and settlement patterns.

The most important driver for change is the ability to reduce energy use from buildings. Planning can have a significant effect on the efficient design of subdivisions and housing forms to provide increased levels of passive solar energy as opposed to reliance upon the need to draw energy from the electricity grid to heat and cool buildings.

Reducing the reliance upon transport is another important mitigation measure to reduce the output of further carbon emissions into the atmosphere. Widespread car ownership has lead to a major change in the form of our cities, with a turn from the traditional main street to suburban living and consequent urban sprawl. The ever-increasing reliance upon private car ownership has resulted in a high dependency upon vehicles for access to services and goods, places of employment and recreation. In order to reduce greenhouse gas emissions arising from transport, there will need to be a shift to reducing the reliance on private motor vehicle use to increasing the use of public transport. Planning can facilitate change by reviewing planning scheme car parking requirements and by providing for greater modal choice between private cars and other forms of transport such as encouraging walking, cycling and public transport.

As indicated above, our settlements have been shaped by high levels of car dependence to the extent that urban sprawl now characterises much of our suburban landscape. Greater Hobart is one of the least dense cities in the world. The approach that will need to be adopted by planners is to reduce motor vehicle usage and to foster more sustainable urban forms by facilitating higher urban densities and allowing more mixed use developments to enable people to live closer to work, services & recreation facilities.

A further impact to be considered through the Planning System is land use change. This is a major source of greenhouse gas emissions, in particular land clearance for conversion to agricultural and other uses. The planning system can play a role by ensuring appropriate planning controls are placed on land clearance. This issue is discussed in greater detail under the Natural and Cultural Values Topic Paper.

5.2.2 Adaptation Responses

Adaptation strategies involve on ground reactions to the effects and risks caused by climate change. The effects of climate change include sea level rise, temperature rise, an increase in extreme storm surge events and changes in rainfall patterns which, in Tasmania's case, means an overall decrease in rainfall (not withstanding modest increases in some areas) These will in turn lead to inundation of low lying coastal areas, erosion of some coastal landforms, increased frequency of bushfires, increased flood events, changes to agriculture including the type of crops and livestock, . It is considered that there is a statutory imperative for planning authorities to address the likely impacts of climate change.

The coast is particularly vulnerable.   Whilst the preferred option is to avoid potential risk scenarios in the first instance, there are numerous existing situations on the coast for which adaptation strategies in some form will have to be applied.

Avoidance can be achieved through identifying areas that are potentially susceptible to sea level rise and storm surge impacts and avoid development from occurring in those areas at the strategic planning stage through appropriate zoning. Planning controls can also address this issue by directing development away from susceptible areas through use status & setbacks and ensuring that development that need to be in risk areas is appropriately protected from impacts by design requirements, such as floor level controls.

Four adaptation methods have been identified, including; accommodation/no protection, protection, adaptation and retreat. Further detailed work is required to analyse coastal areas and the assets that are located there and to determine where is appropriate to, for example, build hard defences such as sea walls, or to allow natural coastal landform defences (predominantly sand dunes) to migrate inland, or to ultimately retreat from some areas that are indefensible in a cost effective manner. Appropriate policy responses need to be further evolved to deal with these various scenarios, along side building a greater understanding of the specific coastal areas and the likely impacts of climate change.

6. Government Policy on Climate Change

6.1 The Australian Government's Policy on Climate Change

The very first act of the then new Prime Minister, Kevin Rudd, in December 2007 was to ratify the Kyoto Protocol. The Kyoto Protocol is an international and legally binding agreement that commits industrialised countries to reduce or limit their greenhouse gas emissions (Australian Government 2010). In addition, through the United Nations climate change negotiations, the international community is working to develop a new long-term approach for global cooperation on climate change. The Federal Government has committed to reduce Australia's carbon pollution to 25 per cent below 2000 levels by 2020 if the world agrees to an ambitious global deal to stabilise levels of greenhouse gases in the atmosphere at 450 parts per million CO2 equivalent or lower (Australian Government 2010).. If the world is unable to reach agreement on a 450 parts per million target, Australia will still reduce its emissions by between 5 and 15 per cent below 2000 levels by 2020 (Australian Government 2010). It has also committed to a long-term emissions reduction target of at least 60 per cent below 2000 levels by 2050.

The proposed Carbon Pollution Reduction Scheme (CPRS) would put a price on carbon in an efficient way throughout the economy. It will use a 'cap and trade' emissions trading mechanism to limit carbon pollution. In a cap and trade scheme, the level of the scheme cap determines the environmental contribution of the Scheme: the lower the cap, the more abatement (reduction in emissions) required. The number of tradable Australian emissions units will be equal to the scheme cap — if the cap were to limit emissions to 100 million tonnes of carbon dioxide equivalent (CO2-e) in a particular year, 100 million emissions units would be issued for that year (Australian Government 2010). The introduction of a carbon price will change the relative prices of goods and services, making emissions-intensive goods more expensive relative to those that are fewer emissions intensive. This provides a powerful incentive for consumers and businesses to adjust their behaviour, resulting in a reduction of emissions. Businesses are likely to be willing to pay for Australian emissions units if their internal costs of abatement are higher than the price of units and to directly reduce their emissions if their internal costs of abatement are lower than the price of units. Companies which own units would be willing to sell them if the revenue received from selling units exceeds the profits from using them. These market incentives work to move the emissions units to the highest value use and to encourage the cheapest abatement to occur first. The CPRS does not rely on the Government knowing the best way to reduce emissions. Rather it encourages innovation throughout the economy as people seek to find alternative lower emission ways of producing goods and services. In this way the ability to trade emissions units ensures that the emissions cap is achieved at least cost to the economy.

On 27 January 2010, Australia formally submitted its existing 2020 target range for reducing emissions to the Copenhagen Accord (Australian Government 2010). Consistent with the Government's commitment to do no more and no less than the rest of the world, Australia submitted its existing target range. The decision to maintain the Government's target range is consistent with the approach expected to be taken by other countries. The Government's aim and intention is to support an ambitious international agreement and set our national emissions targets as soon as possible. As an ambitious and comprehensive global agreement is squarely in Australia's national interest, the Government is keeping the existing range, including the 25 per cent target, on the negotiating table.

If these matters are not resolved in 2011, the Government will then set scheme caps consistent with the five per cent target to provide business certainty for the commencement of the first year of full trading under the Carbon Pollution Reduction Scheme from July 2012.

It must be noted that the uncertainties now within the Australian parliament as a result of the 2010 Federal election have thrown a degree of doubt on the abovementioned plans.

6.2 The Tasmanian Government's Policy on Climate Change

Tasmania is contributing actively to the processes of national policy, legislation, regulation and program development. Chief among these initiatives is work to design a national emissions trading scheme, which will take effect in 2010. Tasmania is also working closely with the Garnaut Review, and with other Australian governments on: extending the national renewable energy target; defining the respective roles of the Commonwealth, and state and territory governments in adapting to climate change; identifying the sectors of the economy which will be able to deliver carbon offsets in future; determining a consistent national approach to the use of energy efficiency programs; and designing other measures to complement an emissions trading scheme (DPAC, 2010). Each of these initiatives will shape the approach Tasmania can take to address climate change.

The Intergovernmental Panel on Climate Change has estimated total global greenhouse gas emissions in 2004 at 49 gigatonnes (billion tonnes) of carbon-dioxide equivalent (CO2-e) (DPAC, 2010). In 2006 Australia emitted 576 megatonnes (million tonnes) CO2-e (DPAC, 2010). This is less than 1.5% of total global greenhouse gas emissions. In 2006, Tasmania emitted about 8.5 million tonnes of greenhouse gases into the atmosphere. Most of Tasmania's emissions come from transport, agriculture, manufacturing and construction.

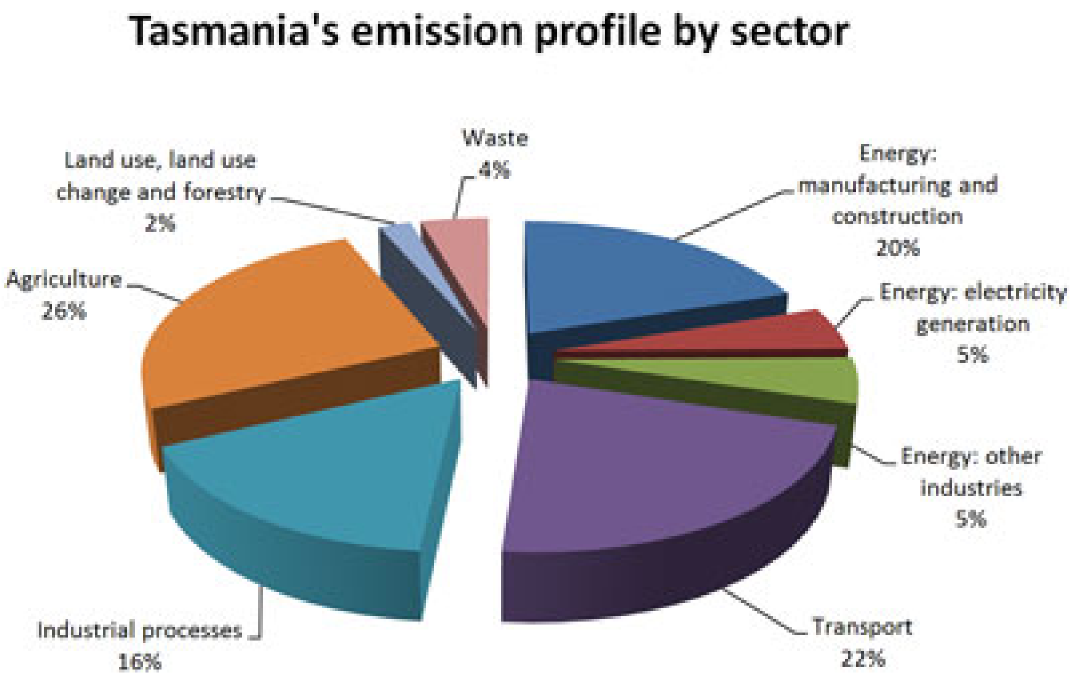

Figure 1: Tasmania's emission profile by sector (DPAC, 2010).

Established under the Climate Change (State Action) Act 2008 in order to provide independent expert advice to Government, the Council's role will be to assess the progress being made towards meeting the State's legislated greenhouse gas emission reduction target as well as the interim and sectoral targets (SoE, 2009). Tasmania is only the second Australian State to do so. The State's target, as set out in the Act, is to reduce its greenhouse gas emissions to at least 60% below 1990 levels by 2050 (Tasmanian Climate Action Council, 2010). The Council will also review the State's progress on adaptation strategies, and will provide a report on progress to the Parliament every two years (SoE, 2009).

The Tasmanian Government is already showing leadership by reducing its own emissions through the Framework for Action on Reducing the Tasmanian Government's Greenhouse Gas Emissions, by setting a 2050 emissions reduction target, and by establishing the Tasmanian Climate Action Council. Traditional approaches to public policy and decision-making will no longer suffice as we respond to the complex, rapidly-evolving issue of climate change. Accordingly, the Tasmanian Climate Change Office has been established in the Department of Premier and Cabinet, the Climate Change (State Action) Bill 2008 has been developed, and the Government has also taken action to reduce its own emissions.

To help reach this target the Tasmanian Government will fund a major analysis of emissions reduction opportunities across the Tasmanian economy. This work will utilise the wedges approach developed in a Princeton University study. The wedges approach is increasingly being used globally as a basis for jurisdictions to identify the most effective emissions reduction measures to adopt within an economy to achieve a set target. Using this approach, we will model a range of possible future greenhouse gas emission profiles to identify the emissions reduction measures in various Tasmanian sectors that will be most effective at achieving our target. The project will include comprehensive consultation with key stakeholder groups and will help industry sectors to re-focus in order to maximise opportunities. The actions that come out of the analysis will also be heavily influenced by the outcomes of the Commonwealth emissions trading scheme design and the Council of Australian Governments' work on policies and programs complementary to the scheme, which should be released later this year.

As well as sectoral targets, the wedges analysis will help identify appropriate interim emissions reduction targets for Tasmania. It will also provide a tool for assessing the merit of various future policy proposals and initiatives related to climate change. Through this work we will create a benchmark for decision-making in Tasmania for the next decade.

In 2008, the then Department of Primary Industries and Water published an audit of Tasmanian coastal assets potentially vulnerable to flooding and sea level rise. The Project is developing tools and resources to assist with risk-based management and planning for various assets and values in the coastal zone. A Template Coastal Risk Management Plan, with supporting Guidelines, has been produced for use by local planners and managers to assist in managing risks to assets in the coastal zone vulnerable to sea-level rise (DPIW, 2008). The appendix of this report details an audit of various hazards in four hazard zones. The inundation zones were adopted from Sharples and correspond to indicative coastal areas potentially susceptible to flooding in a 1%annual exceedance storm surge event,. The sea level rise measurements used were from the IPCC's Third Assessment Report (2001) of 0.9cm and 0.88cm by 2100, adjusted to 0.8cm and 0.84cm to reflect the use of a 2004 base year (as the IPCC's figures were calculated from 1990 levels). A further 50m buffer was added inland of the high sea level rise projection to allow for inaccuracy, large sites and associated infrastructure.

The *Climate Futures for Tasmania* project will also have relevance to land use planning responses to climate change. This project builds upon the earlier work by CSIRO, University of Tasmania and Tasmanian Partnership for Hydro Tasmania as discussed below. Delivered by a consortium of research providers and research users such as the Antarctic Climate & Ecosystems CRC, CSIRO, TPAC, Tasmanian Institute of Agricultural Research, Australian Bureau of Meteorology and Hydro Tasmania. Overall project management responsibilities are vested in the ACE CRC & the State Government. The data generated under this project will better represent Tasmania's geography and its effect on the local climate. The project will also provide an accessible basis for subsequent climate change research, by archiving fine-scale climate. One of the other key outputs of this project to date has been the LiDAR dataset which is new high resolution digital elevation information from which topographic maps along the Tasmanian coast with 250mm intervals up to 10 metres above sea level have been generated. The data covers priority areas of coastline within the State and within Southern Tasmania the information is available for the more populated coastal areas. The value of this data is that it can be utilised to identify and assess areas that may be affected by or vulnerable to sea level rise, sea inundation, storm or tidal surges in a more accurate and finer grained scale than was previously possible (Antarctic Climate & Ecosystem CRC 2008). The LiDAR data was utilised in the Clarence City Council's pilot study to identify the areas most at risk and has been utilised in the preparation of the Coastal Inundation Modelling.

The Climate Change Futures for Tasmania is a jointly funded, collaborative research project that has generated improved climate change information for Tasmania out to 2100. It is a project of the Antarctic Climate & Ecosystems Cooperative Research Centre. Currently, global climate models are unable to predict the local impacts of climate change due to coarse resolution. Dynamical downscaling of global climate models is a way of providing detailed information of the local variations and impacts of projected changes. The Climate Futures for Tasmania project uses CSIRO's Conformal Cubic Atmospheric Model (CCAM) to dynamically downscale IPCC global climate model outputs to produce fine-scale climate projections for Tasmania 2100. Dynamical downscaling simulates the complex processes that influence Tasmania's weather and climate, thus providing the most detailed picture of Tasmania's possible future climates. The project downscaled six of the 23 global climate models with two emissions scenarios that were reported in the IPCC Fourth Assessment Report. In a special report released to the Tasmanian Planning Commission, climate projections were detailed for temperature and rainfall and details of specific projected changes to the general climate included evaporation, water yields, agriculture and extreme events.

The State Government, through DPIPWE, has initiated a project entitled Building Resilience into Natural Systems: Adaptation to Climate Change. The Project addresses the need for the Tasmanian Government and the community to develop and implement adaptation responses to reduce the vulnerability of Tasmania's natural values to climate change (SoE, 2009).

CSIRO is also a major partner in the Australian Climate Change Science Program (ACCSP) along with the Department of Climate Change and the Bureau of Meteorology. The research program aims to maintain and develop Australia's expertise in climate change science, and lead the research effort in the Southern Hemisphere. (CSIRO; http://www.csiro.au/science/climate-and-weather-research.html, accessed 16/02/10).

Furthermore, Tasmania has a head start on other parts of the globe with its predominately renewable electricity generation. There is significant potential for expansion through further investment in hydro, wind, geothermal, solar and wave energy, and this energy will be available through Basslink to Australia's eastern states, offsetting their need to use electricity generated from burning coal. The State is already building on its substantial expertise and investment in renewable electricity generation to supply expertise beyond our shores. Companies such as Roaring 40s are building renewable energy projects in China, helping them reduce their contribution to climate change. As many of our neighbours have incentives to reduce their emissions by expanding their use of renewable energy, Tasmania has an opportunity to build further on its strengths and supply an expanding market. Significant opportunities also exist for Tasmania to export its knowledge and expertise to other parts of the world on the successful management of a large carbon sink, gained through the management of Tasmania's 423 reserves covering 2.5 million hectares (DPAC 2008).

7. Planning Implications

Climate plays a fundamental role in the economic, social and environmental values of the region. Under desirable changes in climatic conditions would, therefore, be likely to adversely disrupt the many resource dependent industries that exist in the region including tourism, agriculture and aquaculture. Given that a large proportion of the population of the Southern Region is centred in and around the coastal areas of south-eastern Tasmania, the risk associated with climatic change is significant as the impacts of sea level rise, flood occurrences and storm events will be more immediate due to coastal exposure. Climate change and sea-level rise will exacerbate the impacts of these hazards, causing progressive flooding and erosion of shorelines. Information on the potential vulnerability to these hazards is critical to the development of planning, mitigation and management responses that are appropriate, and based in sound risk management techniques.

Tasmania's climate is changing in ways that will influence the roles and responsibilities of Local Government. The expected increase in climate variability and extreme weather is of real concern. This change will affect small and large, and rural and urban councils and will have effects on land use planning, infrastructure, emergency preparedness, community services and resource management. Over the last decade, Local Government has been at the forefront of climate change mitigation strategies. Much of the focus has been on reducing the amount of greenhouse gasses emitted into the atmosphere through sustainable building design, improving the transport system and adopting renewable energy sources. However there is now a recognised acceptance that the impacts of climate change are already underway and that further change is inevitable and thus it is the responsibility of all levels of government to adapt to these changes. Of particular importance, local government will need to be able to identify, understand and respond to the impacts of climate change. This response is likely to be complex and will require a multi-faceted approach including land use planning, corporate planning, infrastructure planning, policy development and educating the community on how to change behaviours. To date much of the focus on climate change has been on mitigation with many council's demonstrating a commitment to reduce their carbon emissions through a variety of programs.

Strategic long-term land-use planning will also play a vital role in minimising the exposure of new developments to the effects of climate change, in particular within coastal areas where potential for sea level rise and storm surge activity will create new challenges. Planning to avoid development in high risk locations and developing and applying new design standards will be crucial in managing future challenges as our towns and cities grow. Planning can also be used to restrict development in areas prone to flooding, storm surge or sea level rise, and ensure that essential infrastructure is relocated or protected from severe weather events. The three regional planning strategies give strategic direction for future land use, transport and infrastructure development. They will consider increasing the density of development, encouraging a greater mix of uses, minimising impacts on natural areas, and avoiding areas subject to climate hazards such as sea level rise, storm surge, flooding and bushfire.

Within Australia, planning for adaptation to anticipated climate change is at an early stage. In the absence of any national planning guidelines, each state/territory is developing its own response to the issue. Clearly there are initiatives emerging at all levels of government in response to planning for coastal inundation, increased extreme weather events and loss of rainfall. At the national level there is investment in research and development, at the state level there is policy development and at the local level there are specific examples of possible land use responses. All these actions are contributing to the development of a matrix of possible responses to climate change impacts.

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Southern Tasmania
REGIONAL PLANNING PROJECT

The Southern Tasmania Regional Planning Project
is a joint initiative of the State of Tasmania, the Southern Tasmanian Councils Authority,
the 12 Southern Councils and the Sullivans Cove Waterfront Authority