Notes

The final report of the Garnaut Climate Change Review (referred to throughout this book as 'the 2008 Review') was published by Cambridge University Press in 2008. The update to the Review, commissioned in November 2010, produced a series of eight papers on developments since 2008 and two supplementary notes, released between February and May 2011. Their titles are as follows:

Update papers (released in February and March 2011)

1: *Weighing the costs and benefits of climate change action*
2: *Progress towards effective global action on climate change*
3: *Global emissions trends*
4: *Transforming rural land use*
5: *The science of climate change*
6: *Carbon pricing and reducing Australia's emissions*
7: *Low emissions technology and the innovation challenge*
8: *Transforming the electricity sector*

Supplementary notes (released on 31 May 2011)

A 10-year plan for carbon pricing revenue

Governance arrangements for Australia's carbon pricing scheme

These materials underpin this book and provide further discussion and detail supporting the analysis. A number of commissioned reports also support the 2008 Review and the update.

The 2008 Review, the update papers and supplementary notes, the commissioned reports, and this book are all available at www.garnautreview.org.au.

Unless otherwise stated, all dollar amounts in this book are in Australian dollars.

Introduction

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xi *I asked two leading econometricians*

T. Breusch and F. Vahid 2008, *Global temperature trends*, report prepared for the 2008 Review; T. Breusch and F. Vahid 2011, *Global temperature trends—updated with new data March 2011*, report prepared for the Garnaut Review 2011 update.

xi *Since 2008, advances in climate change science*

It is quite a challenge now simultaneously to respect objective truth and to assert that there is no warming trend. A respected member of the Australian Academy of Social Sciences rose to this challenge in criticism of update paper 1, and a retiring senator for South Australia and former finance minister in criticism of update paper 2. The former's case depended on disputing the reliability of the data, and ignored the observation of glaciers, sea-level rise and changes in locations of plants and animals that do not depend on measurement of temperature. The latter seems not to have felt the need to provide any support for an argument that runs against strong intellectual authority. See D. Aitken 2011, 'Reflections on Ross Garnaut's Cunningham Lecture', *Dialogue* 30(1): 67–71; J. Thompson, 'Minchin ups stakes in carbon war', *ABC Online*, www.abc.net.au, 11 March 2011.

xii *the Great Crash of 2008*

See R. Garnaut with D. Llewellyn-Smith 2009, *The Great Crash of 2008*, Melbourne University Publishing, Melbourne.

Chapter 1: Beyond reasonable doubt

This chapter also draws on update paper 5.

Page

1 *The vast majority of those*

A number of studies have analysed the level of agreement among scientists that climate change is due largely to human activities, and the credibility of scientists taking different positions on climate change. Professor Murray Goot, Department of Politics and International Relations, Macquarie University, conducted a review of the extent to

which the major studies demonstrated agreement among credible scientists. The review found that a range of types of evidence demonstrated that most scientists accept that human activity is a significant factor contributing to rising global temperatures. The results of the review are detailed in the following reports prepared in 2011 by Murray Goot for the Garnaut Review 2011 update: *Anthropogenic climate change: expert credibility and the scientific consensus*; *The 'scientific consensus on climate change': Doran and Zimmerman revisited*; and *Climate scientists and the consensus on climate change: the Bray and von Storch surveys, 1996–2008*.

1 *no doubt that average temperatures on earth are rising*

See, for example, Climate Commission 2011, *The critical decade: climate science, risks and responses*, Department of Climate Change and Energy Efficiency, Canberra.

2 *through the 2007 Intergovernmental Panel on Climate Change*

Created in 1988 by the World Meteorological Organization and the United Nations Environment Programme, the Intergovernmental Panel on Climate Change publishes comprehensive scientific reports about global climate change. The first review of the state of knowledge on various aspects of climate change was completed in 1990 and the latest, the Fourth Assessment Report, was released in 2007. These and other reports are prepared to inform parties to the United Nations Framework Convention on Climate Change so that climate change policy decisions are based on the best available science. Intergovernmental Panel on Climate Change 2010, *Understanding climate change: 22 years of IPCC assessment*, World Meteorological Organization, Switzerland.

3 *Carbon dioxide emissions from fossil fuel combustion*

Recent trends in carbon dioxide emissions from fossil fuel combustion are described in the following: International Energy Agency 2010, *CO_2 emissions from fuel combustion*; T.D. Keenan and H.A. Cleugh (eds) 2011, *Climate science update: a report to the 2011 Garnaut Review*, CAWCR Technical Report No. 036; M.R. Raupach and P.J. Fraser 2011, 'Climate and greenhouse gases', in H.A. Cleugh, M. Stafford Smith, M. Battaglia and P. Graham (eds), *Climate change: science and solutions for Australia* , CSIRO Publishing, Melbourne, pp. 27–46.

4 *Some recent studies have indicated*

J.G. Canadell, C. Le Quéré, M.R. Raupach, C.B. Field, E.T. Buitenhuis, P. Ciais, T.J. Conway, N.P. Gillett, R.A. Houghton and G. Marland 2007, 'Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks', *Proceedings of the National Academy of Sciences* 104(47): 18866–70; T.D. Keenan and H.A. Cleugh (eds) 2011, *Climate science update: a report to the 2011 Garnaut Review*, CAWCR Technical Report No. 036; C. Le Quéré, M.R. Raupach, J.G. Canadell, G. Marland, L. Bopp, P. Ciais, T.J. Conway, S.C. Doney, R. Feely, P. Foster, P. Friedlingstein, K. Gurney, R.A. Houghton, J.I. House, C. Huntingford, P. Levy, M.R. Lomas, J. Majkut, N. Metzl, J. Ometto, G.P. Peters, I.C. Prentice, J.T. Randerson, S.W. Running, J.L. Sarmiento, U. Schuster, S. Sitch, T. Takahashi, N. Viovy, G.R. van der Werf and F.I. Woodward, 2009, 'Trends in the sources and sinks of carbon dioxide', *Nature Geoscience* 2: 831–36; M.R. Raupach and J.G. Canadell 2008, 'Observing a vulnerable carbon cycle', in A.J. Dolman, R. Valentini and A. Freibauer (eds), *The continental-scale greenhouse gas balance of Europe*, Springer, New York, pp. 5–32.

4 *The magnitude and the rate of the increase*

IPCC 2007, *Climate Change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds), Cambridge University Press, Cambridge; T.D. Keenan and H.A. Cleugh (eds) 2011, *Climate science update: a report to the 2011 Garnaut Review*, CAWCR Technical Report No. 036; National Oceanic and Atmospheric Administration 2011, *Carbon dioxide concentration trends*, US Department of Commerce.

5 *The World Meteorological Organization concluded*

World Meteorological Organization 2011, '2010 equals record for world's warmest year', Press Release No. 906.

4 *One of the IPCC's main conclusions*

IPCC 2007, *Climate Change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds), Cambridge University Press, Cambridge, p. 5.

7 *Some recent work looking at events in the northern hemisphere*

P. Pall, T. Aina, D.A. Stone, P.A. Stott, T. Nozawa, A.G.J. Hilberts, D. Lohmann and M.R. Allen 2011, 'Anthropogenic greenhouse gas contribution to flood risk in England and Wales in autumn 2000', *Nature* 470(7334): 382–85.

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7 *A recent study on Australian temperature and rainfall records*

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8 *Analysis has shown that rainfall*

D. Abbs 2009, 'The impact of climate change on the climatology of tropical cyclones in the Australian region', CAWCR Technical Report.

8 *These regional findings are consistent*

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can anthropogenic forcing account for southwest Western Australian rainfall reduction?', *Geophysical Research Letters* 33: L24708; W. Cai, A. Sullivan and T. Cowan 2009, 'Climate change contributes to more frequent consecutive positive Indian Ocean Dipole events,' *Geophysical Research Letters* 36: L19783; CSIRO 2010, *Climate variability and change in south-eastern Australia: a synthesis of findings from Phase 1 of the South Eastern Australian Climate Initiative*; P. Hope, B. Timbal and R. Fawcett 2010, 'Associations between rainfall variability in the southwest and southeast of Australia and their evolution through time', *International Journal of Climatology* 30(9): 1360–71.

8 *Climate models indicate that as temperatures rise*

I.M. Held and B.J. Soden 2006, 'Robust response of the hydrological cycle to global warming', *Journal of Climate* 19: 5686–99.

9 *the majority of climate models project*

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9 *The 2008 Review noted research*

See W. Cai and T. Cowan 2006, 'SAM and regional rainfall in IPCC AR4 models: can anthropogenic forcing account for southwest Western Australian rainfall reduction?', *Geophysical Research Letters* 33: L24708; CSIRO and Australian Bureau of Meteorology 2007, *Climate change in Australia: technical report 2007,* CSIRO, Melbourne.

9 *Annual inflows to Perth's water storages*

Western Australian Water Corporation inflow data for major dams (excluding the Stirling, Wokalup and Samson Brook dams) show that annual inflow averaged 338 gigalitres between 1911 and 1974, 177 gigalitres between 1975 and 2000, 92.4 gigalitres between 2001 and 2005, and 57.7 gigalitres between 2006 and 2010, with annual inflow in 2010 dropping to 6.2 gigalitres.

9 *Analysis of historical observations confirms*

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Journal of Oceanography 65: 287–99; S. Levitus, J.I. Antonov, T.P. Boyer, R.A. Locarnini and H.E. Garcia 2009, 'Global ocean heat content 1955–2007 in light of recently revealed instrumentation problems', *Geophysical Research Letters* 36: L07608.

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11 *a review of all observations*

For further details and a comparison of studies, see update paper 5, p. 23; S. Rahmstorf 2010, 'A new view on sea level rise', *Nature Reports Climate Change* 4: 44–45.

11 *other work suggests that a sea-level rise*

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13 *Measurements indicate that the average seawater acidity*

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13 *New research has focused on the tipping elements*

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13 *In a 2009 survey of 43 experts*

E. Kriegler, J.W. Hall, H. Held, R. Dawson and H.J. Schellnhuber 2009, 'Imprecise probability assessment of tipping points in the climate system', *Proceedings of the National Academy of Sciences*, 106(13): 5041–46.

14 *Simulations that incorporate*

CSIRO and Australian Bureau of Meteorology 2007, *Climate change in Australia: technical report 2007,* CSIRO, Melbourne; IPCC 2007, *Climate Change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds), Cambridge University Press, Cambridge.

14 *A recent study suggested that*

C. Tarnocai, J.G. Canadell, E.A.G. Schuur, P. Kuhry, G. Mazhitova and S. Zimov 2009, 'Soil organic carbon pools in the northern circumpolar permafrost region', *Global Biogeochemical Cycles* 23: GB2023.

15 *While climate change is a common driver*

A recent study ranked a number of tipping points high in both understanding and certainty of projections (for example, the Arctic tundra/permafrost, snow and glacier melt and tropical coral reefs). The authors of the study concluded that while the existence of potentially irreversible tipping points can be anticipated with high confidence, specific thresholds cannot yet be predicted with adequate precision and advance warning. This presents a significant management challenge and a high risk that critical thresholds could be breached. See P. Leadley, H.M. Pereira, R. Alkemade,

J.F. Fernandez-Manjarres, V. Proenca, J.P.W. Scharlemann, M.J. Walpole 2010, *Biodiversity scenarios: projections of 21st century change in biodiversity and associated ecosystem services*, Technical Series No. 50, Secretariat of the Convention on Biological Diversity, Montreal.

15 *Recent research suggests that solar output*

J.L. Lean and D.H. Rind 2008, 'How natural and anthropogenic influences alter global and regional surface temperatures: 1889 to 2006', *Geophysical Research Letters* 35: L18701.

Chapter 2: Carbon after the Great Crash

This chapter also draws on update papers 3 and 5.

Page

20 *what I call the Platinum Age*

The 'Platinum Age' of the early 20th century is so named because global economic growth in this period has been and is expected to continue to be more extensive and stronger than in the 'Golden Age' of the 1950s and 1960s. I used this term in December 2006 in a paper titled 'Making the international system work for the Platinum Age' for a seminar at the University of Queensland in honour of the 80th birthday of economic historian Angus Maddison. See also R. Garnaut 2011 'Making the international system work for the Platinum Age of Asian growth', in S. Armstrong and V.T. Thanh (eds), *International institutions and Asian development*, Routledge, New York, pp. 25–48; R. Garnaut and Y. Huang 2007, 'Mature Chinese growth leads the global Platinum Age', in R. Garnaut and Y. Huang (eds), *China: linking markets for growth*, Asia Pacific Press, Australian National University, Canberra.

22 *great differences in the underlying rate of change*

See, for example, D.I. Stern and F. Jotzo 2010, 'How ambitious are China and India's emissions intensity targets?', *Energy Policy* 38(11): 6776–83.

24 *The agency's most recent projections*

International Energy Agency 2007, *World energy outlook 2007*; International Energy Agency 2010, *World energy outlook 2010*.

26 *In the year to August 2010*

pitt&sherry 2010, *Carbon emissions index*, November 2010 issue.

26 *as reported to the United Nations Framework Convention on Climate Change*

The international treaty that sets general goals and rules for confronting climate change. It has the goal of preventing 'dangerous' human interference with the climate system. Signed in 1992, it entered into force in 1994, and has been ratified by all major countries of the world.

28 *One recent study analysed*

M. Meinshausen, N. Meinshausen, W. Hare, S. Raper, K. Frieler, R. Knutti, D. Frame and M. Allen 2009, 'Greenhouse-gas emission targets for limiting global warming to 2°C', *Nature* 458(7242): 1158–62.

29 *Some models have shown*

See, for example, M. den Elzen, M. Meinshausen and D. van Vuuren 2007, 'Multi-gas emission envelopes to meet greenhouse gas concentration targets: costs versus certainty of limiting temperature increase', *Global Environmental Change* 17(2): 260–80.

29 *Research suggests that the rate of uptake*

See, for example, M.H. England, A.S. Gupta and A.J. Pitman 2009, 'Constraining future greenhouse gas emissions by a cumulative target', *Proceedings of the National Academy of Sciences* 106(39): 16539–40.

29 *Some models suggest … Other models indicate*

J.A. Lowe, C. Huntingford, S.C.B. Raper, C.D. Jones, S.K. Liddicoat and L.K. Gohar 2009, 'How difficult is it to recover from dangerous levels of global warming?', *Environmental Research Letters* 4(2009): 1–9; R. Monastersky 2009, 'Climate crunch: a burden beyond bearing', *Nature* 458(2009): 1091–94; J. Nusbaumer and K. Matsumoto 2008, 'Climate and carbon cycle changes under the overshoot scenario', *Global and Planetary Change* 62(1–2): 164–72; S. Solomon, G.K. Plattner, R. Knutti and P. Friedlingstein 2009, 'Irreversible climate change due to carbon dioxide emissions', *Proceedings of the National Academy of Sciences* 106(6): 1704–09.

29 *While the timing of the climate response*

M.R. Allen, D.J. Frame, C. Huntingford, C.D. Jones, J.A. Lowe, M. Meinshausen and N. Meinshausen 2009, 'Warming caused by cumulative carbon emissions towards the trillionth tonne', *Nature* 458(7242): 1163–66.

30 *And while geoengineering has the potential*

The Convention on Biological Diversity is convening an expert group meeting in London in mid-2011 to work on defining climate-related geoengineering and assessing the potential impacts of geoengineering on biodiversity and associated ecosystem services. See Convention on Biological Diversity 2011, *Call for experts on climate-related geo-engineering as it relates to the convention on biological diversity*, notification, Montreal.

30 *A recent report looking at black carbon*

United Nations Environment Programme and World Meteorological Organization 2011, *Integrated assessment of black carbon and tropospheric ozone: summary for decision makers*.

Chapter 3: What's a fair share?

This chapter also draws on update paper 2.

Page

34 *The Australian political community*

Prime Ministerial Task Group on Emissions Trading 2007, *Report of the Task Group on Emissions Trading*, Commonwealth of Australia, Canberra.

36 *The main outcomes of Cancun were*

Pew Center on Global Climate Change 2010, *Sixteenth session of the conference of the parties to the United Nations Framework Convention on Climate Change and sixth session of the meeting of the parties to the Kyoto Protocol*, Mexico; J. Morgan 2011, *Reflections on the Cancun Agreements*, World Resources Institute, Washington DC.

41 *In addition to developments*

D. Bodansky and E. Diringer 2010, *The evolution of multilateral regimes: implications for climate change*, Pew Center on Global Climate Change; Global Subsidies Initiative, K. Lang (ed.), *Increasing the momentum of fossil-fuel subsidy reform: developments and opportunities*, IISD-UNEP Conference Report, Geneva.

42 *a 'modified contraction and convergence framework'*

The contraction and convergence approach has figured in the international climate change debate since being developed by the Global Commons Institute in the United Kingdom during the 1990s. The approach has been promoted by India and discussed favourably in Germany and the United Kingdom. Reports by Nicholas Stern and the Commission on Growth and Development in 2008 supported variations on this general approach pointing to the need for all countries to aim for equal per capita emissions over the long term.

46 *as the Australian Productivity Commission has pointed out*

Productivity Commission 2011, *Emission reduction policies and carbon prices in key economies: methodology working paper*.

46 *The Productivity Commission had to answer*

Productivity Commission 2010, *Study into emission reduction policies in key economies: Productivity Commission background paper*; Productivity Commission 2011, *Emission reduction policies and carbon prices in key economies: methodology working paper*.

Chapter 4: Pledging the future

This chapter also draws on update paper 2.

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48 *In April 2011 … CBD Energy*

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48 *To date, 89 developed and developing countries*

UN Framework Convention on Climate Change 2011, *Compilation of economy-wide emission reduction targets to be implemented by parties including in Annex I to the Convention*, Subsidiary Body for Technical

Advice and Subsidiary Body for Implementation, United Nations; UN Framework Convention on Climate Change 2011, *Compilation of information on nationally appropriate mitigation actions to be implemented by parties including in Annex I to the Convention*, Ad Hoc Working Group on Long-Term Cooperative Action under the Convention, United Nations.

50 *The Parikh report on low carbon*

Government of India, Planning Commission 2011, *Interim report of the expert group on low carbon strategies for inclusive growth*.

52 *Norway's emissions per person*

Excludes land use, land-use change and forestry. World Resources Institute 2011, *Climate analysis indicator tool*, version 8.

52 *Denmark, Finland, Norway and Sweden*

Data analysis based on various World Economic Forum global competiveness reports. See, for example, K. Schwab 2011, *The Global competitiveness report 2010–2011*, World Economic Forum.

53 *The new targets—50 per cent of 1990 levels*

C. Huhne 2011, *Fourth carbon budget: oral ministerial statement*, 17 May. The previous target under the third carbon budget was 35 per cent.

53 *The five-year plan for 2011–2015*

China's first such plan that incorporates an emissions intensity target in addition to an energy intensity target. Climate change mitigation policies and outcomes for the five-year plans for 2006–2010 and 2011–2015 are discussed in W. Jiabao 2011, *Report on the work of the government*, delivered at the Fourth Session of the Eleventh National People's Congress on 5 March 2011; The Climate Group 2011, *Delivering low carbon growth: a guide to China's 12th five year plan*.

54 *Specific fiscal interventions*

During a speech at the Australian National University in March 2011, National Development and Reform Commission Vice Chairman Xie Zhenhua outlined fiscal interventions including cancellation of value-added tax rebates and application of electricity price surcharges for enterprises with high levels of energy use. A National Development

and Reform Commission circular released in May 2010 stated that enterprises with high electricity use in certain industries, including aluminium, steel and cement, would be subject to surcharges of RMB 0.1 per kilowatt hour or RMB 0.3 per kilowatt hour, depending on levels of electricity use. These surcharges are equivalent to costs of around $19 and $57 respectively per tonne of carbon dioxide equivalent. Estimates are based on exchange rates current at May 2011 and a carbon intensity of energy of 0.745 tonnes carbon dioxide per megawatt hour. Provincial governments are responsible for implementation of the surcharges. National Development and Reform Commission 2010, *Circular on abolishing preferential electricity price for high energy-consuming enterprises*, NDRC No. 978 2010; International Energy Agency 2010, *CO_2 emissions from fossil fuel combustion 2010*.

54 *There has also been substantial fiscal support*

The Climate Group 2011, *Delivering low carbon growth: a guide to China's 12th five year plan*; Department of Climate Change and Energy Efficiency 2011, *Status of global mitigation action: current targets and policies in key countries*, update of paper released by Multi-Party Climate Change Committee in November 2010, Department of Climate Change and Energy Efficiency, Canberra.

59 *Australia, Canada and the United States have the highest*

In relation to Annex I developed countries. Note that the following countries have higher emissions per person: Qatar (55.5 tonnes of carbon dioxide equivalent per person), United Arab Emirates (38.8) and Bahrain (25.4).

60 *the Obama administration is following*

See, for example, Committee on America's Climate Choices 2011, *America's climate choices*, National Academy of Sciences.

61 *A recent major study of the US gas position*

Massachusetts Institute of Technology 2010, *The future of natural gas: an interdisciplinary MIT study*, interim report.

63 *Independent organisations have assessed*

See, for example, World Resources Institute 2010, *US climate action in 2009–10*, Washington DC. Information on carbon pricing measures in countries other than the United States and China is drawn from *An overview of international climate change policies*, produced by the Department of Climate Change and Energy Efficiency for the Multi-Party Climate Change Committee.

Chapter 5: Correcting the great failure

This chapter also draws on update paper 6.

Page

68 *As noted by Nicholas Stern*

N. Stern 2007, *The economics of climate change: The Stern Review*, Cambridge University Press, Cambridge.

71 *Modelling suggests that*

See the 2008 Review and Australian Treasury 2008, *Australia's low pollution future: the economics of climate change mitigation*, Australian Government, Canberra.

72 *The current (May 2011) price of emissions permits … The price of offsets*

CDC Climat Research 2011, *Tendances Carbone* 58: 1.

72 *The US Government recommends that economic assessments*

US Government 2010, *Technical support document: social cost of carbon for regulatory impact analysis under Executive Order 12866*, Interagency Working Group on Social Cost of Carbon, US Government.

72 *In the United Kingdom*

UK Committee on Climate Change 2008, *Building a low-carbon economy—the UK's contribution to tackling climate change: the first report of the Committee on Climate Change*, The Stationery Office, London.

72 *as Hotelling concluded back in 1931*

H. Hotelling 1931, 'The economics of exhaustible resources', *Journal of Political Economy* 39(2): 137–75.

75 *I have recommended that three independent bodies*

R. Garnaut 2011, *Governance arrangements for Australia's carbon pricing scheme*, supplementary note.

76 *As proposed by the government*

Australian Government 2008, *Carbon Pollution Reduction Scheme: Australia's low pollution future*, Commonwealth of Australia, Canberra.

Chapter 6: Better climate, better tax

This chapter also draws on update paper 6.

Page

79 *A carbon price of $26 per tonne*

R. Garnaut 2011, *A 10-year plan for carbon pricing revenue*, supplementary note.

79 *The modelling for the 2008 Review … and the Treasury modelling*

See the 2008 Review, p. 248 and Australian Treasury 2008, *Australia's low pollution future: the economics of climate change mitigation*, Australian Government, Canberra.

79 *Other modelling has found*

S. Hatfield-Dodds 2011, *Assessing the effects of using a share of carbon price revenues for targeted tax reform: a report to the Garnaut Review 2011 Update*, CSIRO Energy Transformed Flagship, Canberra.

81 *The fringe benefits arrangements*

K. Henry 2010, *Australia's future tax system: report to the treasurer*, Commonwealth of Australia, Canberra.

81 *as in the 2011 budget*

Australian Treasury 2011, *2011–12 Budget*, Commonwealth of Australia, Canberra.

82 *This is due to a lag in the availability of data*

The Australian Bureau of Statistics has announced that it would implement a recommendation to produce more frequent (monthly rather than quarterly) estimates of the CPI if funding becomes available.

83 *Analyses in Australia, Europe and the United States*

See, for example, Australian Treasury 2008, *Australia's low pollution future: the economics of climate change mitigation*, Australian Government, Canberra; US Government 2010, *Technical support document: social cost of carbon for regulatory impact analysis under Executive Order 12866*, Interagency Working Group on Social Cost of Carbon, US Government; European Commission 2010, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage,* European Commission, Brussels; Grattan Institute 2010, *Restructuring the Australian economy to emit less carbon: main report*, Grattan Institute, Melbourne.

85 *An independent agency should be responsible*

R. Garnaut 2011, *Governance arrangements for Australia's carbon pricing scheme*, supplementary note.

86 *Table 6.1 brings together the recommended uses*

R. Garnaut 2011, *A 10-year plan for carbon pricing revenue*, supplementary note.

Chapter 7: The best of times

This chapter also draws on update papers 2 and 6.

Page

89 *Officials of the Treasury*

Commonwealth of Australia 1985, *Reform of the Australian tax system: draft white paper*, Canberra.

89 *Bob White, the president of the Business Council*

'Statement by Business Council of Australia to National Taxation Summit', *The Age*, 2 July 1985.

90 *Mr Bradley said that the Business Council*

M. Franklin, 'Julia Gillard rejects need to contain China', *The Australian*, 27 April 2011.

91 *In April 2011, Graeme Kraehe*

G. Kraehe 2011, 'Australian manufacturing—an industry sector under siege', address to the National Press Club, Canberra.

91 *Mr Howes joined Mr Kraehe*

B. Packham, 'Gillard government under growing pressure over fears of job losses under carbon tax', *The Australian*, 15 April 2011.

91 *The Governor of the Reserve Bank*

G. Stevens 2011, *Remarks at the Victoria University public conference on the resources boom: understanding national and regional implications*, Melbourne.

92 *The Australian Treasury has demonstrated*

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92 *In early May, the chairman of BHP Billiton*

This quote was part of the following statement: 'So the reality is we have to do two things at once: we have to cut carbon emissions and at the same time find ways to meet the increasing energy needs of emerging and developing economies. The sheer size of projected energy demand means that we will have to use many different sources. Each source has different costs and environmental impacts.' J. Nasser, *Address to the Melbourne Mining Club*, 9 May 2011.

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Chapter 8: Adapting efficiently

This chapter also draws on update papers 1, 4 and 5.

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101 *A temperature increase of 4°C above pre-industrial levels*

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F. Cimato and M. Mullan 2010, *Adapting to climate change: analysing the role of government*, Defra Evidence and Analysis Series No. 1, UK Department for Environment, Food and Rural Affairs.

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108 *The Council of Australian Governments' agreement*

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Chapter 9: Innovation nation

This chapter also draws on update papers 4 and 7.

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Chapter 10: Transforming the land sector

This chapter also draws on update paper 4.

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S. Heckbert, J. Davies, G. Cook, J. McIvor, G. Bastin and A. Liedloff 2008, *Land management for emissions offsets on Indigenous lands*, CSIRO Sustainable Ecosystems, Townsville.

143 *The West Arnhem Land Fire Abatement Project*

P.J. Whitehead, P. Purdon, P.M. Cooke, J. Russell-Smith and S. Sutton 2009 'The West Arnhem Land Fire Abatement (WALFA) project: the institutional environment and its implications', in J. Russell-Smith, P. Whitehead and G.D. Cooke 2009 (eds), *Culture, ecology and economy of fire management in north Australian savannas: rekindling the Wurrk tradition,* CSIRO, Collingwood.

144 *The area of native forest harvested*

Department of Climate Change and Energy Efficiency 2011, *National inventory report 2009*, vol. 2, Australian Government submission to the UN Framework Convention on Climate Change, Commonwealth of Australia, Canberra, p. 99.

146 *current industry estimates*

Australian Academy of Technological Sciences and Engineering 2011, *New power cost comparisons: levelised cost of electricity for a range of new power generating technologies*, ATSE, Melbourne.

146 *There is increasing recognition in Australia*

Planting and regenerating forests and woodlands can provide carbon sequestration and improve biodiversity, particularly where locally suitable native species are used. However, landholders could respond to a carbon price by favouring forests comprising a single species over biodiverse forests because lower establishment costs and higher carbon sequestration rates can make them more profitable. A study looking at southern Australia found that at a carbon price of $10 per tonne of carbon dioxide, higher carbon sequestration rates in single species plantings would lead to profits that were $7 per hectare higher than with biodiverse plantings. This example shows that incentives for biodiversity conservation that accompany the carbon price incentive could allow biosequestration activities to deliver additional biodiversity benefits at relatively low cost. See N.D. Crossman, B.A. Bryan and D.M. Summers 2011, 'Carbon payments and low-cost conservation', *Conservation Biology* 25, doi: 10.1111/j.1523-1739.2011.01649.x.

147 *Established state and federal schemes*

The Commonwealth, state and territory governments have established a range of incentive mechanisms to help protect and enhance biodiversity. Auction-based programs such as BushTender and EcoTender in Victoria have helped in expanding conservation activities on private land at relatively low cost to government. Landholders make bids based on the costs of management actions, and bids are assessed against cost and environmental benefit criteria. Landholders whose bids deliver best value for money are offered contracts and then receive periodic payments. Incentive programs can be designed to give landholders flexibility to sell biodiversity and carbon services in separate markets, and this can reduce overall costs to government. See Department of Sustainability and Environment 2008, *BushTender: Rethinking investment for native vegetation outcomes. The application of auctions for securing private land management agreements*, Department of Sustainability and Environment, East Melbourne; M. Eigenraam, L. Strappazzon, N. Lansdell, C. Beverly and G. Stoneham 2007, 'Designing frameworks to deliver unknown information to support market-based instruments', *Agricultural Economics* 37: 261–69.

Chapter 11: Electricity transformation

This chapter also draws on update paper 8.

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150 *After a long period in which Australian electricity prices*

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152 *Transmission network investment*

Current regulatory period revenues are forecast in regulatory determinations. Values in this paragraph are from Australian Energy Regulator 2010, *State of the energy market 2010*.

152 *Demand growth has been slow*

Data are based on the National Electricity Market, which excludes Western Australia and the Northern Territory.

154 *The Victorian experience shows*

Victoria has a private transmission network, but planning is carried out by a not-for-profit agency, the Australian Energy Market Operator. New transmission projects are competitively tendered and not subject to economic regulation.

157 *There will be some reduction in demand*

Organisation for Economic Co-operation and Development 2008, *Household behaviour and the environment: reviewing the evidence*, OECD, Paris.

158 *the industry estimates that*

Energy Supply Association of Australia 2010, *Electricity gas Australia 2010*, ESAA, Melbourne.

159 *The National Electricity Market is self-correcting*

When the system is at the point of shedding load, the price must be set at the price cap of $12,500 per megawatt hour. Or, after the equivalent of 7.5 hours of price cap in a week, an administrative price cap applies of $300 per megawatt hour.

161 *The second risk suggested by some electricity stakeholders*

Faced with large maintenance outlays and limited prospects for future revenue, owners will rationally cut back on maintenance and accept a higher risk of outage which will be traded off against the value of peak capacity. This is an intended outcome.

162 *The Australian Bureau of Statistics reports*

Australian Bureau of Statistics 2006, *Household expenditure survey 2003–04*, cat. no. 6530.0, ABS, Canberra.

162 *Analysis by the Australian Treasury in 2008*

Australian Treasury 2008, 'Chapter 6: Mitigation scenarios—Australian results', *Australia's low pollution future: the economics of climate change mitigation*, Australian Government, Canberra.

163 *This potential was recently highlighted*

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