4

Greenhouse gas reductions in Australia

A two percent reduction a year

4.1 In the previous chapter, the Committee concluded that Australia should be willing to reduce greenhouse gas emissions by 80 percent by 2050, which is commensurate with stabilising greenhouse gases in the atmosphere at 450 parts per million.

4.2 While this is a massive reduction in greenhouse gas emissions, the Committee is of the view that it can be achieved. Spread over the 40 years to 2050, the target amounts to a two percent reduction each year.

4.3 The key to achieving a reduction of this sort will be consistency of effort and a willingness to employ a wide range of measures to reduce greenhouse gas emissions incrementally.

4.4 This chapter explores a number of measures for reducing greenhouse gas emissions. Some of these measures are ready to be implemented now, while others will require research, investment and time before they result in meaningful greenhouse gas reductions.

4.5 The measures outlined here provide an example of the incremental process by which significant reductions can be achieved. These include:

- the adoption of policy frameworks, such as:
  - ⇒ the Carbon Pollution Reduction Scheme (CPRS); and
  - ⇒ the Renewable Energy Target (RET);
- the effort to change current practices, such as

- ⇒ use of private vehicles were public transport is a viable option;
- ⇒ land clearing; and
- ⇒ savannah burning; and

- low emissions technologies, such as
  - ⇒ wind generation;
  - ⇒ geothermal energy;
  - ⇒ ocean power;
  - ⇒ solar power;
  - ⇒ cogeneration;
  - ⇒ carbon capture;
  - ⇒ alternative fuels for vehicles; and
  - ⇒ biochar.

Policy frameworks

The Carbon Pollution Reduction Scheme (CPRS)

4.6 The Carbon Pollution Reduction Scheme (CPRS) is the Federal Government's principal policy response to encourage a reduction in emissions. The CPRS is a national carbon market, with the Australian Government issuing tradable instruments that permit carbon emissions. The advantages of a carbon market have been discussed in some detail in the previous chapter.

4.7 The Government estimates that the scheme will result in reductions in greenhouse gas emissions to between five and 15 percent below 2000 levels by 2020 and to 60 percent below 2000 levels by 2050.[1]

Renewable Energy Target (RET)

4.8 In 2006, stationary energy (that is, energy for industrial, commercial and residential sectors) accounted for 34.4 percent of Australia's greenhouse gas emissions. A move to renewable energy generation in the stationary energy sector could significantly reduce Australia's overall emissions.[2]

---

1 Australian Government, *Carbon pollution reduction scheme: Australia's low pollution future*, 2008, p. XX.

2 Department of Climate Change, *National greenhouse gas inventory*, 2006, p. 6.

4.9 As part of the Government's strategy to reduce Australia's emissions, it has imposed a Renewable Energy Target (RET) on large wholesale purchasers of electricity. The RET will require that 20 percent of Australia's stationary energy is generated using renewable energy by 2020.[3] A range of organisations argue that the RET is an important mechanism in Australia reducing greenhouse gas emissions and should operate in conjunction with the CPRS.[4]

4.10 The Obama Administration in the United States has announced a target of 25 percent renewable energy by 2025. In Australia, the Clean Energy Council has expressed concern that Australia's 20 percent by 2020 target will not be met unless investors can see a financial return beyond 2020, given the long time horizon needed to recover large capital investments. It will be important to monitor the implementation of the Renewable Energy Target to ensure that the Government's policy objective is achieved.

4.11 During the inquiry the Committee surveyed a range of renewable energy generation technologies with the potential to contribute to the RET, such as wind, solar and ocean electricity generation. These are discussed in some detail below in the technologies section of this chapter.

Changing current practices

4.12 A number of large sources of greenhouse gas emissions in Australia are due to practices that could be modified with a change in attitude by the community. The practices are:

- use of private vehicles where public transport is a viable option;
- land clearing; and
- savannah burning.

Use of private vehicles

4.13 Passenger cars were the biggest contributor to emissions from road transport, with emissions from passenger cars growing by 21 percent

3 Australian Government, *Carbon pollution reduction scheme: Australia's low pollution future*, 2008, p. XL.

4 The Australian Sugar Milling Council, *Submission to the Garnaut Climate Change Review*, p. 3; Environment Business Australia, *Submission to the Carbon Pollution Reduction Scheme*, p. 6.

between 1990 and 2006.[5] Professor Garnaut identified that there was some scope to reduce emissions from this source. [6]

4.14 The Australian Conservation Foundation (ACF) has argued that the formula for fringe benefits tax concessions for private use of company cars creates an incentive for unnecessary travel, as it is based on the number of kilometres travelled. The ACF believes that fringe benefit tax concessions for company cars should be restructured to create positive incentives for efficient vehicles, remove perverse incentives to drive more, and complement efforts to re-tool the Australian car industry for cleaner vehicle production.[7]

4.15 In a similar vein, Greenpeace recommended that the Australian Government's *Review of Australia's Future Tax System* address transport subsidies to ensure that climate protection is integrated into public spending.[8]

4.16 Evidence to the Committee identified a number of proposals for increasing the use of public transport. The South West Group advocated the development new tram and light rail technology as a pathway to emissions-reduced transport systems.[9] The Group also suggested that the Australian public would have to adjust to new practices for daily travel.[10]

4.17 The ACF advocated the need for investment in infrastructure that has low carbon intensity in both its construction and the life of its operation. The ACF called for the development of a high-quality integrated public transport system to combat Australia's growing levels of greenhouse gas emissions.[11]

---

5 Department of Climate Change, *National greenhouse gas inventory*, 2006, p. 7.

6 The Garnaut Climate Change Review: *Final Report*, 2008, p. 525.

7 Australian Conservation Foundation, *Submission to Department of the Treasury, Priorities for the Federal Budget 2009-10*, January 2009, pp. 3–4.

8 Greenpeace, *Submission No. 24,* p. 14.

9 Mr Chris Fitzhardinge, *Transcript of Evidence*, 19 December 2008, p. 19.

10 Mr Chris Fitzhardinge, *Transcript of Evidence*, 19 December 2008, p. 19.

11 Australian Conservation Foundation, *Submission to Infrastructure Australia: Discussion paper 1: Australia's future infrastructure requirements*, 2008.

Recommendation 5

The Committee recommends that the Australian Government work through the Council of Australian Governments to establish a high quality integrated public transport system including light rail technology.

Reducing emissions from deforestation

4.18 Trees sequester carbon from the atmosphere through the process of photosynthesis. This carbon is then stored in the tissue of trees in the form of starch. Once trees die, some of this carbon is transmitted to the soil where it can be stored for thousands of years.[12]

4.19 Deforestation plays a dual role in climate change. First, as more trees are removed the effectiveness of forests as carbon sinks is reduced, thus lessening the amount of carbon dioxide being withdrawn from the atmosphere. Second, the process of deforestation actually releases carbon dioxide into the atmosphere through the process of combustion and decomposition.[13] It is estimated that in 2004 deforestation, along with the decay of biomass, contributed 17.3 percent of the world's man-made greenhouse gas emissions.[14]

4.20 About 30 percent of the world's land area is covered by forests with the three largest forests located in South America, Central Africa and South East Asia. In other words, forests are largely located in developing and transitional nations. Between 2000 and 2005 the worldwide net rate of deforestation declined[15], however during 2007-2008 deforestation in the Amazon increased by 3.8 percent over the previous year.[16]

4.21 Deforestation is caused by a range of factors including:

12 Alvarado, L.X.R. and Wertz-Kanounnikoff, S., *Why are we seeing "REDD"? An analysis of the international debate on reducing emissions from deforestation and degradation in developing countries*, 2007, p. 8.

13 Alvarado, L.X.R. and Wertz-Kanounnikoff, S., *Why are we seeing "REDD"? An analysis of the international debate on reducing emissions from deforestation and degradation in developing countries*, 2007, p. 8.

14 IPCC, *Climate change 2007: Synthesis report*, 2008, p. 36.

15 Alvarado, L.X.R. and Wertz-Kanounnikoff, S., *Why are we seeing "REDD"? An analysis of the international debate on reducing emissions from deforestation and degradation in developing countries*, 2007, p. 8.

16 World Wildlife Fund for Nature, *Amazon deforestation on the increase*, 2008, www.panda.org, viewed on 22 January 2009.

- demand for land from agricultural expansion driven by population growth, high prices for agricultural commodities and cheap labour;
- more profitable alternative land use, such as growing crops;
- demand for wood products;
- demand for land to be used for infrastructure such as pipelines, dams and open-pit mines;
- government regulations and poor supervision that reward deforestation; and
- economic factors including wood processing company debt levels and international market prices.[17]

4.22 In order to reduce deforestation a range of techniques have been proposed:

- afforestation (planting trees), sequestering carbon from the atmosphere and reducing emissions associated with land clearing;
- improving management of existing forests to increase the density and efficiency of forests; and
- managing the harvest of forests so that the amount of carbon removed annually, through deforestation, is equal to or less than the amount of carbon sequestered and stored by the forest.[18]

4.23 The need to reduce emissions from deforestation was formally recognised by the United Nations Framework Convention on Climate Change through the Bali Action Plan in December 2007. The plan advocates the consideration of approaches to reduce emissions from deforestation and to enhance forest carbon stocks in developed and developing countries.[19] The Convention established the Ad Hoc Working Group on Long-term Cooperative Action under the Convention to implement the Bali Action Plan. The Group is expected to present the outcome of its work, including the consideration of mechanisms to combat deforestation in 2009.[20]

---

17 Kanninen, M., Murdiyarso, D., Seymour, F., Angelsen, A., Wunder, S. and German, L., *Do trees grow on money: The implications of deforestation research for policies to promote REDD*, 2007, pp. 17-26.

18 IPCC, *Climate change 2007: The physical science basis*, *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, 2008, p. 550.

19 United Nations Framework Convention on Climate Change, *Report of the Conference of the parties on tis thirteenth session, held in Bali from 3 to 15 December 2007*, 2008, p. 8.

20 United Nations Framework Convention on Climate Change, 2009, Viewed 22 January 2009 unfccc.int/meetings/items/4381.php.

4.24 A range of policy options exist to encourage the uptake of the above mentioned techniques to combat deforestation:

- eliminate subsidies on goods and services that support and protect agriculture, population expansion, and logging sectors;
- introduce tax breaks for landholders carrying out conservation;
- influence demand by certifying timber goods that minimise deforestation;
- deny public and private investment to industries that are not working to combat deforestation;
- compensate landowners, either through monetary rewards or increased public services, on the condition they preserve and maintain forests;
- direct regulation where deforestation is prohibited in certain areas; and
- restrict property rights so that landholders are prohibited from carrying out land clearing.

The most effective policy will vary on a case by case basis and would be largely dependent upon the strength of the institutions involved in their implementation.[21]

4.25 A range of submissions to the inquiry advocated a larger role for Australian monetary aid in combating deforestation and forest degradation in developing nations.[22]

4.26 In July 2008 the United Nations established the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries in order to promote an economic environment that favours the sustainable management of forests. The programme established a $35 million fund to assist developing countries in constructing deforestation-reduction strategies and solutions. To date, no programmes or projects have been implemented under the scheme.[23]

4.27 In regards to Australian initiatives, the Government heads the International Forest Carbon Initiative. This is an Australian sponsored programme aimed at demonstrating that reducing emissions from

21 Kanninen, M., Murdiyarso, D., Seymour, F., Angelsen, A., Wunder, S. and German, L., *Do trees grow on money: The implications of deforestation research for policies to promote REDD*, 2007, pp. 32-41.

22 The Australian Conservation Foundation, Submission No. 20, p. 6; Humane Society International, Submission No. 17, p. 2.

23 United Nations Development Group, 2009, www.undp.org, viewed on 22 January 2009.

deforestation can be achieved equitably and effectively through international agreements. Through the initiative Australia has so far pledged tens of millions of dollars to programmes throughout the Asia-Pacific.[24]

4.28 Within Australia, deforestation is not included under the announced CPRS. The CPRS White Paper states that deforestation in Australia has reduced markedly since 1990, and the sporadic nature of current land clearing practices would make its inclusion in the scheme impractical.[25]

4.29 However, as will be discussed in the next chapter, afforestation may help in mitigating climate change in Australia.

Recommendation 6

The Committee recommends that the Australian Government endeavour to move to 'full carbon accounting' to ensure that emissions resulting from forestry activities as well as biosequestration are accurately accounted for.

Savannah burning

4.30 The Committee heard evidence of the large contribution of wildfires in regions of northern Australia to Australia's total greenhouse gas emissions. Dr Jeremy Russell-Smith, an expert on savannah burning, argued that the magnitude of these fires, and their effects, are largely unrecognised:

> …we are talking about big fires that are often much greater than 10,000 square kilometres and up to 60,000 square kilometres, which is the area of Tasmania. They are not even reported in the local newspaper, let alone in the media generally. It is something that we sort of live with but it is unacceptable.[26]

4.31 Dr Russell-Smith stated that wildfires in pre-European northern Australia were managed by controlled wet-season savannah burning. In the last century, this system broke down to the point where freely burning dry-season wildfires are making significant contributions to Australia's

24 Department of Climate Change, *International forest carbon initiative factsheet*, 2008.

25 Australian Government, *Carbon pollution reduction scheme: Australia's low pollution future*, 2008.

26 Dr Jeremy Russell-Smith, *Transcript of Evidence,* 19 August 2008, p. 25.

greenhouse gas emissions.[27] In 2006 savannah burning accounted for almost two percent of Australia's greenhouse gas emissions.[28]

4.32 Dr Russell-Smith advocated reducing the frequency and severity of these fires through a programme of managed savannah burning, referring to the West Arnhem Land Fire Abatement (WALFA) project as an example of how these fires can be effectively managed. This project is a partnership between traditional landholders, industry and government where satellite imaging technology and traditional Indigenous fire management practices are used to plan and carry out strategic savannah burning at appropriate times of year. This burning creates natural firebreaks which diminish the severity of the dry-season wildfires. In turn, the greenhouse gas emissions resulting from savannah burning are greatly reduced.[29]

4.33 Dr Russell-Smith stated that data from the WALFA project indicated a 48 percent reduction in greenhouse gas emissions from savannah burning across the region covered by the project. Dr Russell-Smith stated that similar reductions could be expected if similar strategies were applied across other areas of northern Australia.[30] The CSIRO also advocated the implementation of such a strategy across northern Australia.[31]

4.34 Savannah burning has not been initially included under the CPRS. However the CPRS does include savannah burning as a source of offsets. The Government has indicated its intention to conduct a national workshop in the first half of 2009 to consider how to overcome a range of issues relating to such projects.[32]

4.35 If the figures provided by Dr Russell-Smith are accurate, controlled savannah burning could reduce Australian greenhouse gas emissions by one percent.

27 Dr Jeremy Russell-Smith, *Transcript of Evidence,* 19 August 2008, p. 25.

28 Department of Climate Change, *National greenhouse gas inventory*, 2006, p. 7.

29 Dr Jeremy Russell-Smith, *Transcript of Evidence,* 19 August 2008, p. 27.

30 Dr Jeremy Russell-Smith, *Transcript of Evidence,* 19 August 2008, p. 27.

31 Dr Garry Cook, *Transcript of Evidence,* 19 August 2008, p. 43.

32 Australian Government, *Carbon pollution reduction scheme: Australia's low pollution future*, 2008, pp. 6-63.

Recommendation 7

The Committee recommends that the Australian Government, through both the Council of Australian Governments and ongoing work on the Carbon Pollution Reduction Scheme, and in consultation with relevant indigenous communities, explore ways to reduce greenhouse gas emissions from savannah burning.

Low emissions technologies

Wind

4.36 Wind turbines convert the energy from a moving airflow to electricity. Wind rotates a turbine which is connected to an energy generator. The energy generator then converts the energy from the rotation of the turbine to electricity, which is then exported to users via an electricity grid.[33]

4.37 Wind powered electricity generation is a proven technology and is used throughout the world. The efficiency and applicability of electricity generation from wind turbines is increasing due to continued improvements in turbine design and the range of locations where wind turbines can be used. For example, trials are underway throughout Europe of floating wind turbines for use offshore.[34]

4.38 The efficiency of wind generated electricity is being improved by work of the CSIRO on electricity storage batteries attached to wind turbines. For example, the 'Ultrabattery' combines a range of existing technologies to provide a low cost, long life and high performance battery. This battery lasts four times longer and produces 50 percent more energy than conventional batteries.[35]

4.39 Aside from the RET, there are no Federal Government incentives for the development of wind energy generation.[36]

4.40 Worldwide, over forty countries offer feed in tariffs to encourage renewable energy generation. Under such schemes, households and firms are paid a government funded premium rate for electricity that is fed back

33 International Energy Agency, *Renewable energy essentials: Wind*, 2008, p. 4.

34 International Energy Agency, *Renewable energy essentials: Wind*, 2008, p. 2.

35 CSIRO, *CSIRO Project Profile - Ultrabattery: no ordinary battery,* 2008.

36 Clean Energy Council, *Clean energy fact sheets: All about wind energy,* 2007, p. 1.

into the grid from renewable energy sources. The electricity from wind turbines owned by private citizens could be covered under such a scheme.[37]

4.41 A number of state and territory governments currently offer feed in tariffs. Victoria, South Australia, the Australian Capital Territory, Tasmania, the Northern Territory and Queensland all have differing independent feed in tariff schemes. Western Australia and New South Wales have also committed to developing feed in tariff schemes. However wind energy is not necessarily covered under such schemes, and feed in tariffs only encourage the uptake of wind turbines by individuals, rather than by energy generating companies.[38]

4.42 The Clean Energy Council believes that in the short term, the potential exists to more than double the current capacity of wind-powered electricity generation in Australia.[39]

4.43 It is not clear at this stage whether the RET and the state- and territory-based feed in tariffs will be sufficient to ensure that wind turbines are used to their full potential as a renewable energy resource. Environment Business Australia supports the use of feed in tariffs to encourage the uptake of renewable energy sources such as wind energy.[40]

4.44 The Committee is of the view that the uptake of wind turbines should be promoted and monitored by the Government. If wind turbines are not used to their full potential, the Government should consider other measures to encourage their use.

Geothermal energy

4.45 Geothermal energy converts the subterranean heat generated by the planet's core to electricity. Wells are drilled to a depth of three to five kilometres below the earth's surface. Water is then circulated down these wells to be heated to extremely high temperatures then returned to the surface. The hot water is then converted to electricity, usually through a steam turbine.[41]

37 Wind Energy & Solar Power Australia, *Feed-in tariff for grid-connected solar systems*, 2009.

38 Wind Energy & Solar Power Australia, *Feed-in tariff for grid-connected solar systems*, 2009.

39 Clean Energy Council, *Clean energy fact sheets: All about wind energy,* 2007, p. 1.

40 Environment Business Australia, *Submission to the Carbon Pollution Reduction Scheme*, p. 6.

41 Clean Energy Council, *Clean energy fact sheets: All about geothermal energy,* 2007, p. 1.

4.46 Geothermal power is an emission neutral source of power. One megawatt of power from a geothermal facility avoids the emission of approximately one tonne of carbon dioxide.[42]

4.47 Geothermal electricity generation relies on existing technologies and is a rapidly emerging technology in Australia. While still in the development stage, it may provide a predictable and reliable renewable energy source.[43] In 2008 geothermal energy company Geodynamics Ltd established Australia's first commercial-scale well.[44]

4.48 The Government is providing a range of assistance to the geothermal energy industry. During August 2008 the Government announced the *Geothermal Drilling Program* to provide financial assistance for the development of demonstration plants for geothermal energy generation. The programme offers assistance of up to $7 million per project.[45]

4.49 In December 2008, the Government launched the *Geothermal Industry Development Framework*. The framework aims to assist the geothermal industry by encouraging investment, facilitating the exchange of information amongst government and commercial entities, creating an effective research and development network and generating a skilled workforce for the geothermal industry.[46]

4.50 Whilst many of the elements of the geothermal energy process such as drilling, pumping and generation have been proven, it is yet to be determined if the process as a whole is viable. If proven to be viable, however, geothermal electricity generation has the potential to become a significant source of stationary energy. The Australian Geothermal Energy Association believes geothermal energy will be a viable source of stationary energy within 12 years.[47]

Ocean power

4.51 Ocean power employs the energy from the ocean's tides, currents and waves to produce electricity. A range of technologies exist to harness this energy. The most common generation system uses the energy from

42 Clean Energy Council, *Clean energy fact sheets: All about geothermal energy,* 2007, p. 1.

43 Clean Energy Council, *Clean energy fact sheets: All about geothermal energy,* 2007, p. 1.

44 Geodynamics Ltd. 2008, Geodynamics Ltd, www.geodynamics.com.au, viewed on 19 January 2009.

45 Department of Resources, Energy and Tourism, *Geothermal drilling program*, 2008.

46 Department of Resources, Energy and Tourism, *Australian geothermal industry development framework*, 2008, p. XI.

47 Australian Geothermal Energy Association, *Installed capacity and generation from geothermal sources by 2020*, 2008, p. 20.

flowing water to turn a turbine. The rotation of this turbine is then used to generate electricity, which is then transmitted to users via an electricity network or grid.[48]

4.52 Ocean power is an emerging technology. Developers around the world face a range of challenges in developing and testing ocean power devices due to the variability of ocean conditions, a lack of investment interest and difficulties with the regulation of ocean power installations.[49]

4.53 A range of different pilot projects exist internationally. In 2008 Portugal opened the world's first commercial wave-powered energy generation facility.[50] A similar project is proposed in Scotland.[51]

4.54 In Australia, companies are involved in the construction of demonstration plants. At Port Kembla, New South Wales, a prototype wave-powered energy generator supplies a small amount of energy to the local grid. Similar projects are proposed for Portland, Victoria, and Fremantle, Western Australia.[52]

4.55 Australia is in a good position to take advantage of wave technology. It is estimated that one million gigawatts of wave energy hits Australia's shores every year.[53] The World Energy Council anticipates that in five to ten years time wave energy could be making a contribution to the worlds energy supply.[54]

4.56 Given the coastal concentration of Australia's population, it appears that tidal and wave generation have the potential to be better utilised in this country. As a source of stationary energy, wave and tidal power is likely to be a longer term proposition for Australia.

Solar power

4.57 Solar power is harnessed using two types of generating system; photovoltaic cells and solar thermal generation.

48 Clean Energy Council, *Clean energy fact sheets: All about ocean energy,* 2007, p. 1.

49 World Energy Council, *Survey of energy resources*, 2009, www.worldenergy.org, viewed on 19 January 2009.

50 Alok, J., *Making waves: UK firm harnesses power of the sea … in Portugal*, The Guardian, 25 September 2008, www.guardian.co.uk, viewed on 19 January 2009.

51 Scottish Power Renewables, 2009, www.scottishpowerrenewables.com, viewed on 19 January 2009.

52 Clean Energy Council, *Clean energy fact sheets: All about ocean energy,* 2007, p. 2.

53 Carnegie Corporation, *Wave energy as a global resource*, 2009, www.carnegiecorp.com.au, viewed on 19 January 2009.

54 World Energy Council, *Survey of energy resources*, 2009, www.worldenergy.org/publications, viewed on 19 January 2009.

4.58 In photovoltaic cells, light energy from the sun enters a cell made out of silicon. The light energy excites the electrons contained in the silicon, which in turn generates electricity. This electricity is then used at the site of generation or transmitted to users via a local power grid.[55]

4.59 Photovoltaic solar power is an established technology used in around 25,000 homes in Australia. Once installed, photovoltaic solar power creates no emissions. Photovoltaic solar power is a low-maintenance and reliable intermittent power source: it can only generate electricity when exposed to sunlight. Photovoltaic solar power is mainly used to supplement constant base load electricity supplies.[56]

4.60 The current solar market is dominated by crystalline silicon solar cells. These cells are expensive due to the large amount of silicon used in their production.

4.61 A range of developments are driving down the price of photovoltaic solar power including the development of thin film solar cells. Thin film cells use very little or no silicon at all, thus significantly reducing production costs.[57] There are many companies putting thin film solar modules into mass production. This promises to further reduce the costs of thin film solar technology to the point where it may compete against fossil-fuel electricity generation.[58]

4.62 Solar thermal generation technology is a relatively new form of solar energy that uses a mirror field to concentrate solar energy on a tank of liquid or gas. The liquid or gas is heated, expands, and consequently moves through a turbine to generate electricity.

4.63 Solar thermal generation technology requires sufficient space for the mirror field, and so can only be used in industrial, rather than domestic, generation.

4.64 Solar thermal generation technology is considered to have a number of advantages over photovoltaic solar generation. Solar thermal generation is much more efficient and has been enhanced by the development of technologies that allow the storage of solar energy, allowing solar thermal generation to continue to generate electricity after dark.[59]

---

55 Knier, G., *How do photocoltaics work?*, North American Space Agency, 2009, science.nasa.gov, viewed on 19 January 2009.

56 Clean Energy Council, *Clean energy fact sheets: All about solar power,* 2007, p. 1.

57 The Economist, *Bright prospects*, March 2007, Vol. 382, p. 22.

58 Hand, A., *Thin-film photovoltaics*, Semiconductor International, 2008, Vol. 31(8), pp. 26-28.

59 Clean Energy Council, *Clean energy fact sheets: All about solar power,* 2007, p. 3.

4.65 Solar thermal generation technology is sufficiently advanced to be already used on a commercial basis. Most notably, the city of Seville in Spain derives the bulk of its power from solar thermal generators.

4.66 Solar thermal generation technology is currently being explored by the CSIRO:

> [The project] is a 500-kilowatt solar field which contains about 200 mirrors reflecting the sun's energy up to a central tower. There is a reactor mounted on that tower, and that reactor is basically a solar furnace. It can get up to temperatures of 1,200 degrees if needed, but we are running it at about 800 degrees at the moment. It is re-forming natural gas through to what we call 'synthesis gas' with the addition of steam. Synthesis gas contains about 30 percent more energy than the original gases that go in. In other words, we are storing solar energy in the form of a changed gas composition.[60]

Cogeneration

4.67 Cogeneration involves harnessing the by-product or excess heat from industrial processes to generate energy. The excess heat is used to power a turbine to create electricity or to heat buildings, reducing the amount of energy used by the buildings. Cogeneration can take place in fossil-fuel based power plants[61] as well as other industrial processes such as sugar mills.[62]

4.68 Because cogeneration is the generation of electricity as a by-product of an industrial process, it has the potential to reduce the amount of power an industrial plant extracts from the electricity grid, and in limited cases, can permit the plant to export the power to the grid.[63]

4.69 Most energy generation takes place in large centralised single process power plants. Energy from these plants must be transmitted significant distances to users, resulting in significant transmission losses. Cogeneration projects have the potential to be located close to users of the

60 Dr John Wright, *Transcript of Evidence*, 1 December 2008, p. 11.

61 Gurney, A., Ford, M., Low, K., Tulloh, C., Jakeman, G. and Gunasekera, D., *ABARE Research report 7.16: Technology toward a low emissions future,* September 2007, p. 13; The Australian Petroleum Producers and Exporters Association, *Attachment 2 to Submission No. 32,* p. 65.

62 Baker, T., Bartle, J., Dickson, R., Polglase P., and Schuck, S., *Prospects for bio-energy from short-rotation crops in Australia*, September 1999, p. 3; The Australian Sugar Milling Council, *Submission to the Garnaut Climate Change Review*, p. 4.

63 Sunshine Electricity, *Condong project update* , June 2008, www.sunshineelectricity.com.au, viewed on 8 December 2008.

electricity. Consequently, less energy may be lost during the transmission of the electricity, thus further improving efficiency.[64]

4.70 Cogeneration already exists in Australia, particularly in the sugar milling industry. However, price regulation of transmission networks may form a market barrier to new cogenerators entering the national electricity market.

4.71 The benefits of having many decentralised cogenerators may be nullified by a standard transmission charge which is charged to all users, regardless of the distance the electricity has to be transmitted.[65]

Recommendation 8

The Committee recommends that promising renewable energy technologies which are not cost-competitive at the moment, including geothermal, solar thermal, large scale photovoltaic and wave energy, are further supported.

Carbon capture and storage in coal-fired power plants

4.72 Coal is the primary fuel used for electricity generation in Australia. In 2006, coal was used to generate 86.3 percent of Australia's electricity.[66]

4.73 Carbon capture and storage (CCS) is a process to reduce the amount of carbon dioxide emitted to the atmosphere during the combustion of fossil fuels in power plants. A variety of CCS technologies exist, however the basic concept is the same. Through a chemical process, carbon dioxide is extracted either from fossil fuels prior to combustion (called pre-combustion capture) or from the exhaust after the combustion of fossil fuels (called post-combustion capture). This carbon dioxide is then compressed, transported and injected into naturally occurring, sealed, subterranean geological formations for permanent storage.[67]

64 Pepermans, G., Driesen, J., Haeseldonckx, D., Belmans, R. and D'haeseleer, W., *Distributed generation: definition, benefits and issues*, Energy Policy, 2005, Vol 33(6), p. 789.

65 Productivity Commission, *Report No. 36: The private cost effectiveness of improving energy efficiency*, 2005, p. XLI.

66 Department of Climate Change *National greenhouse gas inventory*, 2006, p. 6.

67 International Energy Agency, *Carbon dioxide capture and storage*, 2009, www.iea.org/Textbase/subjectqueries/cdcs.asp, viewed on 20 January 2009.

4.74 According to the Intergovernmental Panel on Climate Change (IPCC), CCS technology could reduce carbon dioxide emissions from power plants by approximately 80 to 90 percent.[68]

4.75 CCS technologies are in different stages of development. Some have been proven to be viable at an industrial scale.[69] Worldwide, there are four commercial-scale carbon dioxide storage projects. These projects have successfully stored millions of tonnes of carbon dioxide without leakage.

4.76 However, it is anticipated that CCS technologies, due to the significant costs and construction timeframe, will not be widely deployed in the near-term. This means that CCS will not make a contribution to greenhouse gas reductions until at least 2015.[70]

4.77 Within Australia, CCS is being developed by the CSIRO and the Cooperative Research Centre for Greenhouse Gas Technologies (CRC GGT). The CRC GGT is a collaborative research organisation that comprises participants from industry, research organisations and all levels of government.

4.78 The CSIRO has participated in the development of three functioning pilot plants with carbon dioxide extraction in New South Wales, Victoria and China.[71]

4.79 The CRC GGT is focusing on three main areas of research: carbon dioxide capture, carbon dioxide storage and demonstration projects. The CRC GGT has three major demonstration projects in Australia:

- a demonstration of deep geological storage of carbon dioxide in South Western Victoria;
- a pilot plant built in partnership between the University of Melbourne, Monash University, CSIRO, Loy Yang Power and International Power to seek ways of improving the reliability, safety and efficiency of pre-combustion capture techniques; and
- a similar pilot plant partnership to investigate post-combustion capture techniques.[72]

---

68 IPCC, *IPCC Special report on carbon dioxide capture and storage*, 2005, p. 4.

69 Gurba, L.W., *Clean coal techniques: challenges and opportunities for eastern Australia*, Paper, September 2008, p. 441.

70 International Energy Agency *Carbon dioxide capture and storage*, 2009, www.iea.org/Textbase/subjectqueries/ccs/technology_status.asp, viewed on 20 January 2009.

71 Dr John Wright, *Transcript of Evidence*, 1 December 2008, p. 10.

72 Cooperative Research Centre for Greenhouse Gas Technologies, 2008, www.co2crc.com.au/about/contact.html, viewed on 20 January 2009.

4.80 Given Australia's reliance on coal generated power, the Government has implemented, and become party to, a range of measures and programmes to support the research, development and implementation of CCS technologies across Australia and abroad:

- in July 2008 the Government established the National Low Emissions Coal Council to develop a national low emissions coal strategy and to oversee a national research programme into low emissions coal technologies;
- also in July 2008 the Government established the Carbon Storage Taskforce to drive the development of geological carbon dioxide storage facilities in Australia;
- in September 2008 the Government established the Global CCS Institute to encourage the international deployment of CCS technologies;
- since it was founded in 2005, Australia has participated in the Asia Pacific Partnership on Clean Development and Climate, along with many other countries including the US and China. One of the aims of the partnership is to encourage the uptake of CCS technologies in partnership countries;
- Australia is a member of the Carbon Sequestration Leadership Forum, founded in 2003, which aims to coordinate research and development of CCS on a international level; and
- in 2007 the Australia-China Joint Coordination Group on Clean Coal Technology was established to facilitate cooperation and the transfer of CCS technologies between Australia and China.[73]

4.81 One of the risks with the subterranean storage of carbon dioxide is that leakage could offset any reductions in carbon dioxide gained through CCS procedures. The IPCC, whilst acknowledging that a persistent leakage may offset the benefits of CCS, found that appropriately selected and managed geological reservoirs can retain more than 99 percent of stored carbon dioxide over 1,000 years of storage.[74]

4.82 Concerns have also been raised in regards to the amount of extra energy needed by power plants to operate CCS technologies. The IPCC estimates that a plant equipped with CCS technology would require ten to 40 percent more energy to generate the same amount of electricity as a

73 Australian Coal Association, 2009, www.australiancoal.com.au, viewed on 20 January 2009.

74 IPCC, *IPCC Special report on carbon dioxide capture and storage*, 2005, p. 14.

plant without CCS technology. This would in turn lead to increased resource consumption.[75]

4.83 The contribution that CCS technology can make in reducing Australia's greenhouse gas emissions is potentially significant. However, due to the fact that the technology is still in its developmental and demonstration phase, and due to the significant costs and timeframes associated with the installation of the technology, CCS is unlikely to be widely deployed in the short term.

Alternative fuels for vehicles

4.84 In 2006, road transport accounted for 12 percent of Australia's national greenhouse gas emissions.[76] The development of low-emissions vehicles, through the use of alternative fuels, could provide a significant reduction in Australia's total greenhouse gas emissions.

4.85 A range of alternatives already exist or are in development:

- electric vehicles;
- hydrogen fuel cells; and
- bio-fuels.

Electric vehicles

4.86 Electric vehicles provide a real opportunity to expand the use of renewable energy in our cities.[77] There are currently two main types of electric vehicles available: hybrid electric and battery electric.

4.87 Hybrid electric vehicles (HEVs) combine a conventional internal combustion engine with an electric motor powered by a large battery. HEVs switch between the two sources to power the vehicle, enabling emissions reductions.

4.88 The charge on the battery is prolonged through drawing on the energy caused by braking and through the use of the combustion engine to generate electricity. Some HEV batteries can be recharged straight from the grid. The electric motor means that a much smaller combustion engine is needed. The combustion engine is switched off when the car is not

75 IPCC, *IPCC Special report on carbon dioxide capture and storage*, 2005, p. 4.

76 Department of Climate Change, *National greenhouse gas inventory*, 2006, p. 7.

77 Dr Peter Newman, Submission No. 3., p. 1.

moving, and restarts when needed.[78] HEVs can be up to 50 percent more efficient than conventional combustion engines, with the highest efficiency occurring during stop-and-go traffic.[79]

4.89 The technology associated with hybrid vehicles is already established and widely used today. A range of hybrid vehicles are already available on the market and many new models are in development. Advances in battery technology are expected to increase battery power, performance and life.[80] For example, the 'UltraBattery', a new form of battery technology recently developed by the CSIRO combines a range of existing technologies to provide a low cost, long life and high performance battery.[81]

4.90 The CSIRO gave evidence that the Ultrabattery is already being employed by manufacturers to improve the performance of electric hybrid vehicles and is attracting worldwide interest:

> We put [the Ultrabattery] into a Honda Insight in the UK and drove that car for 100,000 miles—160,000 kilometres, as we would put it—over the test track, and it went perfectly.[82]

4.91 As part of the Green Car Innovation Fund, the Australian Government has entered into a $35 million partnership with Toyota to implement the manufacture, and increased use, of Toyota hybrid vehicles in Australia.[83]

4.92 Battery electric vehicles (BEVs) rely on large batteries to power an electric motor. The batteries are charged from the electricity grid. BEVs operate with zero vehicular emissions, but rely on electricity from a grid which may be powered by fossil fuels. Nonetheless, as base load energy generation decarbonises, fewer emissions will be created when powering BEVs.[84]

4.93 The technology used in manufacturing BEVs is already established and a small number of BEVs are produced by European car manufacturers. However the short drive-range and past issues with battery reliability have hindered demand for BEVs, especially battery electric cars and

78 International Energy Agency *Hybrid electric vehicles*, 2009, www.iea.org/textbase/papers/2005/ETOAltFuels05.pdf, viewed on 23 January 2009.

79 Gielen, D. and Unander, F., *Alternative fuels: An energy technology perspective*, 2005, p. 17.

80 International Energy Agency *Hybrid electric vehicles*, 2009, www.iea.org/textbase/papers/2005/ETOAltFuels05.pdf, viewed on 23 January 2009.

81 CSIRO, *CSIRO Project profile - Ultrabattery: no ordinary battery,* 2008, www.csiro.au, viewed on 2 December 2008.

82 Dr John Wright, *Transcript of Evidence*, 1 December 2008, p. 10.

83 Franklin, M., *Toyota gets $35m of taxpayers' money to build hybrid in Melbourne*, The Australian, 10 June 2008, www.theaustralian.news.com.au, viewed on 23 January 2009.

84 International Energy Agency, *Out look for hybrid and electric vehicles*, 2008, p. 2.

battery electric heavy-duty vehicles. Nonetheless, sales of two-wheeler BEVs, such as electric scooter and electric bicycles, are rising and this may increase the acceptance and demand for battery electric cars and other larger battery electric vehicles.[85]

4.94 A number of disadvantages and limitations apply to electric vehicles:

- the cost of producing and maintaining electric vehicles is much higher than conventional combustion engine vehicles;
- often the batteries required to power electric motors are large and reduce the amount of cargo space in the vehicle;
- electric vehicles have a much slower acceleration and lower top speed than conventional vehicles;
- heating and cooling significantly reduces the performance of the vehicle;
- many electric vehicles have a limited range and cannot be used for long distance travel; and
- the time it takes to recharge the batteries in electric vehicles makes them impractical.[86]

4.95 Overall, and in conjunction with further improvements in alternative fuel technology, electric vehicles could provide a reduction in Australia's greenhouse gas emission in the future.[87]

Hydrogen fuel cell vehicles

4.96 The hydrogen fuel cell is an emerging technology, with major car producers in the testing and demonstration phase of these vehicles. A range of technological and economic hurdles exist that would need to be overcome before the use of the technology could become widespread. For example, prototype models have experienced issues with drive-range, acceleration and durability. Further, hydrogen is technically difficult and expensive to produce and store.[88]

85 International Energy Agency, *Out look for hybrid and electric vehicles*, 2008, p. 2.

86 National Alternative Fuels Training Consortium, *Why Alternative Fuels?*, 2009, www.naftc.wvu.edu/NAFTC/data/indepth/Electric/HybridElectric.HTML, viewed on 23 January 2009.

87 Garnaut, R., *The Garnaut climate change review* 2008, p. 519.

88 International Energy Agency, *Prospects for hydrogen and fuel cells*, 2005, p. 95.

4.97 Fuel cells react the hydrogen with oxygen to produce electricity. This electricity is then used to power an electric motor. The only emission from hydrogen fuels cells is water.[89]

4.98 In 2006, the CSIRO established the National Hydrogen Materials Alliance as part of its Energy Transformed Research Flagship. The Alliance brings together a range of Australian universities and other research organisations with the aim of improving the efficiency and economics of hydrogen generation and use, including the use of hydrogen in fuel cells.[90]

4.99 In 2008 the Department of Resources, Energy and Tourism published its Hydrogen Technology Roadmap. The Roadmap recommends a range of strategies, identifies key responsibilities and proposes a timeframe for the development and application of hydrogen and associated technologies. The Roadmap aims to facilitate industry, government and researches in developing the use of hydrogen as an alternative fuel in Australia.[91]

Bio-fuels

4.100 A range of methods exist for producing bio-fuels, which are derived from plant material. Some techniques rely on plant matter with a high sugar content (such as sugar cane) to produce ethanol. Other techniques rely on plant matter with high amounts of naturally occurring oils (such as oil palm) to produce a combustible oil similar to diesel. Some processes harness the gases produced during the decomposition of organic matter in the absence of oxygen to produce a form of combustible bio-gas.[92] These fuels are then used to drive internal combustion engines.

4.101 A range of concerns exist about the alleged benefits of bio-fuels:

- bio-fuel feedstocks, such as corn, compete for arable land with food crops, which in turn pushes up global food prices;
- the demand for land and for high crop yields to produce bio-fuel feedstocks may encourage deforestation, increase the use of scarce water resources and promote unsustainable levels of bio-fuel feedstock production; and

89 International Energy Agency, *Prospects for hydrogen and fuel cells*, 2005, p. 95.

90 CSIRO, *Research cluster aims for breakthrough in hydrogen materials science*, 2009, at www.csiro.au/partnerships/ps2lq.html, viewed on 23 January 2009.

91 Department of Resources, Energy and Tourism, *Hydrogen technology roadmap*, 2008, p. I.

92 International Energy Agency, *From 1st to 2nd generation bio-fuel technologies*, 2008, pp. 19-26.

- developing and producing bio-fuels is expensive and may outweigh the limited greenhouse gas reduction benefits.[93]

4.102 Much research is underway to develop a new wave of bio-fuels where many of the above-mentioned concerns would be addressed. These focus on producing bio-fuels from non-food crop feedstocks such as agricultural and forest residues.[94] Newly emerging methods focus on breaking down heavier organic feedstocks (such as woodchips) into simpler sugars to produce a form of ethanol.[95]

4.103 A range of Government initiatives already exist to encourage the development of different bio-fuel technologies:

- the Cleaner Fuels Grants Scheme, administered by the Australian Tax Office, provides grants to encourage the uptake and manufacture of environmentally friendly bio-fuels;[96]
- AusIndustry administers the Ethanol Grants Program which provides a per-litre incentive to produce ethanol from bio-mass feedstocks;[97] and
- in 2008, the Government launched the Second Generation Biofuels Research and Development Grant Program. The programme aims to stimulate the development and uptake of new bio-fuel technologies.[98]

4.104 As this report is being prepared, the Government is undertaking an internal review of bio-fuel programmes and policies.[99]

Soil carbon

4.105 The amount of carbon stored in the world's soils exceeds the amount of carbon held in the atmosphere and the world's vegetation combined. Plants convert carbon dioxide into energy in the form of starch through the process of photosynthesis. When plants die, the starch is broken down, primarily by micro-organisms in the soil. As the plant material is broken down, some of the carbon is released back to the atmosphere in the form of carbon dioxide. However a significant amount of carbon remains

93 International Energy Agency, *From 1st to 2nd generation bio-fuel technologies,* 2008, p. 6.

94 International Energy Agency, *From 1st to 2nd generation bio-fuel technologies*, 2008, p. 6.

95 Iogen Corporation, *What is cellulose ethanol?*, 2009, www.iogen.ca, viewed on 27 January 2009.

96 Australian Tax Office, *The cleaner fuels grants scheme*, 2005, p. 1.

97 AusIndustry, *Ethanol production grants*, 2009, www.ausindustry.gov.au, viewed on 27 January 2009

98 Department of Resources, Energy & Tourism, *Second generation biofuels research and development grant program: Program guidelines*, 2008, p. 3.

99 Department of Agriculture, Fisheries and Forestry, *Biofuels/bioenergy*, 2008, www.daff.gov.au/natural-resources/biofuelsbio-energy, viewed on 27 January 2009.

sequestered in the soil in the form of humus, an organic matter with a stable chemical composition which will not break down any further. Humus, and the carbon it contains, can remain in soils for thousands of years.[100]

4.106 The level of carbon stored in soils in some regions has been declining, thus releasing more carbon into the global carbon cycle. The United Nations Convention to Combat Desertification found that current land use practices, and climate change itself, may be increasing the transmission of carbon from the soil to the atmosphere.[101]

4.107 Land use practices reduce the carbon content of soil in four ways:

- traditional soil tilling practices make soils finer and thus increase the rate at which micro-organisms can break down soils, and in turn the rate at which carbon is released from the soil;
- burning of crop residues after harvesting releases carbon directly to the atmosphere in the form of carbon dioxide, thus resulting in less carbon being absorbed and stored in the soil;
- removal of naturally occurring plant residues (such as leaf litter) and field residues (plant material left behind after harvesting) for use in other agricultural processes results in less plant matter being broken down to become part of the soil; and
- land clearing increases soil salinity, reducing its capacity to support vegetation, in turn reducing the amount of organic matter being decomposed.[102]

4.108 Climate change affects soil carbon levels through its impact on the growth of plants. Where climate change reduces the amount of vegetation in an area, less carbon will be transmitted to the soil by decomposing vegetation. Where climate change results in an increase in vegetation, through warmer, more fertile conditions in previously infertile regions, soil carbon content may increase. Thus the effect of climate change on soil carbon content differs depending on the geological position of the region.[103]

---

100 Rice, C.W., *Storing carbon in soil: Why and how?*, Geotimes, January 2002, www.geotimes.org, viewed on 20 January 2009.

101 United Nations Convention to Combat Desertification, *Submission to the 4th Session of the Ad Hoc Working Group on Long-term Cooperative Action under the UNCCD: Use of biochar (charcoal) to replenish soil carbon pools, restore soil fertility and sequester CO2*, 2008.

102 Food and Agriculture Organization of the United Nations, *Carbon sequestration in dryland soils*, 2004, ftp.fao.org, viewed on 20 January 2009.

103 Food and Agriculture Organization of the United Nations, *Carbon sequestration in dryland soils*, 2004, ftp.fao.org, viewed on 20 January 2009.

4.109 A variety of land use techniques exist in order to stem the falling level of carbon in soils:

- leaving crop fields un-harvested for one or more seasons allows for increased transmission of carbon to the soil;
- in areas severely affected by salinity and thus with reduced vegetation, plants that thrive in areas of high salinity can be introduced to restore carbon to the soil;
- afforestation in degraded soils increases the amount of carbon transmitted to the soil;
- eliminating or reducing the removal of plant residues (both naturally occurring and resulting from harvest) increases the amount of organic matter being broken down and thus the amount of carbon being stored in soils;
- applying manure, which has high carbon content and a higher resistance to being broken down by micro-organisms than plant residues, increases the long-term carbon content of the soil;
- introducing tilling techniques that leave higher levels of plant residue, such as mulch-tillage, increase the amount of organic matter being decomposed and thus the amount of carbon being transmitted to the soil; and
- rotating crops with high carbon transmission and low carbon transmission to improve soil carbon levels.

The effectiveness of these techniques varies significantly depending on the form of vegetation used in mitigation methods and the climate of the region. [104]

4.110 An emerging technology that could be applied in increasing carbon soil content is a process called slow pyrolysis. This is a process where organic material, such as crop residues, is heated in a vacuum to produce, among other products, a high carbon char known as 'biochar'.[105] Biochar can then be applied to soils to increase the carbon content of the soil and improve soil fertility.[106]

---

104 Food and Agriculture Organization of the United Nations, *Carbon sequestration in dryland soils*, 2004, ftp.fao.org, viewed on 20 January 2009.

105 Best Energies Inc, 2006, www.bestenergies.com, viewed on 21 January 2009.

106 Lehmann, J., Gaunt, J. and Rondon, M., *Biochar sequestration in terrestrial ecosystems – A review*, 2006, Vol. 11.

4.111 To drive the uptake of technologies and practices that increase soil carbon content a range of market mechanisms have been proposed. For instance in December 2008 the United Nations Convention to Combat Climate Change advocated including the development of biochar as a Clean Development Mechanism under the Kyoto Protocol in order to encourage the uptake of biochar technology.[107]

4.112 In Australia, the Northern Agricultural Catchments Council, an agricultural advocacy group from Western Australia, is in the process of implementing a three year pilot project called the Australian Soil Carbon Accreditation Scheme. Under such a scheme, landholders would be able to create certified carbon offsets, to sell as part of an emissions trading scheme, through measured increases in soil carbon content. Landholders would thus be encouraged to take up land use practices that increase soil carbon content.[108]

4.113 The world's soils already contain a significant amount of the world's carbon, so a small increase in the rate that carbon is sequestered in soil could lead to a significant decrease in the amount of carbon dioxide in the atmosphere. Land use practices and technologies already exist that could facilitate the increased transmission of carbon dioxide into soils. Consequently the benefits of increased soil carbon levels could be realised in the short-term.[109]

Waste sector

4.114 During 2006, the waste sector contributed three percent of Australia's total greenhouse gas emissions.

4.115 The waste sector contributes to greenhouse gas emissions in three main ways:

- the decomposition of organic materials in landfill;
- emissions from wastewater such as sewage; and
- the incineration of waste.[110]

---

107 United Nations Convention to Combat Desertification, *Submission to the 4th Session of the Ad Hoc Working Group on Long-term Cooperative Action under the UNCCD: Use of biochar (charcoal) to replenish soil carbon pools, restore soil fertility and sequester CO2*, December 2008.

108 Northern Agricultural Catchments Council, 2009, www2.nacc.com.au, viewed on 21 January 2009.

109 Food and Agriculture Organization of the United Nations, C*arbon sequestration in dryland soils*, 2004, ftp.fao.org, viewed on 20 January 2009.

110 Mr Christopher Fitzhardinge, *Transcript of Evidence*, 19 December 2008, p. 15.

4.116 In 2006, the emissions from landfill contributed 79.2 percent of total waste sector emissions, emissions from wastewater contributed 20.6 percent and emissions from incineration contributed 0.2 percent.[111]

4.117 The waste sector in Australia has a good history of reducing emissions. Despite Australia's increased waste generation during the period from 1990 to 2005, the Australian waste sector reduced its emissions by 12.5 percent over the period. This reduction is largely due to a number of water diversion and methane recovery initiatives by the waste sector.[112]

4.118 The CPRS states that all landfill, wastewater and incineration facilities that emit 25,000 tonnes or more of carbon dioxide equivalent each year will face an assumed carbon price of $25 per tonne. To avoid the distribution of waste from landfill facilities above the 25,000 tonne threshold to facilities below the threshold, the carbon price will also apply to landfill facilities that emit 10,000 tonnes of carbon dioxide equivalent per year and are in close proximity to other landfill sites.[113]

4.119 The Committee heard evidence from the South West Group that the inclusion of the waste sector in the CPRS would not reduce, and may in fact increase, the environmental impact of the waste sector. The Committee heard of two main impacts of the CPRS on the waste sector: a reduction in the incentive to recycle and a lack of incentive to reduce emissions in landfill sites.

4.120 The Group stated that due to the increased cost of energy under the CPRS, the cost of recycling will increase, causing a decrease in the incentive for waste sector operators to engage in recycling. This may encourage a move back to simple environmentally-damaging landfill facilities. The Group further argued that in order to maintain current levels of recycling under the CPRS, existing community subsidies which support advanced recycling will increase by around $13 per household per year.[114]

4.121 The Group also gave evidence of the potential effect of the CPRS on the uptake of emission reduction practices in landfill sites, outlining a range of techniques available to contain the emissions from the main waste stream of organic material in landfills such as composting, incineration and methane capture that would be difficult to maintain by applying a carbon price:

---

111 Department of Climate Change, *National greenhouse gas inventory*, 2006, p. 6.

112 Department of Climate Change *Waste sector greenhouse gas emissions projections 2007*, 2007, p. 3.

113 Australian Government, *Carbon pollution reduction scheme: Australia's low pollution future*, 2008.

114 Mr Christopher Fitzhardinge, *Transcript of Evidence*, 19 December 2008, p. 15.

> At the moment, at a carbon price of $25 per tonne it is cheaper to put [organic waste] to landfill, and even at $48 a tonne it is cheaper to put it to landfill.[115]

4.122 The South West Group suggested that the exclusion of the waste sector from the CPRS would provide more benefits than the sector's inclusion in the scheme. Omitting the sector from the scheme would allow the sector to continue to pursue emission reductions in the same way it has over the last 15 years. If excluded, the Group suggested that the waste sector would be driven to produce carbon offsets which could then be sold to sectors covered by the scheme. This would encourage waste operators to move towards further recycling and emission reduction technologies in order to produce carbon offsets.[116]

4.123 It will be important to monitor implementation of the proposed CPRS to ensure that waste recycling efforts are maintained, and that there is no move back to environmentally damaging landfill.

Committee's view

4.124 This chapter discusses a number of mechanisms for reducing greenhouse gas emissions. It is the Committee's view that there are opportunities to make emissions reductions now which are worthy of more detailed exploration.

4.125 There is scope to increase the use of public transport, to reduce emissions from land clearing, and reduce emissions from savannah burning in addition to the emissions reductions to be obtained from the CPRS and RET.

4.126 In addition, a number of the low emissions technologies, such as wind electricity generation, solar photovoltaic, solar thermal generation and hybrid vehicles are technologies available for use now, and are underexploited in Australia.

4.127 A number of low emissions technologies are in the early stages of development, and will not contribute to reductions in greenhouse gases for some time, possibly a decade or longer. These technologies will contribute to emissions reductions in the future and should continue to be developed.

---

115 Mr Christopher Fitzhardinge, *Transcript of Evidence*, 19 December 2008, p. 20.

116 Mr Christopher Fitzhardinge, *Transcript of Evidence*, 19 December 2008, p. 19.

Recommendation 9

The Committee recommends that the Australian Government establish a coordinating mechanism through the Council of Australian Governments to ensure integration and coordination of greenhouse gas reduction actions across all States, Territories and levels of government, including local and State government planning processes.

4.128 In the next chapter, the Committee turns its attention to methods of adapting to climate change.