

## *Super-power* by Ross Garnaut

[These are notes I have made for myself from the text after I have finished reading it. My copy is now heavily marked with pencil!]

### **1 CHAPTER 1 A PERSONAL REFLECTION ON AUSTRALIA'S CLIMATE CHANGE ODYSSEY**

4-5 MDBA, Feb 2019: 5 major b-gr algae blooms in last 13 years; 4 in previous 65.

5 2012, MDBA: 1961-90 avg runoff / annum = 48mm; 1999-2008 = 27 mm

Difficult to differentiate natural variation from climate chg impacts, so they didn't take forecasts into account → not enough water to supply even the minimum of plan

5 Paris Agr – all signatories agreed to work to keep temp increases to 1.5C – need to work 'decisively towards zero net emissions by 2050.'

7 'I worked with partners in South Australia to develop Zen Energy' – towards renewable energy production in SA + Whyalla Steelworks – now with Sunshot Energy

8-9 'Now, much more than was anticipated a decade ago, we can be confident that we will be richer materially sooner rather than later, as well as very much richer in human and natural heritage, should we embrace a zero-emissions future.' BECAUSE

i. 'Per person, Australia has natural resources for renewable energy superior to any other developed country and far superior to our important economic partners in northeast Asia. Together with our strengths in mining, this makes us the natural home of processing mineral ores and some foodstuffs.'

ii. '... the immense opportunity for capturing and sequestering, at relatively low cost, atmospheric carbon in soils, pastures, woodlands, forests and plantations.'

12 'The low-carbon world economy will be especially favourable for rural and provincial Australia.'

13 Maybe the mess we leave will be 'manageable'

### **15 CHAPTER 2 EXORCISING THE DIABOLICAL POLICY PROBLEM**

16 CLIMATE CHANGE AND ECONOMIC DEVELOPMENT -- 'Climate change will not be stopped by ending development. The challenge is to change the relationship between economic growth and emissions of the greenhouse gases that cause climate change.'

17 OUR SHARED SCIENTIFIC UNDERSTANDING

21 graphic of declining inflows into dams around Perth

22 THE ETHICS OF CLIMATE CHANGE ---- if a target temp rise, eg 2C, & target date, eg 2050, are set, then a 'budget' for greenhouse gas emissions is possible – because the total, accumulated amount of gr gases is what causes the warming

→ slow start to mitigation = total accum of gr gases is reached earlier → date needs to be brought forward → later mitigation efforts need to be more intense or more effective

22 'Generally accepted ethical principles, and the governments of developed countries in UN negotiations, support the view that developed countries need to reduce emissions more rapidly than developing.'

23 Pope Francis 1915 *Laudato si'*:

a. acknowledges 'disturbing warming of the climate system' & that it is due 'to great concentration of greenhouse gases' ... caused by human activity, ie development model 'based on intensive use of fossil fuels'

(24) b. believes the cost of cl chg will be disproportionately borne by the poor: social justice issue

c. responsibility to care for physical environment: 'Francis interprets humans 'dominion over the earth' as a responsibility to 'protect the earth and ensure its fruitfulness for coming generations'.

- John Broome, Oxford Uni ethicist, concluded that each person is morally obligated to deal with their own carbon footprint. 'Each tonne of greenhouse-gas emissions is reasonably expected to impose some extra damage on someone, somewhere. That the victim is unknown does not diminish the responsibility.'

24 DEVELOPMENTS IN GLOBAL ACTION

**35 CHAPTER 3 RISK, REWARD AND THE ECONOMICS OF CLIMATE CHANGE**

36 DECISIONS BY ONE COUNTRY IN A MANY-COUNTRY WORLD

37 COMPARING COSTS AND BENEFITS --- 2008: 'I posed the questions: Would the substantial costs of mitigation be exceeded by avoided costs of climate change? What degree of mitigation would lead to the largest net benefits?'

- costs come early; benefits later; limiting scope to 2100 negates the bulk of the benefits

38 4 types of mitigation benefits

i. costs of cl chg which are capable of being fairly precisely measured

ii. economic costs which are not so easily measured

iii. outcomes that might be more severe or benign than the avg suggested by scientific analysis

iv. 'Australians value many things other than their own material standard of living.'

40ff INTRODUCING THE FISH --- The Fish – graphic: measures change in human welfare over time due to mitigation strategies

- 'Mitigation leads initially to a reduction in utility'

- if the strategies are effective, there is a crossover point at which accruing benefits overtake declining utility as a result of no action

- the more benefits (Types 1-4) that are accounted for, the sooner the crossover happens

43 WHAT HAS CHANGED --- *The Discount Rate*

i. compares value of wellbeing for future population with present wellbeing

ii. rate of return to business investment: the value of what is foregone if capital is diverted to cl chg mitigation rather than invested as usual

iii. rate of carbon price rise over time: determined by how much mitigation effort when: earlier or later

-46 discussion of changes since 2008 review: lower interest rates, flatlining wages growth + ppl's hopes for their children and their children → case for strong, early effort towards 1.5C

46 *Other Costs of Mitigation*

48 *Benefits of Reduced Climate Change* --- observation that Types 3 & 4 benefits feature more highly in discussion now than a decade ago

49 *The Rise of Policy Uncertainty* --- 'externality' – the cost of an activity imposed on others as a result of the activity

- 'economic analysis argues for a tax on that activity at a rate equal to the costs imposed'

- this seems to apply across the spectrum of economic theory

[[Sounds like raising children: if you make the mess, you clean it up; or in business: if you leave it to someone else, you recompense them for their efforts.]]

51 'William Nordhaus has demonstrated that pricing carbon is a relatively efficient form of taxation.'

49 world-wide, consistent price on carbon is the most efficient way of tackling the global issue, eg

[52] [INTERNATIONAL TRADE IN EMISSIONS ENTITLEMENTS]

53 California – Quebec; Aust – EU agreement in 2012-13 *Trade-exposed Emissions-intensive Industries*

54 AUSTRALIAN POLICY AFTER ABBOTT 'The path to good policy does not go straight to restoration of comprehensive carbon pricing. For now, the first step along the path is realistic recognition of the emissions-reduction task. ... that is zero net emissions for the world as a whole by the middle of the century and in Australia and other developed countries before that.'

Step 2: 'recognition that emissions should be reduced most quickly where costs are lowest. For Australia, the low-cost opportunities include the electricity and land sectors.'

56 THE CONTEMPORARY FISH

58-67 APPENDIX 3: indepth reasoning of the factors involved in determining the discount rates for emissions-reduction strategies

## 69 CHAPTER 4 THE ELECTRICITY TRANSFORMATION

69 MAIN THESIS: 'The early and orderly movement to zero-emissions electricity is the cornerstone of the decarbonisation of the Australian economy. It is also the foundation for Australia's emergence as a superpower of the post-carbon world.'

- 3 ways Aus renewable energy could help reduce emissions for the whole world:

i. 'Australia is the largest exporter in the world of mineral ores requiring energy intensive processing'

70 - if Aus had superior renewable energy supply, it would make economic sense to process here

ii. hydrogen export

iii. possibility of longterm supply of direct current to S\_E Asia

70 DIFFICULT POLITICS ---- 4 reasons why prices rose disproportionately post 2006

73 ENERGY TRANSITION IN 2008 & 2011 ---- 2008 review: optimistic about transition to renewable energy supply: high-quality renewable energy resources + ample opportunity for geosequestration of CO<sub>2</sub> from coal & gas

- not economically logical to use nuclear power here

- review & revamp of regs governing the poles-&-wire system →

- need for investment in long-distance, high-voltage transmission network to provide interconnections

74 future of coal as domestic power source depended on development of effective CCS; if not developed, coal would decline quickly after 2030

76 tiny investment by coalmining industry in CCS research

76 SPURS TO DECARBONISATION --- *Policy* -- RET – renewable energy target – ‘expected to provide main early impetus for electricity transformation’ – legislated by Howard govt

CEF – Clean Energy Future package – from 1 July 2012 – implemented 2011 Review on electricity: institution of carbon price @ \$23 (for 3C limit cf \$40 for 2C)

77 argument for CEF over RET

SRES – Small Scale Renewable Energy Scheme – support for systems up to 100 kilowatt hours

ARENA – Australian Renewable Energy Agency – ‘to expand private investment in innovation’

CEFC – Clean Energy Finance Corporation – increase ‘debt for investment in low-emissions energy’

- Decarbonising of energy sector expected to be more rapid because cost was lower than others

2013 – election of Abbott govt → policy uncertainty

78 Warburton review of RET indicated electricity prices to rise if RET abolished

- RET reduced from 41 terawatt hours to 34.

80 Graphic 4.2: substantial investment in renewable energy supply since 2008

81 *Changing Economics* → 83 changing financial situation since 2011 means coal has become relatively expensive

‘By 2019, the total costs of coal generation were so much higher than the total costs of solar and wind plus firming that there was no prospect of commercial investors building new coal generators without large direct subsidies – in addition to the subsidy inherent in the failure to tax external environmental costs.’

86 ‘The competitiveness of renewable energy in Australia was enhanced by the big increases in coal and gas prices to export parity levels.’

GRAPHIC 4.8: decreasing total solar PV costs versus costs of coal fuel alone (89 does not include cost of firming)

87 ACCC’s 2018 report into electricity pricing: Recommendation 4: ‘addresses the critical question about Australia’s capacity to supply energy-intensive industry of the future with globally competitive power.’

Observed: in 29 OECD countries, in 2004 Aus had 4<sup>th</sup> cheapest electricity; 2018 – 4<sup>th</sup> most expensive

88 ‘Firm Power’ : ‘meeting all of the customer’s requirements whenever needed.’

89 cost of firming typically adds \$5 - \$20 / megawatt hour

Delivered price of globally competitive power in 2019 = \$45 - \$55

‘... a trainwreck of regulatory failure has to be cleared before the underlying economics can transform Australia’s prospects.’

90-94 THE TRILEMMA TRAINWRECK: EMISSIONS, PRICES, SECURITY --- covers the history of the last decade with reference to these concerns, incl. now-you-see-it-now you-don't carbon pricing, SA power blackouts in 2016, failure of 'black start' capability, 2016 failure of major transmission lines in Victoria, major heatwave in 2017, retirement of Hazlewood, the Finkel Review, pumped hydro proposals and SA's emergence as secure, renewable energy exporter into national grid

95 RELIABILITY, TRANSMISSION AND STORAGE --- 'Transmission has become a major constraint on new investment in renewable energy.'

In particular, long distance transmission

96 'The current transmission and distribution system will not be able to support the vast expansion of demand for power required for the replacement of oil, gas and coal in road transport, industry and household heating, and the utilisation of opportunities to expand output of energy-intensive industry.'

A proportion of current renewables is stranded by lack of transmission capacity

97 → major investment needed in long-distance, high-voltage transmission to create interconnections

If Aus is to expand its energy-intensive industries

97 PHS (pumped hydro storage): ANU identified 22,000 potential sites

Snowy 2.0

101 ELECTRICITY AS THE FOUNDATION OF THE ENERGY SUPERPOWER --- 'After a dozen years of close acquaintance with the Australian and global energy transitions, I now have no doubt that intermittent renewables could meet 100 per cent of Australia's electricity requirements by the 2030s, with high degrees of security and reliability, and at wholesale prices much lower than experienced in Australia over the past half dozen years.'

102 'No other developed country has a comparable opportunity for large-scale firm zero-emissions power, supplied at low cost beyond domestic consumption requirements.'

The opportunity is here, now: seize it or fall behind

Will take a long time to restore globally competitive practices to the established systems BUT

'We do not have to wait.'

102-103 'We can let the fleet of foot in business and state and regional government move on their own until the established structures have acted on the opportunity. The three large policy reforms proposed in this chapter will increase the chances of a strong outcome: the extension of the current minister of energy's power investment underwriting proposal to embrace the whole of Recommendation 4 on underwriting firm power sales from new facilities; the reward to unregulated transmission investment for benefits provided to the regulated system; and the securing of reliability through SNEG. Each could be implemented quickly. Each is fully consistent with the Coalition government's 2019 electoral commitments. Administered well, each would allow innovative businesses to build a globally competitive electricity supply system for expanding Australian industry. Administered well, together they would deliver lower prices, greater security and reliability, and lower emissions in the established system.'

103 *Mutually supportive electricity, industrial and transport transformations*

104 'Turning electrolysers up and down will be of immense value once renewable hydrogen production is established.'

**105 CHAPTER 5 THE INDUSTRIAL TRANSFORMATION**

IF Aus developed globally competitive, zero-emissions electricity capacity, it would allow for rejuvenated, transformed, globally competitive industry

## 106 RECENT DEVELOPMENTS

109 'Improving our performance in energy efficiency and recycling is important for reducing our emissions as well as for our economic performance.'

'Low cost electricity is the main determinant of competitiveness in hydrogen-based processes.'

110 AUSTRALIA'S COMPETITIVENESS IN A ZERO-CARBON WORLD -- 'Thermal coal does not cost much more in China or Japan than in Australia. However, renewable energy can be traded internationally only at high cost' Transmission of electricity would cost more than the electricity itself. More than half the value of hydrogen is lost through the prep and transport costs. [see 111-112]

'Unlike Australian coal resources, Australian renewable electricity will be available at much lower cost to Australia than overseas industry.'

111 AN ADVANTAGE LOST AND GAINED --- 1980s- early 90s: Aus was the world's main exporter of Al metal BUT we lost our edge with rising electricity costs

112-3 He is no fan of oligopolies – refers to ACCC & Productivity Commission

113 'Australian energy-intensive processing industries can be globally competitive when the transport cost savings on raw materials, lower energy costs and Australian skill advantages outweigh the drags on our competitiveness.'

113 MANUFACTURING ALUMINIUM METAL COMPETITIVELY - @ current market prices for Al metal & \$50 / megawatt hour, electricity makes up 20% of cost of product

114 Aus produces 2.5% of world's Al but exports nearly 10% of world exports

Aluminium is made from alumina: Aus makes 25% of world's alumina

115 to smelt half our alumina exports → '... require construction of four or five world-scale plants, increase aluminium production severalfold, and increase Australian electricity demand by around a quarter.' These smelters, presently, have the advantage of being able to be turned off 1 hour in 20 → could help to stabilise electricity system

115 MANUFACTURING CLEAN IRON COMPETITIVELY --- Aus produces nearly 40% of global iron ore & has nearly 60% of the global export market

116 much of the steel produced in Nth America, Europe & Japan is from recycling scrap: energy intensive

The rest of the world, incl China, uses coke to remove oxygen from the ore → CO<sub>2</sub>

Using coke → 7% of global emissions

Lowest-cost lower-carbon process is direct reduction using natural gas (some processors inject hydrogen) → halves CO<sub>2</sub> emissions

including 70% hydrogen → reduces emissions to 15%

116-120 discussion of the costings of mfg of iron and steel from Aus ores using hydrogen, CCS in a zero-emissions environment

'Reducing a tenth of the iron ore exported from Australia into crude steel through renewables-based hydrogen would roughly double Australian total electricity demand. Both electrolysis for making hydrogen

and the electric arc for turning iron metal into steel are interruptible processes, so that a large presence helps reliability in the whole electricity system.'

## 120 OTHER ENERGY-INTENSIVE MANUFACTURING

120-1 **Silicon** – energy-intensive to produce – high demand and increasing –

- Australia produces small amounts (globally) of high quality silicon

- China mfgs 2/3 world product – much used domestically nowadays – high cost of power & local environmental factors are constraints

121-2 **Ammonia** – used in fertilisers, explosives, chemical products

- global production: 150 million tonnes / annum – mostly from fossil fuels; Aus – 1% of that

- 'renewable ammonia' can be produced with zero emissions using renewable electricity

- potential as carrier of hydrogen instead of in liquified form

- Norwegian wealth fund is invested in a plant in Pilbara: pilot using renewables under construction because 'it must shift to renewable hydrogen within a reasonable period.'

123 **BIOMASS AS A BASE FOR INDUSTRY** – 'renewable source of energy or industrial materials if the plants from which it is drawn are continuously replenished.'

- will become a valuable resource in a zero-emissions, global economy

- 'There will be special opportunities in Australian regions which have access to low-cost renewable electricity and biomass' eg southwest WA, southeast SA, riverland & Sunraysia regions, Riverina in NSW, southwest VIC & Latrobe valley, cane coast of QLD

- + southwest WA & VIC: locations close to good geo-sequestration sites → 'capture and storage of emissions will lead to the holy grail of climate change mitigation: negative emissions through bioenergy carbon capture and storage (BECCS).'

## 124 **LOCATIONS OF ZERO-EMISSIONS INDUSTRIES** THIS IS AN EXCITING BIT

- in the beginning: a few regions

- 'For processing of minerals and metals, it will be an advantage to be located close to mining of the raw material.'

- Aluminium: southwest WA, Gladstone QLD & further north

- Iron: can be transported to plants: WA is ideal; in zero-emissions world: Upper Spencer Gulf & Eyre Peninsular possible

- Silicon: widespread locations possible

- Copper, lithium, vanadium, cobalt, titanium: demand will increase in zero-emissions world; processing of these ores could be undertaken at strong industrial locations at some distance from mines

- products for which electricity is major material input can be located wherever electricity costs are low & industrial facilities high quality, eg ammonia & the fertilisers & explosives from it

124 'New industrial strengths will be built more easily in provincial cities with strong industrial traditions, and established energy, port, other transport, and training infrastructure'

- Collie-Bunbury & mining ports in Pilbara, WA

- Upper Spencer Gulf, SA
- Portland & Latrobe Valley, VIC
- Port Kembla & Newcastle, NSW
- Gladstone & Townsville & Mackay, QLD
- materials processing regions in TAS

125 advantages in locating industry at transmission nodes built near declining fossil power generation: established networks could transmit renewable energy back to the industrial centres (rather than transmit coal-fired power out to the regions)

Eg, Collie; Upper Spencer Gulf; Latrobe Valley; Newcastle; Gladstone + Northern Tasmania

- greater advantages where hydro/pumped hydro is close by → cities near Great Dividing Range (Latrobe Valley, Port Kembla, Newcastle, Gladstone, Mackay, Townsville); Tasmania; & deep depleted mines

125 biggest challenge in using biomass in industry – high cost of collecting dispersed material

- large amounts of sugar processing byproduct available along QLD coast
- potential for collection at low cost from marginal regions in WA, SA, VIC, NSW, QLD

126 - algae

- global mapping shows Aus has exceptional opportunities ‘for low-cost geological sequestration.’

- best sites: good for permanent storage; close to industrial centres with ‘low-cost electricity and sources of emissions’ – known from oil & gas drilling: Harvey River basin (close to Collie-Bunbury WA); East Gippsland & Bass Strait (near to Latrobe Valley); Otway Basin (near to Portland)

126 FUGITIVE EMISSIONS: suddenly escalated in the last few years, sufficient to derail Aus’s planned emissions reduction – eliminated in a zero-emissions world?

127 i. CO<sub>2</sub> in methane & hydrogen in natural gas, released in gas processing (largest element)

ii. CO<sub>2</sub> from natural gas combustion in processing gas

iii. methane from coal mining

- ‘huge variations in emissions across gas fields.’

- ‘In the absence of CCS, well over a tonne of carbon dioxide can be released into the atmosphere for every tonne of gas landed in Asian markets.’

So, while gas releases roughly half CO<sub>2</sub> as coal, taking the whole process into account tells a different story.

- Emissions of methane also vary across mine fields

128 current international agreements: ‘Each country is responsible for emissions within its own territory’

- Good news: ‘... most fugitive emissions can be reduced at low cost’ – eg WA policy

- Bad news: ‘... low-cost opportunities for stopping the increase in fugitive emissions through CCS in the gas export industry have been missed as a result of incoherence in Australian climate policy.’

129 States repealed their own regs after Federal govt introduced carbon pricing

- repeal of carbon pricing 2013-14 → no restraints on at all on fugitive emissions
- always easier to just release emissions into the air than deal with them

### 131 CHAPTER 6 THE TRANSPORT TRANSFORMATION

132 - Aus lags in taking up non-fossil transport, [137: in 2018 electric vehicles in Aus = 0.2% of car sales, 3.8% in world, 5.8% in China]

‘... once the Australian adoption of electric battery and hydrogen road motor vehicles begins, it is likely to move quickly.’

133 ‘On current information, the battery is likely to win out in vehicles used mainly within cities, and hydrogen more likely to be competitive for vehicles travelling over long distances.

134 100% renewable resourced transport → increase electricity demand by 25%

135 recharging private vehicle batteries at home might need to be supported by time-of-use pricing

136 VIC already has time-of-use meters

138 2017: sales of internal combustion engine cars peaked

Bloomberg New Energy Finance predicts parity of price between electric & internal combustion cars reached in 2012

Advantages of electric vehicle:

- uses energy more efficiently: 60-66% less per equivalent capacity
- electricity is much cheaper per unit than petrol & diesel (even after excises removed)
- fewer moving parts → less maintenance + cars last longer
- autonomous cars likely to be electric

139 Advantages of petrol/diesel cars:

- greater range
  - refuelling is quicker & locations are more available
- increased uptake & regulation → address (ii) above
  - Average life of vehicle in Aus = 18 years

### 141 CHAPTER 7 EARTHING CARBON

- 2011 review: he speculated that ‘the value of land credits sold into the emissions trading scheme could equal, by 2030, the contribution now made by wool to the Australian farm economy’

- CSIRO 2011: potential for rural lands to offset 20% of Aus emissions over next 40 years

142 - these ‘natural climate solutions’ are increasingly prominent in international discussions of the means of removing/storing atmospheric CO<sub>2</sub>

- land-based carbon storage credits will need a market for them to be traded

143 Aus advantages: i. large natural environment relative to population ii. Expertise in agriculture

144 Colin Clark *Conditions of Economic Progress* (1940) : warned against burning too many fossil fuels too quickly; reassured that there was other, abundant, solar energy coming in & that natural photosynthesis was an effective way to harness it ... and the eucalypt is a most productive photosynthesiser

145 2011 review → Carbon Farming Initiative (CFI): offsets from agric brought into emissions trading scheme -- kept alive in the ERF

151 Huge potential in Aus for sequestering carbon in landscape → begging research

‘In a globally efficient sequestration effort, this would see Australia emerge as a major exporter of carbon credits from the management of land and vegetation’

152 70% Aus landmass is arid or semi-arid – not conducive to productive agriculture → potential for rehabilitating large areas AND storing carbon in the soil

Eg QLD Study: rehab of 200 million hectares of overgrazed rangelands could sequester 100 million tonnes per year for 40 years

153 Melb company commercially converting bulky biomass to char & liquid hydrocarbon

Char: for boosting carbon in soil OR replacement for coal/gas

Hydrocarbon: can be replace fossil fuels in industry, in power generation or, upon refinement, in transport

- savannah covers 20% of earth’s land – much in northern Aus where rainfall is increasing → greater density of vegetation happening already: could be built upon to increase carbon stores

154 starting Western Arnhem Land Fire Abatement, 75 projects registered with Emissions Reduction Fund by January 2018 to abate 14 million tonnes of carbon over 8 years

‘Globally, there is more carbon in soils down to 2 metres than in the atmosphere and living biomass combined.’

‘regenerative farming’ – advocated by

155 - Michael Jeffrey, former Governor General founded Soils for Life

Overall, it is a story of immense potential and declining research

156 Sheep and cattle contribute most to total enteric emissions [read: methane?]

- alternatives possible for making a living from the land + kangaroos as protein? (currently only 3% of cull is used for human consumption)

157 THE FOOD CHALLENGE – rising economic growth in developing countries → movement towards food consumption patterns of the rich, ie more meat

- China: over 40 years, consumption of meat (pork & poultry mainly) rose to equiv of developed populations’ @ 70 kg / person / year → upward pressure on grain prices

- if this pattern were to be reproduced across total global population, it would be ‘inconsistent with climate stability, and more generally with the stability of ecological systems. It would also be unhealthy.’

158 since 1960, Aus meat consumption patterns have reflected movements in prices: Beef declined 20%; sheep down almost 90%; pork up 375% and poultry up 1300%

- revolution in producing plant-based meat-like products is underway: price is a motivator for change, along with personal preferences

159 Aus has a comparative advantage in supplying higher-end food products: 'The main meat substitutes make intensive use of biomass and energy and use less water than the animal competitors.'

Eg for future food production: Sundrop greenhouse in Port Augusta, SA: hydroponics using desal water, solar energy, in an arid region → national Coles tomato supplier

## 160 CARBON FARMING AND THE INTERNATIONAL RULES

Paris Agreement (2015) anticipated achievement of mitigation goals longterm would be a combination of reducing emissions and increasing sinks (Article 41), ie 'terrestrial sequestration of carbon emissions'

161 - Aus 'is well positioned to fully account for land-sector emissions and removals under the Paris Agreement.'

- 'The Carbon Farming Initiative (CFI) allowed farmers and land managers to earn Australian Carbon Credit Units (ACCUs). Each ACCU represents one tonne of carbon dioxide equivalent stored or avoided by reducing greenhouse gas emissions.'

-162 - 2014: ERF established Direct Action Plan → CFI actions could be included in the abatement bidding

- BUT 'The loss of opportunity for selling offsets into an emissions trading scheme lowered the price to well below the social cost of carbon, placed a low cap on total funding and, by making access to credits dependent on winning a bid at auction, introduced uncertainty about whether action to reduce emissions would be rewarded at all.'

-163 PROPOSAL for a way forward 'that does not violate the current government's electoral commitments'

i. make available the entire funding of the Climate Solutions Fund available now to use for legitimate carbon credits

ii. (in next term) phase in full offset of fugitive emissions using ACCUs

- potential to link into EU emissions schemes, BUT have to convince Europeans of validity of and accuracy of accounting for carbon farming

[This will be one instance where our international reputation will be critical to success.]

164 GROWING THE FUTURE - now clear that land use, changes to it, and agriculture (i) will have key role in avoiding the worst effects of climate change

- transforming land use & agric will also (ii) global development (iii) improve human health (iv) stabilise global ecology generally

'To make good use of this opportunity, Australia will need systematic incentives for reducing emissions I nagriculture and land, and to provide sound reasons to believe that they are here to stay.' + renew research into these fields 'The combination of low-cost renewable energy and abundant land for bio-mass will be powerful in the synthetic food production industries of a zero-carbon world.'

## 165 CHAPTER 8 EMBRACING AUSTRALIA'S LOW-CARBON OPPORTUNITY

'There is a chasm between a world that quickly breaks the link between modern economic growth and carbon emissions, and a world that fails to do so. The side of the chasm that we are now on is a dangerous place. It would be reckless beyond the normal human irrationality for us to stay where we are.'

- To stay = probable disaster

‘ We need to build the bridge on which Australians can walk over that chasm, from policy incoherence to hope and opportunity. Hope that we might avoid that worst outcomes of climate change. Opportunity for Australia to be the world’s main trading source of metals, other energy-intensive goods and carbon chemical manufactures in tomorrow’s [166] zero-net-emissions world; and a major contributor to the world’s efforts to absorb excessive carbon into land and plants.

‘ We need that bridge. And we need Australians to walk across it.’

‘It has always been true that Australians walking across the bridge alone will not deal with the challenge. A large part of humanity needs to make the shift. But many others are already halfway across their bridges and we remain on the side of troubles, encouraging others to stay with us.’

- RISKS: maybe not enough populations make sufficient changes; maybe there will be catastrophes we can’t avoid even if we do achieve targets

- so does it matter what we do?

i. ‘It matters morally’ – see Pope Francis & Professor John Broome

ii. ‘It matters economically’ – we could miss out on the enormous opportunities detailed above

167 - We have some influence & standing in the world: to act may carry some weight, especially in a global effort

‘It seems crazy now and will seem crazier to Australians in the future if we use the influence we have against rather than in favour of the prosperity and security and natural and human heritage of Australians who come after us.’

Q. How can he still be optimistic? Still keep plugging away at this?

A. ‘... there is still a chance of avoiding disastrous outcomes, and the incidental advantages of that outcome for Australians are so large that once my fellow citizens see them as they are, they will want us all to cross the bridge.’

- believes the last decade has been a lost one, of wasted opportunity BUT we can do big things when we have to if we have the willing leadership

- AND, maybe we have left it too late AND maybe we will not shift far enough soon enough AND maybe catastrophe does await in a [168] in a ‘parched and disordered country’

168 ‘But there is still a path to a manageable outcome. And I see no good purpose in acceding to despair while the path to a manageable outcome remains open to us.’

- Large cost to Aus: loss of exports of coal & gas

- if the rest of the world moves to zero-emissions, we will lose most of them anyway [183 – unless we develop economical CCS technologies]

- the benefits of working with the rest of the world to zero-emissions would outweigh the costs to us

170ff - discussion of changing public opinion on climate change, citing the Lowy Institute poll on attitudes to climate change (has asked the same questions since 2006)

171 ‘The Lowy Institute Poll in 2019 revealed a marked elevation in Australian perception of climate change as a threat to national security. For the first time, climate change was first in the list of threats’

172 other shifts: in awareness of insurance costs & the value of avoiding them in future; in mainstream ethical thinking; in seeing climate change as an issue of social justice

173 3 big changes affecting decisions:

- i. falling cost of equipment
- ii. Increasing awareness of managing land differently to sequester carbon
- ii. Falling interest rates

174-186 detailed SUMMARY of his proposals and the benefits

183 'Far from raising electricity prices and reducing economic activity, the measures listed here would lead to substantially lower wholesale prices to major industrial users of power. This would then help lower prices for other users.'

'These early measures would nurture the use of the four great opportunities for Australian industrial leadership in the post-carbon world economy: globally competitive renewable power; use of competitive electricity and hydrogen for local processing of a high proportion of Australian mineral production; an abundance of biomass for the chemical manufacturing industries; and low-cost biological and geological sequestration of carbon wastes.'