

POST CARBON PATHWAYS

TOWARDS A JUST AND RESILIENT POST CARBON FUTURE

Learning from leading international post-carbon
economy researchers and policy makers



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About the Melbourne Sustainable Society Institute

The mission of the Melbourne Sustainable Society Institute is to progress sustainability as a societal goal, in Australia and the Asia-Pacific region. We achieve this by being a portal to sustainability-related research at the University of Melbourne, and a platform to facilitate multi-disciplinary, multi-institutional research. For further information about MSSI visit <http://sustainable.unimelb.edu.au>

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The Centre for Policy Development (CPD) is a progressive think tank dedicated to seeking out creative, viable ideas and innovative research to inject into Australia's policy debates. Our work combines big picture thinking about the future of government with practical research on options for policy reform. We give a diverse, cross-disciplinary community of thinkers space to imagine solutions to Australia's most urgent challenges, and we connect their ideas with policy makers, media and concerned citizens. The CPD is a non-profit organisation and donations to our research fund are tax deductible. To join CPD's supporters or hear about future publications go to <http://cpd.org.au>.

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For further information about the Post Carbon Pathways project visit <http://www.postcarbonpathways.net.au>

Contents	Page
Key messages	5
Introduction	6
1. The accelerating probabilities and risks of catastrophic climate change	16
2. Technological and policy roadmaps to a post-carbon future	20
3. Political roadblocks preventing rapid implementation of de-carbonisation strategies	25
<ul style="list-style-type: none"> • Climate science denial • The power of the fossil fuel industry and its allies • Political paralysis • Unsustainable consumption of energy and resources • Path dependencies and outdated infrastructure • Financial and governance constraints 	
4. How a rapid transition to a post-carbon future might be achieved: Four transformational change scenarios	41
#####▶ Education and evidence	
#####▶# Game changing technological and social innovation	
#####▶ Visionary leadership and community mobilization	
#####▶# Decisive action at moment of crisis	
5. The climate change action ‘elevator pitch’	47
6. Conclusion: Future research and policy development priorities	49
Tables	
Table 1: Large-scale economic de-carbonisation strategies: Overview of targets, costings and assumptions about social and political change	8
Table 2: Post carbon transition researchers, policy makers and activists interviewed for <i>Post Carbon Pathways</i> research project	12
Table 3: Technological and policy priorities for achieving a rapid transition to a post carbon economy	21
Table 4: Strategies for removing political obstacles preventing rapid implementation of post carbon economy transition strategies	25
Table 5: Drivers and examples of transformational social and political change	41

Key messages

Learning from leading international post-carbon economy researchers and policy makers

1. The probability and risks of global warming of four degrees or more are rapidly increasing. This is, however, an argument for visionary leadership and decisive action - not political paralysis and buck-passing.
2. The technological and economic roadmaps showing the actions we need to take to avoid catastrophic global warming are now widely understood. From Germany to California and from the United Kingdom to China the global momentum for implementation of large scale de-carbonisation strategies is rapidly accelerating.
3. The biggest roadblocks preventing implementation of large-scale de-carbonisation strategies at the speed required to prevent runaway climate change are primarily political not technological. The key roadblocks are:
 - Climate science denial
 - The power of the fossil fuel industry and its allies
 - Political paralysis
 - Unsustainable consumption of energy and resources
 - Path dependencies and outdated infrastructure
 - Financial and governance constraints
4. The key actions needed to overcome these political roadblocks are:
 - ~~clear~~ clear understanding of the necessity and possibility of an emergency speed transition to a just and resilient post-carbon future;
 - ~~broad~~ broad recognition of the potentially enormous social and economic benefits of switching investment from fossil fuels to energy efficiency, renewable energy and carbon sequestration;
 - game changing social and technological innovation; and
 - decisive leadership and skillful implementation by communities, business and government – at every level of society.

Introduction

As the probability and risks of runaway climate change continue to grow, so too does the urgency of a swift transition to a just and resilient post-carbon future.¹ The *Post Carbon Pathways* project aims to help meet this challenge by strengthening understanding of i) key elements of the most promising and innovative large-scale de-carbonisation strategies; and ii) the most effective ways of overcoming barriers to the rapid implementation of these strategies.

The project has been informed by the view that, while increased public understanding of the necessity of swift reductions in greenhouse gases is crucial, the transformational changes required to drive large-scale de-carbonisation also depend on broad recognition that alternative, more desirable futures and pathways are indeed possible.

The first phase of the *Post Carbon Pathways* project involved a critical overview of eighteen of the most ambitious large-scale post-carbon economy transition strategies, from both government and non-government sources.² Table 1 provides a summary of the targets, costings and assumptions about social change informing each of these strategies.

The second phase of the project has focused on learning about the challenges involved in the swift implementation of large-scale post-carbon economy transition strategies. This analysis has been informed by interviews with leading policy makers and researchers working in the field of post-carbon economy transitions (Table 2). The aim of the current report is to draw on insights and reflections from these interviews to complement and augment the rapidly growing range of more systematic surveys and analyses of climate change policy solutions.³

The report begins with some initial observations on the speed with which the gateway for effective action to prevent catastrophic climate change is closing along with the widely shared understanding of the key components of the technological and policy roadmaps needed to reduce atmospheric greenhouse gases at emergency speed. The third section of the report outlines and explores ways of overcoming six major social and political roadblocks standing in the way of rapid implementation of large-scale de-carbonisation strategies.

¹ The conceptual framework and language of 'post carbon futures' is being used in an increasingly broad range of settings to emphasise the importance of systemic transformations leading to 'a world in which we are no longer dependent on hydrocarbon fuels, and no longer emitting climate-changing levels of carbon into the atmosphere'. Post Carbon Institute, <http://www.postcarbon.org/about/faqs/>

² See *Post Carbon Pathways: Reviewing Post Carbon Economy Transition Strategies*, CPD and MSSl 2012, <http://www.postcarbonpathways.net.au/overview-report/>

This is not of course an exhaustive list of post carbon economy policy frameworks and strategies. See also, for example, *Climatico Analysis, Policy Monitor Report, 2013*; Amory B. Lovins and Rocky Mountain Institute, *Reinventing Fire: Bold Business Solutions for the New Energy Era*; United Kingdom Energy Research Centre, *Energy 2050*; Garnaut *Climate Change Review Update 2011*

³ This report focuses on and highlights short extracts from the interviews. Full transcripts of the interviews are available on the Post Carbon Pathways website, <http://www.postcarbonpathways.net.au>.

Section four provides a sketch of four transformational pathways and scenarios which might plausibly drive a swift and comprehensive process of global de-carbonisation. These scenarios are informed by the responses of interviewees to the following ‘backcasting’ question: “Imagine it is 2030 and we now live in a world in which the transition to a just and sustainable post carbon society has occurred so there is now real hope that runaway climate change will be avoided ... How did this happen?”

Section five highlights a number of responses to the question: “What ‘elevator pitch’ would you make to people in key global and national decision making positions if you had a few sentences to convince them of the need to take decisive action to address climate change?” The report concludes with some brief suggestions about future research and policy development priorities and opportunities.

Table 1: Large-scale economic de-carbonisation strategies:

 Overview of targets, costings and assumptions about social and political change⁴

Transition strategy	Energy and emissions targets	Approx cost of transition policies	Assumptions about social and political change
Non-government authored strategies			
German Advisory Council on Global Change, <i>World in Transition</i> http://www.wbgu.de/en/flagship-reports/fr-2011-a-social-contract/	De-carbonise global energy system by 2050.	Additional net investment between US\$ 200 and US \$1000 billion p.a. by 2030	Knowledge-based, shared visions of desirable future; strong and effective change agents and champions; social and economic shocks; proactive state; supportive global governance structures; low carbon technology innovation; recognition required investments are viable when compared with costs of inaction; changing values towards sustainability; global knowledge networks; recognition of co-benefits of transformational change.
Lester R. Brown, Earth Policy Institute, <i>World on the Edge</i> http://www.earth-policy.org/books/world	Cut global CO2 emissions by 80% by 2020 (on 2006 levels).	Net cost US \$200 billion p.a.	Three social change models: <ul style="list-style-type: none"> • Pearl Harbor: Dramatic event leads to fundamental change • Berlin Wall: Social tipping point reached after gradual change in thinking and attitudes • Sandwich: Grassroots movement strongly supported by political leadership.
Al Gore, <i>Our Choice</i> http://ourchoicethebook.com/	Rapid reduction to 350ppm atmospheric CO2 concentration.	Does not include detailed costings.	Visionary leadership combined with broad community mobilisation. Need to hold self-interested corporations to account and ensure higher standards in media.
Paul Gilding and Jørgen Randers, <i>One Degree War Plan</i> http://www.emeraldinsight.com/journals.htm?articleid=1860356 http://paulgilding.com/the-great-disruption	Cut global GHG emissions to zero over 15 years; negative emissions for rest of century	Carbon tax expected to generate US\$2,500 billion p.a. by year 5 to spend on transition.	One or more critical ecological, economic or social tipping point events leading to shift in public support for action required.
Mark Z Jacobson and Mark A Delucchi, <i>Powering</i>	Switch global energy system to 100% renewable energy	Approx. US \$100 trillion over 20 years to construct global	Strong political and policy leadership and regulation to overcome path dependencies and

⁴ Post Carbon Pathways: Reviewing Post Carbon Economy Transition Strategies, CPD and MSSI 2012, <http://www.postcarbonpathways.net.au/overview-report/>

<p>a Green Planet http://www.scientificamerican.com/article.cfm?id=a-path-to-sustainable-energy-by-2030</p>	<p>(wind, water, solar) by 2030</p>	<p>renewable energy systems. Business As Usual will cost approx. US\$ 10 trillion (not including mounting social costs)</p>	<p>avoid dominance of industry preferred technologies.</p>
<p>The Energy Report http://wwf.panda.org/what_we_do/footprint/climate_carbon_energy/energy_solutions/renewable_energy/sustainable_energy_report/</p>	<p>Peak and decline global GHG emissions within five years, reduce by 80% by 2050 (on 1990 levels); 100% renewable energy by 2050</p>	<p>Total cost of approx €1 trillion p.a. Investment expected to have paid itself off by around 2040 at latest</p>	<p>Human ingenuity, technological innovation and behaviour change as key drivers of transition.</p>
<p>Zero Carbon Britain 2030 http://zerocarbonbritain.org/</p>	<p>Reduce net UK GHG emissions to zero by 2030</p>	<p>Approx. £ 50 billion p.a. required for initial investment program</p>	<p>Importance of sudden, unexpected events as political tipping points in driving dramatic political shifts. Importance of behaviour change plus promotion of wider societal dialogue on values, structures and processes that have led to overconsumption, climate change and resource depletion.</p>
<p>Climate Works, Low Carbon Growth Plan for Australia http://www.climateworksaustralia.com/low_carbon_growth_plan_australia.html</p>	<p>Reduce Australian GHG emissions by 25% by 2020</p>	<p>AU\$ 1.8 billion per year. Strong emphasis on net savings to business.</p>	<p>Focus on winning support from key industry sectors as a basis for achieving and maintaining broader social and political support.</p>
<p>Beyond Zero Emissions, Zero Carbon Australia 2020 Stationary Energy Plan http://beyondzeroemissions.org/zero-carbon-australia-2020</p>	<p>Reduce net Australian GHG emissions to zero by 2020; 100% of stationary energy from renewables by 2020</p>	<p>AU\$ 37 billion p.a. for ten-year period, or approx 3% of Australian GDP. Net present costs over longer time period (2010–40) roughly equivalent to Business As Usual (not including transport savings).</p>	<p>Focus on contributing to settling debate on technical feasibility of 100% renewable energy in Australia to enable social and political changes to occur. Need for decisive leadership from government, business, academia and wider community to implement the plan.</p>
<p>Government authored strategies</p>			
<p>European Commission: Low Carbon Roadmap http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=</p>	<p>Reduce EU GHG emissions by 20% by 2020 and 80-95% by 2050 (on 1990</p>	<p>Approx. € 270 billion p.a. over 40 years (1.5% of EU GDP p.a. above 2009 investment levels). Savings between € 175–320 billion p.a. (not incl.</p>	<p>Political and social change drivers not covered in detail Notes importance of policy innovation, public education and behaviour change.</p>

COM:2011:0112:FIN:EN:PDF	levels)	savings on social costs)	
Government of the United Kingdom, <i>Carbon Plan</i> http://www.decc.gov.uk/en/content/cms/tackling/carbon_plan/carbon_plan.aspx	Reduce UK GHG emissions by 34% by 2020 and 80% by 2050 (on 1990 levels)	Total net present cost over lifetime of policies in past carbon budget periods approx £ 9 billion. Average cost 0.4% of UK GDP p.a. in period 2008–22 and 0.6% of UK GDP per year over 2023–27	Importance of UK Government, industry and citizens ‘pulling in the same direction’ in order to achieve low carbon transition.
Government of South Korea: <i>Green Growth Strategy</i> http://www.greengrowth.go.kr/english/en_main/index.do	Reduce Korean GHG emissions by 30% below projected 2020 levels (equivalent to 4% reduction on 2005 levels)	Total investment announced as part of Five-Year Plan (2009–13) US\$83.6 billion	Emphasis on education and raising public awareness about need for lifestyle change needed to support green growth.
Government of People’s Republic of China: <i>12th Five-Year Plan & Climate Change White Paper</i> http://cbi.typepad.com/china_direct/2011/05/chinas-twelfth-five-new-plan-the-full-english-version.html http://www.gov.cn/english/official/2011-11/22/content_2000272.htm	Reduce Chinese CO2 emissions per unit of GDP by 40–45% by 2020 (on 2005 levels)	Total investment (public and private) in ‘new energy’ of approx RMB5 trillion (US\$760 billion) over next 10 years	Assumption of strong, ongoing role for co-ordinated government planning and intervention, consistent with overall Chinese economic and political governance arrangements.
Government of India: <i>National Action Plan & Low Carbon Growth Report</i> http://pmindia.nic.in/Pg01-52.pdf http://planningcommission.nic.in/reports/genrep/Inter_Exp.pdf	Reduce India’s emissions intensity of GDP by 20–25% by 2020 (on 2005 levels)	Does not include detailed costings	Notes need for final report to include discussion of ways of overcoming barriers to policy implementation and adoption by communities, business and governments.
Government of Australia: <i>Clean Energy Future</i> http://www.cleanenergyfuture.gov.au/clean-	Reduce Australian GHG emissions by 5% by 2020	Carbon price and related measures to raise approx. AUD\$ 25.5 billion in the period 2011–15. Further \$3.9	Carbon price as central driver of change. Strong emphasis on limited impact of policy measures on Australian economy and

<p>energy-future/our-plan/</p>	<p>and 80% by 2050 (on 2000 levels)</p>	<p>billion public funds to augment.</p>	<p>lifestyles.</p>
<p>Government of Germany: <i>Energy Concept</i> http://www.bmu.de/files/english/pdf/applications/pdf/energiekonzept_bundesregierung_en.pdf</p>	<p>Reduce German GHG emissions by 40% by 2020 and at least 80% by 2050 (on 1990 levels)</p>	<p>Additional investment €20 billion p.a., offset by energy cost savings</p>	<p>Importance of public understanding and support for transition. Emphasises importance of accessible information, transparent decision making and opportunities for public dialogue.</p>
<p>Government of Denmark, <i>Our Future Energy</i> http://ens.netboghandel.dk/publikationer/publikationsdetaljer.aspx?PID=5308989e-ea64-436b-8346-4e29c8a84d62</p>	<p>100% renewable energy in all Danish energy supply by 2050</p>	<p>Cost to 2020 approx. DKK 5.6 billion (US\$952 million). Immediate net costs of < 0.25% GDP in 2020. Average additional costs to Danish households approx. DKK 1,700 (US\$ 289) in 2020</p>	<p>Assumes strong ongoing role for government in encouraging innovation and community education.</p>
<p>Government of California, <i>Scoping Plan & Clean Energy Future Plan</i> http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm http://www.cacleanenergyfuture.org/</p>	<p>Reduce GHG emissions to 1990 levels by 2020 and 80% of 1990 levels by 2050; 33% of electricity from renewable energy by 2020</p>	<p>Ongoing costs approx. US\$36 million p.a. Benefits by 2020 (compared to BAU) include increases in economic production of US\$33 billion and overall gross state product of US\$7 billion</p>	<p>Active public participation essential. Emphasis on role for market forces and growing environmental awareness to shift individual choices and attitudes. Targeted public outreach, marketing and education programs.</p>

Table 2: Post carbon transition researchers, policy makers and activists interviewed for the Post Carbon Pathways research project



Kevin Anderson
Deputy Director, Tyndall Centre for Climate Change Research and Professor of Energy and Climate Change, University of Manchester
 Kevin Anderson is professor of energy and climate change in the School of Mechanical, Aeronautical and Civil Engineering at the University of Manchester. He is also Deputy Director of the Tyndall Centre, the UK’s leading academic climate change research organisation. He sits as commissioner on the Welsh Governments Climate Change Commission and is a director of Greenstone Carbon Management, a London-based company providing emission-related advice to private and public sector organisations.



Lester Brown
President, Earth Policy Institute and author, ‘Plan B’ series and ‘World on the Edge’
 Lester Brown is the President of the Earth Policy Institute based in Washington D.C. His distinguished career, spanning agricultural policy, international development and environmental analysis, has seen him found two major environmental research institutes – the WorldWatch Institute in 1974 and the Earth Policy Institute in 2001. He is the author or co-author of over 50 books including the Plan B series and ‘World on the Edge: How to Prevent Environmental and Economic Collapse’



Jenny Clad
Former Executive Director, The Climate Project
 Jenny Clad is the former Executive Director of The Climate Project, a non-profit organisation founded by Al Gore in 2006 to increase public awareness of the climate crisis in the United States and globally. The Climate Project is now integrated with The Climate Reality Project based in Washington D.C.



Kevin Curtis
Former Chief Program and Advocacy Officer, The Climate Reality Project
 As Chief Program & Advocacy Officer at The Climate Reality Project, Kevin Curtis has been responsible for managing the implementation of various initiatives and campaigns. Prior to joining The Climate Reality Project, Kevin gained a decade of leadership experience in senior roles in the environmental advocacy movement including Deputy Director of the Pew Environment Group and Senior Vice President for Programs at the National Environmental Trust (NET).



Mark Delucchi
Research Scientist, Institute for Transportation Studies, UC Davis and co-author, ‘Powering a Green Planet’
 Dr Mark A. Delucchi is a research scientist at the Institute of Transportation Studies, University of California, Davis, where he specialises in economic, environmental, engineering and planning analyses of transport systems and technologies. He has worked on projects for the World Bank, the International Energy Agency, the U. S. Department of Energy, the U. S. Environmental Protection Agency, the U. S. Department of Transportation, and a number of other organisations and agencies.



Jean-Philippe Denruyter

Manager, Global Renewable Energy Policy, WWF International and co-author, 'The Energy Report'

Jean-Philippe Denruyter leads global renewable energy strategy development and activities at the conservation organisation WWF International. He is a founding member of the Roundtable on Sustainable Biofuels and has been president of the European Green Electricity Network (2006–2008). Jean-Philippe was also a trader for an energy utility before joining WWF in 2003.



Ian Dunlop

Member, Club of Rome, Chair, Safe Climate Australia and Deputy Convenor, Australian Association for the Study of Peak Oil

Ian Dunlop is a former senior executive of Royal Dutch Shell. He has worked in oil, gas and coal exploration and production, as well as scenario and long-term energy planning. He chaired the Australian Coal Association 1987-88, and the Australian Greenhouse Office Experts Group on Emissions Trading 1998-2000. He was CEO of the Australian Institute of Company Directors 1997–2001. He currently holds several positions including as a Fellow of the Centre for Policy Development, Chairman of Safe Climate Australia, Deputy Convenor of the Australian Association for the Study of Peak Oil and Member of the Club of Rome



Ottmar Edenhofer

Deputy Director and Chief Economist, Potsdam Institute for Climate Impact Research and co-Chair, IPCC Working Group III

Professor Ottmar Edenhofer is Deputy Director and Chief Economist at the Potsdam Institute for Climate Impacts Research (PIK). He is also professor of the Economics of Climate Change at the Technische Universität Berlin and Co-Chair of the Working Group III of the Intergovernmental Panel on Climate Change (IPCC), as well as director of the newly founded Mercator Research Institute on Global Commons and Climate Change.



Adrian Gault

Chief Economist, UK Committee on Climate Change

Adrian Gault joined the secretariat of the UK Committee on Climate Change (CCC) in May 2009, where he is responsible for analytical work looking at UK greenhouse gas emission reduction potential and costs. Prior to joining the CCC secretariat, Adrian has substantial experience of energy and environmental issues – as an economist in Department for Transport, the Energy Group at DTI (now part of DECC) and in the Treasury tax team.



Paul Gilding

Author, 'The Great Disruption' and co-author, 'One Degree War Plan'

Paul Gilding is a former CEO of Greenpeace International and founder of sustainability-focused companies, Ecos Corporation and Easy Being Green. He now works as an independent writer and adviser on sustainability. He is co-author, with Jorgen Randers, of The One Degree War Plan and released his own book elaborating on that plan, The Great Disruption, in 2011.



James Goldstene
Executive Officer of California Air Resources Board

James N Goldstene is the former Executive Officer of the California Air Resources Board which is responsible for promoting and protecting the public health and ecological resources of California through effective reduction of air pollutants while recognizing and considering the effects of its actions on the state's economy. During his time at the CARB James oversaw the adoption of a comprehensive plan to reduce global warming pollutants under AB32, California's pioneering climate change legislation.



Peter Harper
Head of Research and Innovation, Centre for Alternative Technology, Wales and co-author, 'Zero Carbon Britain 2030'

Peter Harper is one of several authors of Zero Carbon Britain 2030, which presents an integrated vision for how the United Kingdom can reduce net greenhouse gas emissions to zero by 2030. He is Head of Research and Innovation at the Centre for Alternative Technology in Wales, UK, where he has worked for over 20 years. His interests and publications have ranged widely, including in energy policy, sustainable lifestyles, eco-villages, alternative sanitation, landscape design, organic horticulture, and composting.



Mark Jacobson
Director of Atmosphere and Energy, Stanford University and co-author, 'Powering a Green Planet'

Professor Mark Z. Jacobson is co-author, with Dr Mark A. Delucchi, of 'A Plan to Power 100 percent of the Planet with Renewables' published in Scientific American and the journal, Energy Policy. As Professor of Civil and Environmental Engineering and Director of Stanford University's Atmosphere and Energy Program, his research focuses on addressing atmospheric problems, such as climate change and urban air pollution. He also examines resource availability of renewable energies, and optimal methods of combining renewable energy resources.



Alex Kazaglis
Senior Policy Analyst, UK Committee on Climate Change

Alex Kazaglis joined the secretariat of the Committee on Climate Change in October 2009, where he leads the analytical work program covering the industry and buildings sectors. Current projects include an assessment of the impact of low-carbon policies on the competitiveness of energy intensive industries. Prior to joining the CCC secretariat, Alex worked as an analyst on water economics and policy at the Institute for Sustainable Futures in Sydney, and as a technical consultant on EU water and sanitation projects in India.



Amory Lovins
Chairman and Chief Scientist, Rocky Mountain Institute and author of 'Reinventing Fire'

Physicist Amory Lovins is Chairman and Chief Scientist of Rocky Mountain Institute and Chairman Emeritus of Fiberforge Corporation. He advises governments and major firms worldwide on advanced energy and resource efficiency, has briefed 20 heads of state, and has led the technical redesign of more than \$30 billion worth of industrial facilities in 29 sectors to achieve very large energy savings at typically lower capital cost. A Harvard and Oxford dropout, he has published 29 books and hundreds of papers and has taught at eight universities. In 2009, Time named him one of the 100 most influential people in the world, and Foreign Policy, one of the 100 top global thinkers.



Roy Neel

Former Chief of staff to Al Gore and Adjunct Professor, Vanderbilt University

Roy Neel worked for many years as chief of staff for former US Vice President Al Gore, overseeing his climate change advocacy programs, national and international political relationships and liaison with his clean energy business interests. He is currently an Adjunct Professor of Political Science at Vanderbilt University in Nashville, Tennessee where he teaches courses in the U. S. Presidency, White House operations, and Presidential Campaigns, and White House Transitions.



Mark Ogge

Co-founder, Zero Carbon Australia 2020 project

Mark Ogge, former Operations Director at Beyond Zero Emissions, was one of the initiators and directors of the award-winning Zero Carbon Australia 2020 project. The project, run jointly by the Melbourne Energy Institute, University of Melbourne and Beyond Zero Emissions, involves hundreds of technical experts putting together a blueprint for the complete decarbonisation of the Australian economy within a decade. Mark has developed detailed knowledge of renewable energy and energy efficiency technologies and works to communicate about these solutions and support grassroots campaigns in Australian communities.



Jørgen Randers

Professor of Climate Strategy, Norwegian Business School, co-author of 'Limits to Growth', 'One Degree War Plan' and '2052'

Jørgen Randers is professor of climate strategy at the Norwegian Business School, where he works on climate and energy issues, scenario analysis and system dynamics. He lectures widely at home and abroad on sustainable development issues – particularly climate change – for corporate and non-corporate audiences and sits on several boards. He has authored a number of books and scientific papers, including co-authoring “The Limits to Growth” (1972) and its sequels in 1992 and 2004. He recently wrote “2052 – A Global Forecast for the Next Forty Years”.



John SchellInhuber

Director, Potsdam Institute for Climate Impact Research and Chair, German Advisory Council on Global Change

Professor Hans Joachim ‘John’ SchellInhuber founded the Potsdam Institute for Climate Impact Research (PIK) in 1991 and has been its director ever since. He holds a chair in theoretical physics at Potsdam University and is an external professor at the Santa Fe Institute (USA). He holds a range of leadership positions including chair of the German Advisory Council on Global Change.



Anna Skarbek

Executive Director, ClimateWorks Australia

Anna Skarbek is Executive Director of ClimateWorks Australia – a non-profit collaboration between Monash University and The Myer Foundation, which pursues practical emissions reduction opportunities across different sectors of the Australian economy. ClimateWorks Australia released the award-winning Low Carbon Growth Plan for Australia in 2010 and an update in 2011. Anna has worked in government, business and advocacy roles, including as Vice President at London’s Climate Change Capital.

1. The accelerating probabilities and risks of catastrophic climate change

“We are running out of both time and options because we are not being honest about what has to be done. The solutions exist, but unless you are honest about the problem, they will never be adopted.”

Ian Dunlop, member of the Club of Rome; former CEO, Australian Coal Association; Chair, Safe Climate Australia⁵

As the following recent quotations from a diverse range of sources illustrate, the scientific consensus is rapidly growing that current emission trends are creating an increasing likelihood of global warming well above 2°C.

“It is becoming extremely challenging to remain below 2 degrees. The prospect is getting bleaker. That is what the numbers say.”

Fatih Birol, Chief Economist, International Energy Agency⁶

“Even with the current mitigation commitments and pledges fully implemented there is roughly a 20 per cent likelihood of exceeding 4°C by 2100. If they are not met warming of 4°C could occur as early as the 2060s.”

World Bank, *Turn Down the Heat*⁷

“Governments’ ambitions to limit warming to 2°C appear highly unrealistic.”

PricewaterhouseCoopers, *Too Late for 2 Degrees*⁸

“To be quite candid the idea of a 2°C target is largely out of the window.”

Sir Robert Watson, Chief Scientist, UK Department for Environment, Food and Rural Affairs⁹

“Looking back, I underestimated the risks. The planet and the atmosphere seem to be absorbing less carbon than we expected and emissions are rising pretty strongly. [If I had known the way the situation would evolve] I would have been much more strong about the risks of a four or five-degree rise...I now believe we are on track for something like four degrees.”

Lord Nicholas Stern¹⁰

“It does look increasingly tough worldwide to be hitting the two degree target. We still believe that is possible but...what you’re talking about here is questions of probabilities...Even if we thought we were on track to that as a central case, there are significant risks... For the Committee, it’s extremely important that we try to avoid the really substantial risks of something like a four degree plus increase.”

Adrian Gault, Chief Economist, UK Committee on Climate Change

5 All quotations are from the Post Carbon Pathways interviews project transcripts unless otherwise cited.

6 <http://www.guardian.co.uk/environment/2011/may/29/carbon-emissions-nuclearpower>

7 World Bank, *Turn Down the Heat*, November 2012,

<http://climatechange.worldbank.org/content/climate-change-report-warns-dramatically-warmer-world-century>

8 PricewaterhouseCoopers, *Too Late for 2 Degrees*, December 2012,

<http://www.pwc.com/gx/en/sustainability/publications/low-carbon-economy-index/index.jhtml>

9 <http://www.rtcc.org/2%C2%B0c-warming-target-%E2%80%9Cout-the-window%E2%80%9D-says-top-uk-scientist/>

10 <http://www.guardian.co.uk/environment/2013/jan/27/nicholas-stern-climate-change-davos>

“If we do everything we say we’re going to do, but that we’re not doing... then we still can’t hold two degrees C. Four degrees C by 2050, 2070 doesn’t seem unreasonable if you look at the current projections of emissions.”

Kevin Anderson, Professor of Energy and Climate Change,
University of Manchester¹¹

“The highest plausible scenario suggestions... by 2300 will more or less deliver – our best guess – a warming of 8 degrees, which will be sustained over many hundreds of years. Then there is a range of desirable, much more ambitious, scenarios that lead to a 2 degree warming. Generally, the 2 degree threshold is considered to represent an upper boundary for a manageable situation, particularly in terms of sea-level rise. The worst of the plausible outcomes is a world that simply removes all the conditions under which human civilisation was created.”

“The cardinal issue is that either you deny the scientific evidence of global warming entirely or you acknowledge it but then deem the 2 degrees guard rail politically impossible and state that the world can adapt to any degree of warming, and thereby deny the lack of scientific evidence of its feasibility. Or you acknowledge both, the basic problem and our basic ignorance concerning the limits to adaptation, and think the 2 degrees guard rail is doable. The question then is how it can be achieved.”

Professor John SchellInhuber, Director Potsdam Institute for Climate Impact Research

The scientific evidence of the implications of global warming above 4 degrees is both overwhelmingly clear and deeply concerning. As World Bank President, Jim Yong Kim notes:

“A world that warm means seas would rise 1.5 to 3 feet, putting at risk hundreds of millions of city dwellers globally. It would mean that storms once dubbed ‘once in a century’ would become common, perhaps occurring every year. And it would mean that much of the United States from Los Angeles to Kansas to the nation’s capital, would feel like an unbearable oven in the summer... There will be water and food fights everywhere.”¹²

Recent analysis of emissions pathways consistent with a reasonable probability of preventing runaway climate change continue to confirm that “a likely (greater than 66 per cent) chance of keeping global warming below 2°C, requires emissions to peak between 2010 and 2020 and fall to a median level of 44 Gigatonnes of CO₂ equivalent [GtCO₂e] in 2020.” Between 2020 and 2050 a rapid decline to close to zero emissions combined with carbon sequestration would then be needed in order to achieve the goal of returning atmospheric CO₂e to 350 ppm or below.¹³

The 2012 *Climate Action Tracker* report on emission pledges and trends reached the following conclusion about the likely outcomes of current emission reduction trends.

“The aggregated emissions level from all countries’ pledges is still likely to induce warming exceeding 2°C by a wide margin, unless pledges are improved and more policies implemented on a national level. While we see some improvement, the fundamental

¹¹ Kevin Anderson, ‘Real Clothes for the Emperor: Facing the Challenges of Climate Change’ Cabot Institute Speech, Bristol, November 12, 2012, <http://www.ecoshock.info/2012/11/kevin-anderson-what-they-wont-tell-you.html>

¹² http://articles.washingtonpost.com/2013-01-24/opinions/36527558_1_global-carbon-dioxide-emissions-climate-change-climate-and-energy

¹³ Rogelj, J., Meinshausen, M. and Knutti, R. ‘Global warming under old and new scenarios using IPCC climate sensitivity range estimates’ *Nature Climate Change* 2, February 2012, pp. 248-253.

problem remains: few countries have policies in place to meet their pledges and even fewer have sufficiently ambitious pledges.”

Limiting global warming below 2°C – or even to below 1.5°C remains technically and economically feasible, but only with political ambition backed by rapid action starting now. If nothing more is done except the current pledges, costs would be much higher to reach deeper reductions necessary later, and/or the damage from climate impacts would be far greater.”¹⁴

A frank assessment of the social and ecological consequences of global warming beyond 4°C has the potential to create a sense of despair, fuelled by the belief that it is already ‘too late’ for the action required to prevent catastrophic climate change. However, as Lester Brown, Director of the Earth Policy Institute usefully reminds us the accelerating risks of runaway climate change are, however an argument for visionary leadership and decisive action – not political paralysis, buck-passing and despair.

“When we use the term ‘Is it too late,’ we have to say, ‘Is it too late for what?’ The question is, can we get carbon emissions coming down soon enough to avert the worst consequences of climate change? We’re not going to avert all of them. We’re already experiencing them. The question is, can we keep climate change from spiralling out of control? I don’t know the answer to that question but we certainly have to try.”

And, as Kevin Anderson also notes, a robust assessment of the scale and speed of action now required is an argument for decisive and determined action rather than resignation and despair.

“This is not a message of futility but a wake-up call of where our rose-tinted spectacles have brought us. Real hope, if it is to arise at all, will do so from a bare assessment of the scale of the challenge we now face. I take the view that 2°C is better than 2.5°C, 2.5°C is better than 3°C, 3°C is better than 3.5°C and so forth...and we know that the lower the temperature, the lower is the carbon budget that we have available to play with...But failing on 2°C is no reason to give up on mitigation, making hay whilst the sun shines and resigning to an impact and adaptation future. We need to do everything we can to get emissions out of our system as quickly as possible so that we can have the rise in temperature as low as is possible.”

Other responses to the question: Is it too late for effective action to prevent runaway climate change included the following.

“I think it’s easy to wallow and get stuck in the ‘it’s too late’ category, but that doesn’t solve the problem...We have to solve this problem and the sooner we solve it the less damage will be caused by the change in climate. So sure, it would have been great to have solved it 30 years ago, but it’s better to solve it in the next 20 years than to wait another 50 years.”

Kevin Curtis, Executive **Director**, Climate Reality project

“I think that people who say that it’s too late take an easy way out. You can avoid doing something by saying that it doesn’t happen, it doesn’t exist, it’s a hoax or whatever and the other way is to say it’s too late...Of course if we get to two degrees instead of five it would be nice and given the scientific uncertainty about the variation between these degrees, I would say it’s always worthwhile trying to reduce. The quicker we can do that the better for the world and then if we are still at plus three degrees well at least we will have tried and probably the impact will still be lower than if we go higher.”

Jean-Philippe Denruyter

“Is it too late to actually do anything seriously? No, it is not too late, but it’s not going to happen with the conventional political and corporate reform processes that we have used

¹⁴ Climate Action Tracker 2012 <http://www.climateactiontracker.org/>

through the latter part of the 20th century. It is not possible for adversarial politics to achieve the type of change we now need in the time required. In this country, emissions must reduce, ideally, by around 50% by 2020 and by 100% no later than 2050.”

Ian Dunlop

“I think defeatism has often been a problem. It apparently was in the Second World War - a lot of people just became really defeatist. But, you know, people with a bit of backbone about them just said, ‘Well, maybe we’ve lost but we’ll fight’ you know - and I think that’s the only way you win.”

Mark Ogge, Co-founder, Zero Carbon Australia

“The most consistent emails I get from people are, ‘Like your work. I’m glad you’re optimistic. I’m not. We’re screwed. We’re stupid and we’re done and we’ll fall over.’ My response, is, ‘So what do you do with that? Why do you bother? Why do you bother talking to me about it actually? There’s nothing to do with that. I mean, you can’t act on that – and you could be wrong.’”

“You get to the point of saying, ‘Well, if you genuinely believe there’s a 100 per cent chance that we’re fried and society is going to collapse, then there’s nothing for me to discuss with you because I can’t do anything with that, apart from give up and grow vegetables. If you’re going to go and grow vegetables in the middle of nowhere – your choice. But it’s not an actionable kind of analysis.’ Then I say to them, ‘And by the way, the reason you’re wrong is you can’t be sure. You can’t be a hundred per cent sure that that is going to happen. Then you argue, ‘Okay, given that there is actually some potential, which I think is very high – some would argue it’s very low – but even if you think there’s a 10 per cent chance that we can avoid catastrophic collapse and go somewhere else, then why wouldn’t you do that?’”

“Then you get to what I think is the killer argument which is the political strategy. If you’re involved in this debate and you don’t believe that we can get through it, you will be ineffective. If you don’t believe that there is a path that makes sense for this that’s worth pursuing, then you’re basically lying every day in your work. If you don’t internalise that belief, then you will fail. So you have to get yourself to that place.”

Paul Gilding, author, **The Great Disruption**

2. Technological and policy roadmaps to a post-carbon future

“Limiting global warming to below 2°C maximum, or even reducing to below 1.5°C by 2100 remains technically and economically feasible, provided there is sufficient political ambition backed up by action to introduce the required measures and policy changes now.”

2012 Climate Action Tracker Update, Climate Analytics, Potsdam Institute for Climate Impact Research and Ecofys¹⁵

The overall suite of technological and policy priorities needed to achieve a just and sustainable post carbon future is now widely understood. It includes:

- Rapid replacement of fossil fuels by renewable energy
- Rapid reduction in energy consumption (through improved efficiency and reduced demand)
- Significant reduction of emissions from agricultural activity
- Drawdown and sequestration of carbon into sustainable carbon sinks.¹⁶

While significant technological questions remain – about the most appropriate mix of centralised and decentralised renewable energy generation and distribution technologies and systems - there is also increasingly widespread recognition that technology is not the biggest barrier to rapid transitions.

As Stanford University’s Professor Mark Jacobson concludes, meeting 100% of the planet’s energy needs with wind, water and solar power is technically and economically feasible: “the real problem is not the technological ability to do something fast, it’s really the political ability to do it fast.” Jacobson’s co-author Professor Mark Delucchi of UC Davis also highlights the importance of demonstrating the potential for existing technologies to deliver rapid de-carbonisation.

“While there’s a good deal of uncertainty and there remains work to do, we did not see any obvious show-stoppers, including addressing the question of the variability of these sources. The answer is, we think, that we can use those wind, water and solar sources to provide energy for all end-uses reliably to meet projected demand in the long run – we looked at 2050 – to provide energy demand reliably and at reasonable cost, with no obvious constraints on materials or technical availability...You put that together and it points to a potential way forward. It opens the door for saying, ‘this path is possible and definitely worth looking at in detail’”.

Zero Carbon Australia 2020 co-founder Mark Ogge reaches a similar conclusion in relation to the potential for Australia’s energy needs to be met by 100% renewable energy within ten years: “There are no technical barriers to this deployment. Implementing the proposed infrastructure in ten years is well within the capability of Australia’s existing industrial capacity.”

Importantly there is also growing understanding that action at the required scale and speed will require transformational rather than incremental change. As the recent PricewaterhouseCoopers Report, *Too Late for 2 Degrees* concludes:

“The only way to avoid the pessimistic scenarios will be radical transformations in the way the global economy currently functions: rapid uptake of renewable energy, sharp falls in fossil fuel use or massive deployment of Carbon Capture and Storage, removal of industrial emissions and halting deforestation. This suggests a need for much more

¹⁵ Ecofys, Climate Action Tracker 2012 <http://www.climateactiontracker.org/>

¹⁶ Post Carbon Pathways: Reviewing Post Carbon Economy Transition Strategies, CPD and MSSI 2012, <http://www.postcarbonpathways.net.au/overview-report/>

ambition and urgency on climate policy, at both the national and international level. Either way, business-as-usual is not an option.”¹⁷

Table 3 provides an overview of technological and policy priorities common to many of the strategies reviewed in the initial *Post Carbon Pathways* report summarizing key elements of large-scale de-carbonisation strategies.

Table 3: Technological and policy priorities for achieving a rapid transition to a post carbon economy

Goal	Technological and policy priorities for achieving a rapid transition to a post carbon economy
Rapid replacement of fossil fuels by renewable energy ¹⁹	<ul style="list-style-type: none"> • Robust carbon price at level required to drive rapid shift from fossil fuels to renewables. • Complementary taxation, subsidy and regulatory policies driving rapid electrification and swift phase out of fossil fuel energy in all industry sectors. Key initial priorities include transport (e.g. cars, aviation and shipping) and fossil fuel-intensive industries (e.g. aluminium, cement, iron and plastics). • Tax incentives, low interest loans, loan guarantees, feed-in tariffs, public sector investment and community based initiatives driving innovation and deployment of renewable energy sources including: <ul style="list-style-type: none"> ○ solar: concentrated and photovoltaic; ○ wind: on-and off-shore; ○ wave and tidal; ○ hydroelectricity; ○ geothermal: directly to heat buildings and at high temperatures for electricity generation; ○ bioenergy: traditional biomass; sustainable residues and waste; sustainable energy crops; sustainable algae; ○ use of spare wind, water and solar energy to produce electrolytic hydrogen; and ○ liquefied hydrogen combustion for aircraft. • Designing and building interconnected ‘smart’ grids and other network infrastructure required for replacement of fossil fuels by renewable energy. • Strengthening investment and innovation in decentralised renewable energy supply systems.
Rapid improvements in energy efficiency and reductions in energy consumption	<ul style="list-style-type: none"> ○ Zero waste economy and ‘cradle to cradle’ product design systems. ○ Energy efficient buildings and planning including: <ul style="list-style-type: none"> ○ retrofit existing buildings to maximise energy efficiency; ○ zero emissions standards for new buildings; ○ maximise insulation; ○ wide rollout of passive solar, combined heat and power and decentralised heating and cooling systems; ○ improve efficiency of all heating, cooling, lighting and appliances; and

¹⁷ PricewaterhouseCoopers, *Too Late for 2 Degrees*, December 2012, <http://www.pwc.com/gx/en/sustainability/publications/low-carbon-economy-index/index.jhtml>

¹⁸ Based on analysis of key features of de-carbonisation strategies reviewed in *Dcgh7UFVcb DUHk Ung F Yj JYk Jb[Dcgh7UFVcb 9Wbca mHfUbgHcb GHUM JYg*

- integrated land use, housing and transportation planning to reduce distances travelled and facilitate the shift to energy efficient transport.
- Energy efficient transport including through:
 - investment in resource and energy efficient industrial processes and equipment;
 - reducing impact of energy intensive industries (e.g. aluminium, cement, iron, plastics);
 - upgrading inefficient electric motors, lighting and heating systems;
 - recycling heat energy from electricity generation through co-generation
 - reducing fugitive methane emissions from mining; and
 - improving recycling and abatement technologies for non-CO2 emissions.
 - Energy efficient transport including through:
 - setting and achieving higher vehicle fuel economy standards;
 - reducing carbon intensity of transportation fuels;
 - reducing distances travelled through urban planning, traffic congestion taxes, and increased use of video conferencing etc;
 - replacing fossil fuel cars with electric and plug-in hybrid vehicles;
 - improving access to electric vehicle charging stations;
 - encouraging shift from private cars to public transport, high-speed rail, bicycles and walking;
 - expanding use of second-generation biofuels (e.g. algal biodiesel and lingo-cellulosic ethanol); and
 - significantly reducing airline travel.

Significantly reduce GHG emissions from agricultural activity

- Reducing livestock production and consumption.
- More efficient use of on-farm energy and fuel.
- Increasing localised food production and distribution.
- Reducing cropland soil emissions: reducing tillage; improving fertiliser and nutrient management; restoring degraded farmland.
- Improving pasture and grassland management: optimising grazing intensity; expanding planting of deep-rooted perennial grasses; improving fire management.
- Reducing livestock emissions: active livestock feeding; anti-methanogenic treatments; improving manure management.
- Bio-gasification of organic manure; capturing or burning of agricultural methane.

Drawdown and sequestration of carbon into sustainable sinks

- Significant expansion of cropland carbon sequestration.
- Ending and reversing deforestation.
- Improving forest management (weed and pest control).

The growing global momentum towards implementation of large scale de-carbonisation strategies

From Germany, Denmark and the UK to California and China the global momentum for implementation of large-scale de-carbonisation strategies is rapidly accelerating. While even the most ambitious of these emissions reduction targets still require significant strengthening, these initiatives provide valuable laboratories for exploring the most effective combinations of expansion in renewable energy; reductions in energy demand and carbon sequestration.

By the end of 2011 Germany had achieved a 26% reduction in greenhouse gas emissions (from 1990 levels), significantly exceeding its 2012 Kyoto commitment of a 21% emissions reduction.¹⁹ All major political parties in Germany are committed to 40% emissions reductions by 2020; 55% emissions reductions by 2030, 70% by 2040, and 80-95% by 2050. By 2011 Germany had also achieved 10.9% of energy demand covered by renewable energy. The 2010 *Germany Energy Concept* has set targets of increasing the share of renewable energy to 18% of total energy demand by 2022, 30% by 2030, 45% by 2040 and 60% by 2050. By 2010 Germany was already home to half the world's installed solar photo-voltaics.²⁰ Feed in tariffs and accelerated investment in grid expansion are playing a key role in driving the German transition from fossil fuels and nuclear energy to renewables.²¹ Importantly over 50 per cent of renewable energy capacity built as a result of the feed in tariff policies is owned by individual households, community groups and farmers.²² The flow-on effects of the *German Energy Transition (Energiewende)* policies have provided over 382,000 new jobs in the renewable energy sector and saved over €3.5 billion in energy costs. In addition to a strong emphasis on reducing energy consumption (including a 5.3% reduction between 2011 and 2010) Germany has also invested significant funds in promoting renewable energy and energy efficiency knowledge transfer to developing and newly industrializing countries.

In 2012 the Danish parliament agreed to a target of 35 per cent renewable energy by 2020 as a significant step towards the achievement of a 100 per cent fossil fuel free economy by 2050.²³ One of the most ambitious commitments yet declared by a developed country this target builds on Denmark's already impressive renewable energy industry and emphasises the importance of a range of energy sources, including wind, solar, biogas and geothermal heat pumps.²⁴

Danish Minister for Trade and Investment, Mrs. Pia Olsen Dyhr, noted, "with this historically broad and ambitious agreement we have paved the way for an even stronger cleantech industry in Denmark. The agreement assures good framework conditions and that energy policy will continue detached from changes in the governing majorities." Søren Dyck-Madsen, Energy Advisor to the Danish Ecological Council added "the world needs countries that can serve as role-models of how to switch an entire society to be dependent on sustainable energy with a large degree of energy efficiency. Denmark is such a country. We demonstrate that it is both possible and economically sustainable to make a switch in energy supply."

Under the administration of Conservative Prime Minister David Cameron the United Kingdom remains committed to the achievement of a reduction in greenhouse gas emissions of 34% (base year 1990) by 2020 and 80% by 2050.²⁵ By 2011 renewable energy had risen to 9.5% of total UK energy generation. Between 1990 and 2007 emissions from agriculture, forestry and land use fell by 27.6% due to a decrease in the number of animals and fertilizer used, less intensive agriculture, and expansion in forest areas.

19 Climatico Analysis, Policy Monitor Report 2013, <http://www.climaticoanalysis.org/reports/>

20 World Watch Institute, 'Germany Leads Way on Renewables, Sets 45% Target by 20' <http://www.worldwatch.org/node/5430>

21 See Beyond Zero Emissions, Laggard to Leader How Australia can Lead the World to Zero Carbon Prosperity, BZE, Melbourne, 2012.

22 Julius Fischer, Learning from the German Energy Transition, Climate Progress, March 27, 2013 <http://thinkprogress.org/climate/2013/03/27/1781671/learning-from-the-german-transition-to-renewable-energy/>

23 Danish Ministry of Foreign Affairs, 'Denmark takes the lead in combating climate change', 07/12/12 <<http://um.dk/en/news/newsdisplaypage/?newsid=d30e7dff-3c12-44fb-9fd7-120b7dd8de63>>

24 Stephen Lacey, 'A True 'All Of The Above' Energy Policy: Denmark Affirms Commitment To 100% Renewable Energy By 2050' (27 March 2012) Climate Progress <<http://thinkprogress.org/climate/2012/03/27/452736/all-of-the-above-energy-policy-denmark-commitment-100-renewable-energy-by-2050/>>.

25 Climatico Analysis, Policy Monitor Report 2013, <http://www.climaticoanalysis.org/reports/>

While the prospects of federal action by the United States to comprehensively address climate change remains hamstrung by Congressional political dynamics, the State of California continues to demonstrate strong leadership. As of 2013 California has established its own cap and trade mechanism to regulate carbon dioxide emissions.²⁶ In the near future this will be linked to the cap and trade regime in the Canadian Province of Québec.²⁷ On top of the cap and trade mechanism the State of California has also announced a 'Renewable Portfolio Standard' of 33 percent renewable energy by 2020 and a net feed in tariff to provide a financial incentive for individual homes and businesses to install their own renewable energy systems.²⁸ As a result of these policies, California now leads the United States in installed solar projects and its three largest energy providers now meet close to 20% of their energy supply through renewable energy.²⁹

Although consistently reluctant to sign up to binding international commitments to reduce greenhouse gas emissions, China has also taken significant unilateral steps to develop its renewable energy industry and reduce emissions. Under the 12th Five Year Plan (2011–2015), the primary policy directive for the Chinese Government, targets are included to cut the carbon intensity of GDP 17% by 2015, to cut overall energy intensity by 16% and to increase renewable energy production to 11.4%.³⁰ As a result of these policy directives in the last few years China has invested dramatically in developing its renewable energy industry and in 2011 earned over US\$ 36 billion from the export of solar panels. In 2013 China is expected to surpass Germany as the country with the greatest energy generating capacity from installed solar panels.³¹ In 2013 alone China will add 21 gigawatts of hydroelectricity, 18 gigawatts of wind generation and 10 gigawatts of solar.³²

²⁶ <http://www.arb.ca.gov/cc/capandtrade/capandtrade.htm>

²⁷ California Air Resources Board, *Linkage*, <<http://www.arb.ca.gov/cc/capandtrade/linkage/linkage.htm>>

²⁸ Mat Kasper, 'California to Other 49 States: Can you Match our Clean Energy Economy?' (17 March 2013) *Think Progress* <<http://thinkprogress.org/climate/2013/03/17/1730481/california-to-other-49-states-can-you-match-our-clean-energy-economy/>>

²⁹ Ibid.

³⁰ See English translation of China's twelfth five year plan:

<http://cbi.typepad.com/china_direct/2011/05/chinas-twelfth-five-new-plan-the-full-english-version.html>

³¹ See Justin Doom, 'China to Boost Renewable Power in 2013 to Cut Carbon Dependency' (9 January 2013) *Bloomberg News* <<http://www.bloomberg.com/news/2013-01-08/china-to-boost-renewable-power-in-2013-to-curb-carbon-dependency.html>>

³² Ibid.

3. Political roadblocks preventing rapid implementation of de-carbonisation strategies

As Rogelj et al note in their recent review of progress in implementing national mitigation strategies: “despite all of the uncertainty in the geophysical, social and technological aspects, our analysis indicates that the dominant factor affecting the likelihood and costs of achieving the 2°C objective is politics.”³³

Key political ‘roadblocks’ preventing the rapid implementation of post carbon economy transition strategies and explored further in the following pages include the following:

- Denial of the necessity and urgency of action
- Power of fossil fuel industry and its allies
- Political paralysis, short termism and ‘moral corruption’
- The dominant economic paradigm of unconstrained and unsustainable consumption
- Technological and social path dependencies and outdated infrastructure and systems
- Financial and governance constraints

Table 4 provides a summary overview of strategic actions required to overcome political obstacles preventing rapid implementation of post-carbon economy transition strategies

Table 4: Strategies for removing political obstacles preventing rapid implementation of post carbon economy transition strategies

Political obstacles	Strategies for overcoming political obstacles
Denial of the necessity and urgency of action to reduce greenhouse gas emissions	<ul style="list-style-type: none"> • Maximising clarity and effectiveness of communication about climate change trends, causes and consequences • Highlighting relationship between extreme weather events, climate trends and impacts • Refuting and critiquing arguments and strategies of climate science deniers • Improving understanding of carbon budgets and emission reduction timetables consistent with required emissions reductions • Communicating the health and wellbeing co-benefits of a rapid shift to a post carbon economy • Creating positive and plausible visions and narratives of a just and sustainable post carbon future
Power of vested interests (ie. fossil fuel industry and its allies, particularly in finance and media industries)	<ul style="list-style-type: none"> • Broadening understanding of tactics being employed by fossil fuel lobby and its allies to increase doubt about climate change trends and denial of the necessity and urgency of reducing greenhouse gas emissions • Exposing and challenging media concentration and bias; strengthening media diversity and independence • Ending subsidies to fossil fuel industries • Encouraging and driving disinvestment in fossil fuel industries • Legislative and regulatory action to end mining and production of fossil fuels

³³ Rogelj, J., McCollum, D., Reisinger, R., Meinshausen, M. & Riahi, K. ‘Probabilistic cost estimates for climate change mitigation’, Nature, Vol. 493, January 2013, p.79

- Political paralysis, (short term thinking, competing priorities and resignation)

 - Providing resources to support equitable structural adjustment programs for communities and households effected by phase out of fossil fuel production and industries
 - Encouraging and supporting courageous ethical and moral leadership at all levels of society
 - Creating and communicating transformational visions and narratives
 - Enshrining climate protection and decarbonisation targets in global, national and local government treaties, constitutions and legislation
 - Increasing numbers of elected politicians with strong commitment to action on climate change
 - Establishing deliberative 'future' chambers of parliament providing opportunity for informed consideration of the impact of policy decisions on future generations
- Dominant economic paradigm of unconstrained and unsustainable consumption

 - Opening up and leading public debate about importance of shift in economic paradigm from unconstrained and unsustainable consumption to focus on sustainable wellbeing and resilience
 - Replacing narrow, GDP based measures of societal progress with broader economic, social and environmental wellbeing and resilience indicators and targets
 - Supporting community education, incentive based and regulatory initiatives encouraging reduced household, community and industry consumption of energy and resources
 - Encouraging and supporting decentralised local systems of economic production and distribution and for distributed energy systems
- Technological and social path dependencies

 - Encouraging development and dissemination of creative and disruptive ideas and technologies
 - Valuing and supporting work of sustainability change agents and social entrepreneurs
 - Creating demonstration projects and 'living laboratories' in which social and technological innovations can be trialled and showcased
 - Supporting commercialisation and deployment of post carbon economy innovations through price signals, financial incentives, regulation, strategic planning and infrastructure investment
- Financial, governance and implementation constraints

 - Ending subsidies and tax concessions to fossil fuel industries
 - Utilisation of funds from introduction of robust carbon taxes and taxes on international financial transactions
 - Global, national and regional structural adjustment assistance to support workers and communities shift away from fossil fuel based employment
 - Embedding renewable energy and climate change resilience investment resources in all international aid and development programs
 - Continuing to work towards global and regional commitments to an internationally verifiable decarbonisation road map and a shared approach to carbon pricing
 - Strengthening role of international governance institutions eg. International Energy Agency and International Renewable Energy Agency

- Decarbonisation alliances and collaborations between nation states, sub-national regions, provinces and cities
- Extending opportunities for citizen participation, including legislative obligation for governments to provide citizens with opportunities to participate in informed debate
- Increasing role of local government and local community organisations in exploring and implementing innovative post carbon economy transition solutions
- Capacity building and training programs in renewable technology and energy efficiency policy development and implementation
- Sustainability and de-carbonisation transition studies as core discipline, teaching and research programs in all universities

Priority 1: Overcoming climate science denial and strengthening understanding of the scale and urgency of action required

“What we didn’t really anticipate was the success that the opposition would have in taking a few random anecdotes and turning them into enormous elements of doubt in the minds of people that had not yet begun to really focus on this.”

Roy Neel, former Chief of Staff to US Vice President Al Gore

The spread of misinformation, doubt and denial of climate science is widely recognised as the first key obstacle to widespread recognition of the necessity for rapid reductions greenhouse gas emissions.

Roy Neel, reflecting on his experience of climate science denial following the release of *An Inconvenient Truth* notes:

“At the beginning very few people knew much but once they began to get information about the threat of climate change they were for the most part extremely open to the [need for action]. They wanted more information and they trusted the science for the most part. You cannot [however] underestimate the ability and the willingness of your opponents to do anything possible to not only debate you and fight you on the merits of your argument. In this case the need to act on climate change...but to try to destroy you in every other way.”

Clear and effective communication of the most robust scientific evidence of climate change trends, causes and risks remains the essential foundation for overcoming climate change denial and strengthening understanding of the necessity and urgency of action. As Kevin Curtis, Executive Director of the Climate Reality Project argues, evidence of the ways in which climate change is increasing the frequency and severity of extreme weather events can play a crucial role in enabling individuals to ‘join the dots’ between personal experience and broader climate change trends and patterns.

“The Climate Reality Project’s work on ‘Connecting the Dots’ is trying to make climate change as real to people as possible in their everyday ordinary lives. It’s not this theoretical thing that will happen in the future; it’s happening now. The emissions have gone up now, the climate’s changing, the impacts are happening. Severe weather is probably the best example of that impact and the way to make the connections.”

The evaluation and interpretation of climate science messages is, however, profoundly influenced by pre-existing value frameworks and political perspectives. The core messages of climate science therefore need to be augmented by action to expose and overcome climate denial misinformation

campaigns and by framing and communicating strategies in ways which reach and appeal to a variety of audiences.

For some audiences an ethical concern about the consequences of catastrophic climate change for the most vulnerable people and species now and in the future will be a sufficient motive for action. For others recognition of more immediate and personal risks to their own families and communities will be crucial. Others again may be most influenced by imagining and understanding the potential social and economic opportunities and co-benefits of a healthy and sustainable post-carbon future.

“Providing good information about the reality of climate change is an essential but insufficient piece of the communication and education effort. For much of the debate and particularly the demographic groups we are focusing on, they already know it’s a problem. What they need to be armed with and supported on is how to go win the conversation; how to make the case to their neighbours, to their friends, to their grandparents, to their grumpy uncle who talks about sunspots at Thanksgiving dinner. Then I think it’s really trying to connect people with each other. So they draw their strength from each other, get a sense of a community and really arm themselves with the internal belief that they can change the conversation. Because...at the end of the day, what we’re really talking about is building a movement.”

Kevin Curtis

“Even if you understand the science, it’s still hard to connect yourself to the actual effects and so it’s not surprising at all that people question our efforts to regulate in an area that might have an economic cost, when they don’t see the actual impact of what we’re doing. Or they’ll say California alone is only a small percentage of the overall global emissions - why are we doing this - if not everybody else is...The primary response again is about leadership. That we are the incubator, that we’re developing these programs so others can adopt them, and copy them. We can learn from them and they can learn from us. It really is an issue of ongoing and sustained leadership.”

James Goldstene, Executive Officer, California Air Resources Board

Jenny Clad, former Executive Director of The Climate Project, also points to the importance of ensuring messages about climate change trends and emissions targets and pathways are made accessible to different audiences and delivered by credible messengers:

“A couple of years ago...the Australian Conservation Foundation, the host of The Climate Project in Australia, put together a great film called ‘Telling the Truth’ in which they picked a cross section of people trained as Climate Project presenters. The one that stands out to me was a 28 year old hulky, good looking rugby player who was giving a presentation to his fellow rugby team in the dressing room. All these guys are sitting there in rapt attention and the interviewer asked a couple of people their impression after the presentation was over and the consensus was, ‘well if John here says it’s a problem, it must be a problem’. And therein lies the power of peer-to-peer.”

Crucially, as Ian Dunlop points out, there is an important link between the climate change action roadblocks of denial and vested interests.

“Denial is interesting, politically and corporately, because the moment you accept that you have a problem, and the seriousness of it, then you have to do something about it. For example, directors have a fiduciary responsibility to objectively assess the critical risks to which their companies are exposed, and take action to ensure these risks are adequately managed. But if they acknowledge climate change as a serious risk, they are bound to act, which requires a radical redirection of Australian business away from our addiction to

high-carbon coal and gas, our most powerful vested interests losing out in the process. Better then to stick to absolute denial, irrespective of the consequences.”

High priority strategies identified as important in overcoming climate denial include the following.

- Maximising clarity and effectiveness of communication about climate change trends, causes and consequences
- Highlighting relationship between extreme weather events, climate trends and impacts
- Refuting and critiquing arguments and strategies of climate science deniers
- Improving understanding of carbon budgets and emission reduction timetables consistent with required emissions reductions
- Communicating the health and wellbeing co-benefits of a rapid shift to a post carbon economy
- Creating positive and plausible visions and narratives of a just and sustainable post carbon future

Priority 2: Overcoming the power and influence of the fossil fuel industry and its allies

“The biggest barriers to solving the climate crisis...are the vested interests of big oil and big coal and the influence they have. They put a lot of money in political campaigns and now there are no limits on what they can put in so they’re just buying everything in sight.”

Lester Brown

The most commonly cited obstacle to the swift implementation of post-carbon transition strategies is the power and influence of the companies and individuals with interests threatened by a rapid shift away from fossil fuels and fossil fuel based industries. As Jenny Clad notes:

“Vested interests of the fossil fuel industries, oil and coal [are the biggest obstacle]...They make an awful lot of money so they make a formidable adversary in terms of their ability to buy eyes and ears and the media...and they also have a lot a lot of lobbying influence with politicians. The other big obstacle is that in the United States we’re still putting both sides of the issue on climate change on a split screen on a television interview saying ‘here to represent pro-climate change action is so-and-so. And here is the denier on the other side’ as if it’s 50/50!”

Paul Gilding also emphasises the frequency and effectiveness with which the ‘no need to act now’ argument is employed by vested interests opposed to action to reduce reliance on fossil based energy. “The story from the vested interests now is that [rapid transitions to renewable energy are] not possible. They say ‘we can’t do that. It’s going to take 50 years” - which is another way of saying, ‘I don’t want to do it now.’”

For Kevin Curtis...

“One of the [key] challenges of this fight is [that] there’s a very well entrenched status quo that’s taken 150 years to build. On one level, it’s a wonderful status quo. It’s why we have power and electricity and air conditioning in our homes; but it’s a fossil fuel based energy system and to solve this crisis we have to adopt a non-fossil fuel based solution. So we try to point out that there’s an entrenched economic self-interest that is behind much of the confusion or delay or obfuscation on this issue. We try to use humour, satire and amusement, because it’s too strong a foe to take on head on. If we can chip away at their credibility, then they’re less effective.”

It is however also important to remember as Jørgen Randers, Professor of Climate Strategy at the Norwegian Business School and co-author of *The One Degree War Plan*. It reminds us, that there are many ways in which we all have a 'vested interest' (at least in the short term) in maintaining the current economic status quo:

"We used to have a very shallow interpretation of vested interest, we thought it was limited to the 'business interest for higher profits'. But the current obstacle of vested interests is much more monumental. In my country, Norway, after half a century of successful oil and gas exploration, most people are in favour of continuation of business as usual. The vested interest in this case includes both the labour unions and people in general, including the employees of the oil and energy department which within the last 40 years have put in place a well regulated orderly and creative oil sector where almost all the profits from oil and energy ends up in the public coffers. So the vested interest in the current solution is amazingly strong."

As Mark Ogge, co-founder of Zero Carbon Australia 2020 points out recognition of the central importance of challenging the arguments – and the power – of the fossil fuel industry has crucial implications for political priorities and strategy.

"In Australia both the major parties, are completely locked down by the influence of the fossil fuel industry - the oligopoly of the big integrated energy companies ...and also the resource extraction sector. The lobbying and constant interaction with government has really locked-in government policy. We actually have to beat the fossil fuel lobby. It has to...be more painful for our electoral representatives to ignore us than it is for them to ignore the fossil fuel industry. That's the basic equation. Until you reach that point, we don't win."

The *Do the Math* campaign organised by 350.org in the United States provides one recent example of the way in which the power of the fossil fuel industry might be challenged through campaigns promoting divestment by universities and other institutions in coal and oil companies. 350.org President, Bill McKibben summarises the rationale for this strategy in the following way:

"Scientists estimate that humans can pour roughly 565 more gigatonnes of carbon dioxide into the atmosphere by midcentury and still have some reasonable hope of staying below two degrees. ...[Meanwhile, 2,795 gigatonnes] of carbon [are] already contained in the proven coal and oil and gas reserves of the fossil-fuel companies, and the countries (think Venezuela or Kuwait) that act like fossil-fuel companies. In short, it's the fossil fuel we're currently planning to burn."

"If you told Exxon or Lukoil that, in order to avoid wrecking the climate, they couldn't pump out their reserves, the value of their companies would plummet. ...if you paid attention to the scientists and kept 80 per cent of it underground, you'd be writing off \$20 trillion in assets. That carbon bubble makes the housing bubble look small by comparison. It won't necessarily burst – we might well burn all that carbon, in which case investors will do fine. But if we do, the planet will crater. You can have a healthy fossil-fuel balance sheet, or a relatively healthy planet – but now that we know the numbers, it looks like you can't have both. Do the math: 2,795 is five times 565. That's how the story ends."

High priority strategies identified as important in overcoming the power of the fossil fuel lobby and its allies include the following.

- Broadening understanding of tactics being employed by fossil fuel lobby and its allies to increase doubt about climate change trends and denial of the necessity and urgency of reducing greenhouse gas emissions

- Exposing and challenging media concentration and bias; strengthening media diversity and independence
- Ending subsidies to fossil fuel industries
- Encouraging and driving disinvestment in fossil fuel industries
- Legislative and regulatory action to end mining and production of fossil fuels
- Providing resources to support equitable structural adjustment programs for communities and households effected by phase out of fossil fuel production and industries

Priority 3: Overcoming political paralysis and strengthening the determination of communities, governments and business to take decisive action

“In order to de-carbonise the American economy and the world economy in the time frame we need it to happen; it’s not an evolutionary change. It’s a very revolutionary change which will take a movement and a commitment to solving it. The good news is that there’s a wealth of solutions out there. But what’s lacking is the political will to pursue those solutions...The *Climate Reality Project* is dedicated to revealing the complete truth about the climate crisis, in a way that ignites the moral courage in each of us.”

Kevin Curtis

Courageous moral leadership – at multiple levels and in many sectors – is clearly an essential precondition for rapid implementation of post-carbon economy transition strategies. In addition to the corrosive influence of denial campaigns and the lobbying of vested interests, other obstacles standing in the way of decisive climate leadership include competing, short term economic and political pressures and demands, the desire not to be seen to be politically naive or unrealistic and the sense that the transformational change required is simply not possible.

“The major barrier to action is the incentive system under which the corporate world operates. Bonus incentives have become the dominant form of remuneration since their introduction in the early-1990s from the US, based predominantly on short-term performance. Previously you had organisations who were seriously prepared to look at the long-term and to take decisions accordingly. You had statesmen who considered not just the next six months’ financial performance but what might happen in 20 to 30 years’ time. There are still big organisations who claim to do that but, in fact, the day-to-day performance of those groups almost totally dominates decision-making. Short-term pressure also comes from the financial markets and superannuation funds, all of whom are paid the same way, and all of whom are looking for instant gratification in terms of financial returns.”

“So the focus of the business world has moved from one which took a balanced view of the short and long-term, to one which, whatever is said publicly on websites, sustainability reports and the like, is almost entirely short-term focused. That attitude also spread to the political world and the politicisation of the public service. The result is that our institutions are ill-equipped to handle the long-term issues such as climate change, which are now our major challenges.”

Ian Dunlop

Doubt and denial of the possibility as well as necessity of rapid, large-scale emissions reductions can also be significant drivers of political paralysis and resignation. In this context Jenny Clad provides an important reminder of the need to strike the right balance between ‘fear and hope budgets’.

“The hope-budget, the fear-budget’, that is something we have to negotiate, those of us who are trying to work in climate change education, all the time because there is a burn-out, there is a turn-off rate that you wouldn’t believe. Even among people who [understand the science]. They say ‘I know it but I’ve got a baby now, I have to pay the mortgage, I’m not going to think about this anymore.”

Reflecting on his experience with the media in promoting his book, *The Great Disruption*, Paul Gilding is struck by the fact that there is, “a lot of focus on the idea of a crisis, a lot of focus on the idea of disruptive change and threat to civilisation but very little focus on the response.”

“I think it’s very hard to think outside your frame of reference - and this is such a long way outside [the mainstream media’s] frame of reference that they can’t quite get to that place. [It’s like the] great scene in *The Hitchhiker’s Guide to the Galaxy* where a spaceship lands at Lords cricket ground and they get up and go, “We’re in a spaceship and no one’s looking at us - what’s going on?” And he says, “Well, no, this is so incongruous. You simply can’t see things that are this incongruous. It was a very insightful idea which I think explains that... when we can’t get action on climate change at the minor, local, insignificant level, the idea of going a hundred steps beyond that is so incomprehensible, people can’t see it. So they can’t argue it’s ridiculous. They ignore it.”

“It’s like the Ghandi quote: ‘First they ignore you, then they laugh at you, then they fight you, then you win.’ We’re kind of at the ignoring phase.”

Gilding also notes that

“...one of the reasons it’s so important to do this work [to develop and track post carbon transition plans] now is because when the general public panic, they’ll ask for the plan. Therefore, the more we have that conversation in more places now, the more acceptance there’ll be of these plans as examples.”

Parallel narratives, outlining plausible pathways towards a post-carbon future are frequently identified as important tools in strengthening the sense that the transformational change required for rapid de-carbonisation is indeed socially and politically feasible.

“I think the most important [step] was putting out a vision that was bold and comprehensive and supported by a lot of good analysis. It allowed people to start talking about the possibility and the details of having 100 per cent of our energy, for all purposes, provided not just from renewable energy in general but more specifically from wind, water and solar power.”

Mark Delucchi

“My favoured idea is a ‘parallel narrative’... like a science fiction story, about how we got to zero. People might enjoy the story, but say, ‘Well, thank God we don’t have to do that. The government itself tells us we don’t have to do it.’ This allows them to rehearse the story without getting scared, because it’s just a story. But nevertheless it does unconsciously prepare people for potentially rapid changes. Probably the government should have plans to contain localised collapses. I think people would be less nervous about embracing changes in society if they knew that, come what may, their basic needs would be taken care of. I’d like to see a kind of emergency guarantee of basic conditions [food, shelter, security, energy, communication]... so there is no panic, no amplification of instability.

Peter Harper, co-author of *Zero Carbon Britain 2030*

And, as Lester Brown argues, political leadership and mobilisation will need to occur at many levels.

"The question I get most often as I travel around the world is, 'What can I do, what can I do?' and I think they expect me to say, 'Recycle your newspapers, change your light bulbs,' and so on. Those lifestyle changes are important but we now have to change the system and that means becoming politically active, not for one party or another but to support the *Beyond Coal* campaign, for example. And be prepared to write letters to your Congressman to lobby, to demonstrate, in front of a coal-fired power plant if necessary or in front of a utilities office."

High priority strategies for overcoming political paralysis and strengthening the determination of communities, governments and businesses to take decisive action include the following.

- Encouraging and supporting courageous ethical and moral leadership at all levels of society
- Creating and communicating transformational visions and narratives
- Enshrining climate protection and decarbonisation targets in global, national and local government treaties, constitutions and legislation
- Increasing numbers of elected politicians with strong commitment to action on climate change
- Establishing deliberative 'future' chambers of parliament providing opportunity for informed consideration of the impact of policy decisions on future generations

Priority 4: Developing an economic paradigm focused on strengthening social and economic wellbeing rather than maximising the consumption of fossil fuels

Questions about the extent to which rapid de-carbonisation can be achieved within existing assumptions about economic growth provoked a range of perspectives and responses from interviewees. Amory Lovins, for example, argues that the main focus should be on reconsidering the way we use and produce energy:

"The climate problem and many others - energy poverty, energy insecurity, nuclear proliferation and so on - are all artefacts of not using energy in a way that saves money. Most of the energy we use is wasted. The rest can be got with least cost and least risk from an integrated system of modern renewables supply. In order to do this, it would be extremely helpful to level the playing field; ideally to let all ways to save or produce energy compete fairly at honest prices, regardless of their size, type, technology, location or ownership. That is pretty much the opposite of the national energy policies most of us have got - but it would give us a much more competitive economy and a richer, cooler, fairer and safer world."

Others, such as Mark Ogge remain cautious of over-simplifying and over-emphasising arguments which imply that climate change solutions inevitably require a radical shift in economic growth assumptions and targets.

"I'd be slightly wary of saying, 'Well, nothing's ever going to change unless we fundamentally change our attitude to growth' because I think that's not going to happen and it could become another barrier to actually get on and do the simple straightforward things that we all know we need to do...That's not to say I don't think advocating for a steady state economy isn't a good idea. I probably philosophically agree with it. However, to actually get the change we need, I don't think you have to start by getting government support for a steady state economy. You have to look at where emissions are coming from."

"For instance in Germany, the energy bills for businesses and consumers are less than half of what they are in Australia. They have a higher per unit energy cost but they have done a

massive amount of energy efficiency. So they use less energy but they have the same services. So they have big industry and they have homes that they've got to heat, manufacturing - but they just use a lot less energy. So you can do that and still have economic growth. On the power generation side, you have to produce less energy but you do it from renewable sources...I do think we need to deal with excessive consumption - because there's a lot of embodied energy obviously from imported consumer goods - and I think we need to just deal with that straight-up."

Others, such as Peter Harper, Ian Dunlop and Kevin Anderson take the view that emissions reductions at the required speed and scale can only be achieved by significantly reframing and rethinking economic growth, at least in developed economies.

"I can't see how we can continue economic growth. The maths just don't stack up! So I'm in favour of a transition to a very slow growth path. Above about \$15,000 dollars per capita GDP the level seems completely arbitrary anyway, in terms of welfare, so why not quit while you're ahead? In *Zero Carbon Britain 3* we are planning to introduce the idea of 'encouraged' low-emitting households, perhaps as many as 20% of all UK households. We notice that individual households can reduce by up to 80% all on their own, and some would prefer to do this by cultural adaptations rather than paying high taxes for 'top-down' solutions. We think the government ought to find ways to make such adaptations worthwhile."

Peter Harper

"One of the most important [challenges] is to change the concept of economic growth in the Western world, as it is not going to be possible to continue growing in conventional terms given the need to reduce emissions and contend with other resource shortages. There is a sound argument for the developing world to continue growing, in order to raise standards of living and alleviate poverty, but the size of the climate challenge may mean that the flexibility to do so disappears. The developing countries will have to evolve in a very different way from ourselves – introducing new technologies rapidly and leapfrogging the West. The West itself will have to cut back on its growth expectations, and on consumption, introducing a wide range of low-carbon solutions."

Ian Dunlop

"For the relatively developed, wealthy countries, I don't think there's any option for our first move other than to reduce our consumption. I'm not saying that because I think that's an easy thing to do politically or that it's something that I might agree with for another set of reasons. I'm simply saying we cannot get off the emissions curve fast enough through technology. We have to change what it is we consume. Not just what we consume but the rates and levels of our consumption. So, the number one thing is reduce what we consume. The number two thing is to try and consume differently and the number three thing is to try, in the wealthy parts of the world, to change the mechanisms that feed into that consumption."

Kevin Anderson

Another point of view again is that a profound shift in economic growth assumptions and priorities is in fact already underway...

"The cultural shift is that the idea of acquiring property – starting with a small house and getting a bigger one and so forth – that acquisition of material things doesn't exist with young people in the way it did with an earlier generation; the generations that were shaped by the Depression and World War Two, for example. There was a period when growth was

everything and more material possessions was everything ‘but I think we’re beginning to leave that behind now. Values and attitudes are changing. The acquisition of material wealth is not something that looms very high in the minds of young people today. They don’t want to be bothered with it.”

Lester Brown

“Growth will end...I think growth has ended in developed countries. We’re now going to be living on debt and bringing forward growth from the future...You have to go back to the physical limits and say, ‘Well, look, I’m not saying China shouldn’t grow, doesn’t want to grow, doesn’t need to grow, wouldn’t benefit from growing. I’m saying it’s not going to happen. You have to imagine China lowering its growth rate from 10 per cent to 7 per cent, which is what it’s currently trying to do, to slow down the growth rate. Then you have to put in your head all of China’s current ecological resource constraints of forest, and water, and food and everything else. Then you have to imagine all those issues being multiplied by four within 20 years.”

“What does work now is to talk about the basic numbers on happiness. We’ve had, in Western countries – 30 or 40 years of very consistent economic growth with doubling and tripling of per capita incomes and no improvement in average quality of life in terms of self-perceived life satisfaction. Why are we doing this? So you say, ‘Yes it’s going to fail anyway – but by the way it’s not working.’ That’s a different language. It’s like there’s a better way of doing this which is actually more effective than the old way.”

Paul Gilding

Priority strategies for opening up and leading public debate about importance of shift in economic paradigm from unconstrained and unsustainable consumption to focus on sustainable wellbeing and resilience include the following:

- Replacing narrow, GDP based measures of societal progress with broader economic, social and environmental wellbeing and resilience indicators and targets
- Supporting community education, incentive based and regulatory initiatives encouraging reduced household, community and industry consumption of energy and resources
- Encouraging and supporting decentralised local systems of economic production and distribution and for distributed energy systems

Priority 5: Driving the social and technological innovation needed to overcome path dependencies and replace outdated infrastructure

“Public will, individual psychology, and technological innovation come together to create tremendous innovation dynamics...tremendous substitution dynamics...which in a few years has already overtaken, at least in installed capacity, the nuclear power industry in Germany. So this is ‘proof of concept’... that yes we can create big transitions.”

John SchellInhuber

The crucial role of disruptive ideas and of individual and organisational change agents, social entrepreneurs and demonstration projects in challenging path dependent thinking and in overcoming institutional inertia was a common theme across many of the conversations undertaken for this report.

“There is an institutional inertia that has to be overcome. Institutions, especially in the US, tend to not be designed or used to thinking about very long-term and very large-scale integrated systems. Look, for example, at the US Energy Information Administration’s

National Energy Modeling System cannot handle, by the way it's structured, a 100 per cent renewable energy system. It has built-in limits on how much wind energy you can have and how much intermittent energy you can have. Just simply by its structure, it can't accommodate the sorts of interconnections and system changes you'd have to have in order to expand and integrate renewables. So there is analytical and regulatory and institutional inertia and habits that get in the way of thinking about this because this isn't an incremental difference."

Mark Delucchi

"Aside from the ingrained people with financial interests, most people don't really care one way or the other what their energy infrastructure is. They're currently used to a certain infrastructure and they have this impression that clean renewable energy is not efficient, or unreliable or electric cars don't go very far, or they'll break down. They have these stereotypes of what this new energy system would look like and it's not very favourable. But with examples and with education I think these people actually would realise that this is a much better energy infrastructure. For example, if people realised that an electric car consumes four to five times less energy than a gasoline car in raw energy and if they also were convinced that their car would run just as well as the current car, they would be less opposed to shifting resources from current fossil fuel based cars to electric cars."

Mark Jacobson

"We are already in the digital age and there is enormous potential for that. Starting in the home, which is where Apple has gone with its iPhones...ends up in the workplace. So I think that there is potential for home energy use to be attractively transformed because once pricing gets over a bit of a tipping point, maybe we'll move to time-of-use pricing; then it becomes the norm and people know how to use it in a smarter way. Then providers come in, like all the apps that just emerge on an Apple phone [and they] want to provide all these whizz-bang things."

Anna Skarbek, **Executive Director**, Climate Works Australia

As John SchellInhuber argues, a number of crucial lessons can be drawn from the German experience in driving a rapid transition economic transformation towards a renewable energy fuelled future.

"We talked about transformation - how it could be brought about...I'll give you an example. The German feed-in tariff...During Easter [2012], photovoltaic panels produced for a few hours more electricity than the entire nuclear power stations ...of which there are almost 20 in Germany right now. More than 22 gigawatts – just amazing...Ten years ago [solar photovoltaic power in Germany] was almost non-existent. People told us it will never make a significant contribution...So what came together? Three things."

"First of all a 'new technology' which is not entirely new because it was invented at Bell Labs in 1953 along with the transistor, so it's a very old fashioned thing. But the technology was there and they called it at the time the 'sun battery'...So you have the innovation of the technology. The second thing you need is the government setting – a framework, or maybe an incentive, or subsidy - a 'boundary condition'. The third thing you need is the mass psychology... everybody loves the sun and everybody loves renewable energy, at least in Germany. That is quite easy to understand, you can do it locally, everybody has the chance to put it on the roof, there are no side effects, no nuclear waste or anything else, you cannot create a weapon out of it, and it's inexhaustible in principle."

"We're really on the edge of some fundamental changes... I liken it to recognising the link between smoking and health 20 years ago and the tobacco company CEOs are under oath saying, 'There's no proof of a link between smoking and health,' and get away with it."

Then, within a year or two, everything had changed and they couldn't say anything because no one would listen to them and no elected member of Congress would be seen in public with a tobacco company CEO. It just changed that fast. The Tobacco Institute used to be here in town, staffed by 300 people. Totally dismantled; forced to dismantle by NGOs and public opinion. I mean, it was amazing to see it happen. It happened very quickly, it had reached the tipping point and suddenly it was an entirely new ball game."

Lester Brown

Priority strategies for driving social and technological innovation include the following.

- Encouraging development and dissemination of creative and disruptive ideas and technologies
- Valuing and supporting work of sustainability change agents and social entrepreneurs
- Creating demonstration projects and 'living laboratories' in which social and technological innovations can be trialled and showcased
- Supporting commercialisation and deployment of post carbon economy innovations through price signals, financial incentives, regulation, strategic planning and infrastructure investment

Priority 6: Strengthening the financial and governance institutions and capabilities needed to drive swift and equitable implementation of de-carbonisation strategies.

"The cost of staying below 2°C can be less than 1% of global GDP, when investments are spread overtime. Coordinated early action (ie. starting now, well before 2020) will deliver the least cost way of staying below 2°C. The longer the delay, the higher the cost and the bigger the technological challenges."

Climate Action Tracker Update, 2012³⁴

"It's an all too common story. You speak to people who've tried to install solar panels on their roof [and they tell you] how difficult it was and the guy that they dealt with didn't seem to know all the different options and had his own agenda. So, there's a whole raft of issues there that are very difficult to overcome and I think they're not the glamorous part of the policy. Once you've announced the policy, that implementation side gets forgotten a little bit. Whereas, actually, in terms of success, it's critical."

Alex Kazaglis, **Senior Policy Analyst, UK Committee on Climate Change**

Two deeply entrenched assumptions about financial and equity challenges create additional obstacles to the achievement of broad support for the rapid implementation of post-carbon economy transition strategies: *i)* the view that such strategies are simply unaffordable and *ii)* the view that implementation of these strategies will lead to further unacceptable entrenchment of inequalities.

Addressing the first concern, the German Advisory on Global Change, 'World in Transition' report concluded the following:

"Globally, the additional investment required for transformation into a low carbon society, compared with the cost of 'just carrying on as we are'... lies somewhere in the region of US \$200

³⁴ Ecofys, Climate Action Tracker, November 2012 www.climateactiontracker.org

to \$1,000 billion per year by 2030. These investments will be offset by later savings of a similar size, and the avoidance of the immense costs of dangerous climate change.”³⁵

As Ottmar Edenhofer, **Deputy Director at PIK** argues, an equitable strategy for redistributing the financial burdens and costs of the transition policies would also need to include global, national and regional structural adjustment assistance to support workers and communities shift away from fossil fuel based employment as well as the embedding of renewable energy and climate change resilience investment resources in all international aid and development programs.

“There clearly are regions which are more vulnerable [to extreme climate change], and these are precisely the regions of lesser economic power. They cannot just easily grow and develop out of the predicament. Hence you would need an international transfer of money if they were to be guarded against the impacts of unmitigated global warming. The United States, Australia, Germany and others would have to provide the funding, and so far it is hard to recognize their willingness to do that. In fact, if that willingness could be organised, it could also be directed at investments into clean technologies, at actually mitigating global warming before it’s too late. This symmetry of problems and challenges in mitigation and adaptation is something I think science should investigate.”

Alex Kazaglis, **senior policy analyst** at the UK Committee on Climate Change also notes the important role which the UK Committee on Climate Change has played in contributing to an informed, evidence based public debate about the real costs and benefits of de-carbonisation policies:

“The media has been seeking to link [rising energy bills] to the low carbon agenda, arguing that if we get rid of the low carbon agenda, then our bills will go back down. One of the things that worked here [in the UK] reasonably well is the Committee stepping into the debate and providing an evidence-based response to the question of what is driving up bills. The Committee produced a report and put some numbers around it and in the time since then – we’ve seen our numbers used in the press...[arguing that] the bills are going up but, only this much is due to the low carbon agenda and the rest of it is due to the wholesale gas price and so forth. That provides some evidence to the argument and deflates some of the more hysterical narratives.”

The achievement of global commitments to an internationally verifiable de-carbonisation road map; a shared approach to carbon pricing and a strengthened role for international governance institutions such as the International Energy Agency and International Renewable Energy Agency remain important goals. However the urgency of the timetable for emissions reductions and the limited likelihood of progress towards binding global treaties means that the main focus in then next few years will need to be on alliances and collaborations between nation states, sub-national regions, provinces and cities.

“Global greenhouse-gas emissions from fossil fuels have reached new record levels, yet there will be no new, globally binding climate-protection agreement for all states before 2020. The challenge now, therefore, is to launch other initiatives to achieve further reductions in greenhouse gases before 2020 – but to be much more ambitious than we have been up to now. To this purpose, ground breaking alliances should be formed quickly between pioneering states.”

German Advisory Council on **Global Change**³⁶

³⁵ German Advisory Council on Global Change, World in Transition, WBGU, Berlin, 2012

³⁶ Ibid.

The lack of effective international agreements will also create significant challenges for national governments as they endeavor to maintain ambitious emissions reduction targets in the face of more immediate economic pressures.

“One of the lessons... from what’s happened in the UK is that having a *Climate Change Act* which sets things out in law, where there’s legal implications for government if they don’t continue on the track that’s set out in that Act... and an independent watchdog, that’s us, overseeing progress. Those things help to bind the politics to the long-term targets that it’s set itself so when these other factors come up, it doesn’t completely knock it off course. We’ve seen that in the recession. I think you could say that that was pulling things away from spending on climate change policy and they [the government] stuck to their guns and legislated even deeper targets in the fourth carbon budget, just after the height of the recession. So there’s a lesson there that we were able to stay on track through that as a result of the Climate Change Act.”

“Creating an independent committee, enshrining that in legislation, making sure that they set budgets that are practical but cost effective and on the path to delivering the UK’s share of moving to the target. That sort of framework, taking the politics out of that process and letting an independent body have the authority to recommend and persuade government to do it, has been incredibly effective and I think being able to weather the recession and have those recommendations continue to be legislated has surprised a lot of people. So I think that’s something that’s worked.”

Alex Kazaglis

The recent UK experience of de-carbonisation policies also leads to a range of important insights about the need to augment market based policies with a range of complementary interventions.

“When we talk to people overseas and their reaction is ‘Well, don’t you just set the carbon price and then let the market work it out?’ Well, I think the new consensus, the new economic consensus in the UK, is no, that doesn’t work. You need a market, yes, but you need a policy toolbox which has all sorts of other supporting mechanisms in it, and in some cases, the market might not be appropriate at all. For example, in trying to incentivise the insulating of the housing stock, the UK government has created what is effectively a market mechanism for incentivising households but they’ve had to support that with direct subsidies for insulation measures. So what you end up with is not really a market mechanism; it’s a hybrid.”

“Similarly, on electricity market reform, which is part of the Energy Bill that’s going through, it’s a market framework but it involves long-term contracts and strike prices that are actually a sort of price-setting tool and also meant to bring on certain quantities so you don’t really have something that looks that much like a completely free market mechanism there. You’ve got something that’s, again, more of a hybrid mechanism and I think the UK’s been on a journey where we understand why that’s necessary and when you speak to someone who hasn’t been part of that journey, it’s surprising to them. It sounds a little bit like central planning but, actually, it’s a bit of a new consensus in the economics.”

Finally the experience of the *UK Committee on Climate Change* also demonstrates the importance of strengthening labour market skills and policy making capabilities through capacity building and training programs in renewable technology and energy efficiency.

“Retrofitting something that somebody already owns is the more difficult policy type and part of that is the need for third parties like the installers and the middle men who are negotiating between the government policy and individuals. I think that’s where all the risks come in because that’s where the rubber hits the road, that’s where people see the evidence of government policies. So if you have a few of these technologies installed badly

and they end up increasing energy bills rather than decreasing them or if you poorly install insulation and this leads to fires.”

“Those sorts of problems end up jettisoning the whole scheme. It’s a problem because the ambition is very high and you need a lot of people to be able to deliver it... [You need to make] sure that their training is sufficiently accredited and you’ve minimised the risks of those sorts of problems. It [also] means that you need a really well-funded accreditation scheme and an accreditation body that’s monitoring all of the installers that are out there on the ground.”

Alex Kazaglis

Priority strategies for overcoming financial, governance and implementation constraints include the following.

- Ending subsidies and tax concessions to fossil fuel industries
- Utilisation of funds from introduction of robust carbon taxes and taxes on international financial transactions
- Global, national and regional structural adjustment assistance to support workers and communities shift away from fossil fuel based employment
- Embedding renewable energy and climate change resilience investment resources in all international aid and development programs
- Continuing to work towards global and regional commitments to an internationally verifiable decarbonisation road map and a shared approach to carbon pricing
- Strengthening role of international governance institutions eg. International Energy Agency and International Renewable Energy Agency
- Decarbonisation alliances and collaborations between nation states, sub-national regions, provinces and cities
- Extending opportunities for citizen participation, including legislative obligation for governments to provide citizens with opportunities to participate in informed debate
- Increasing role of local government and local community organisations in exploring and implementing innovative post carbon economy transition solutions
- Capacity building and training programs in renewable technology and energy efficiency policy development and implementation
- Sustainability and decarbonisation transition studies as core discipline, teaching and research programs in all universities

4. How a rapid transition to a post carbon future might be achieved:

Four transformational change scenarios

Human civilisation is rich in stories of transformational change which few at the time saw coming. Familiar examples include the abolition of slavery, the end of apartheid, the fall of the Berlin Wall, and the still unfolding possibilities of the Arab Spring. Such reminders of the complex and unpredictable relationships between the constraints of our physical environment and the human capacity to imagine and create alternative futures provide valuable starting points for thinking about political scenarios with the potential to inspire and drive rapid post carbon economy transition strategies.

Each of the interviewees was asked for their response to the following ‘backcasting’ question in order to explore and illuminate possible political wildcards and tipping points.

“Imagine it is 2030 and we now live in a world in which the transition to a just and sustainable post carbon society has occurred so there is now real hope that runaway climate change will be avoided... How did this happen?”

As the following responses show there are many different ways of answering this challenging question about what may be the most important drivers of social and political change (see also Table 5 below). The relentless pressure of evidence, education and legislation? The unpredictable step-changes of social and technological innovation? The inspirational power of visionary leadership and community mobilisation? Or perhaps the alignment of all these possibilities with one or more game changing social or environmental crises?

Table 5: Drivers and examples of transformational social and political change

Drivers of transformational change	Illustrative historical examples
Evidence, education and legislation	Ending slavery Stopping ozone depletion Defeating Big Tobacco
Social and technological innovation	Invention of the printing press Invention of the steam engine Invention of penicillin The digital revolution
Visionary leadership and popular mobilisation	The role of the suffragettes in achieving legal and civil rights for women The American Civil Rights movement Ending apartheid in South Africa Achieving independence in East Timor
Decisive action at moments of crisis	The transformation of the US economy following Pearl Harbor The Battle of Britain Fall of the Berlin Wall and the overthrow of Communism in Eastern Europe

Scenario 1: The power of evidence and education

Reflecting on the campaigns which overcame the threat of ozone depletion or the power of the tobacco corporations might lead us to imagine an emissions reduction scenario driven first of all by scientific evidence, persuasion and regulation. The key question which remains is whether the speed with which climate tipping points are approaching will allow us the time for primarily incremental strategies.

Looking back from 2030 - how did the transformation to a post-carbon economy occur?

"The role of climate science was thrust front and centre. Political leaders were willing to say, 'Let's step back from partisan political debate and take a clear eyed view of what the science says. Then let's take action.' The public call for action on climate change and new energy policy grew to such an extent because we increasingly had a population which grew up with an environmental ethic and a consciousness about climate change."

Roy Neel

"Little by little, every year, the evidence, the increased education of the public, of the politicians, the work from businesses who are looking to the bottom line profit of the next quarter, but also looking for ways to do that in a more socially responsible and sustainable way. All of this inch-by-inch is going to have the effect of making the deniers and those who profess to do nothing and put more money into drilling oil, digging out coal, more and more marginalised."

Jenny Clad

"There would be big progress towards decarbonisation of the power generation sector... You'd also see international progress in joining up some of the carbon trading systems so you'd have greater confidence globally in a carbon price."

Adrian Gault

"It partly comes back, I think, to the point that hasn't happened yet - but that will happen - when there's an alignment of the policy, the science and the politics, that allow for the United States - for Congress to act broadly, for other countries to act too, simultaneously... A part of that is because we've seen what's technologically possible."

"We've come to enjoy living in more pedestrian friendly transit oriented communities. We've enjoyed the cleaner air and the less pollution. We've seen that the programs that we developed at the state and local level ...like a low carbon fuel standard and the Cap and Trade program have benefits that we hadn't even envisioned when we first put them in place and that the national governments adopt them - so Washington DC and Ottawa and others pick them up and they become national programs that everybody accepts as normal, in an effort to reduce the impacts of what will then be strongly felt, the environmental impacts of climate change, water supply, fishing, farming, fires and other things."

"I think that's the main story. Then you see leaders of countries working together and these become very much part of these programs. Those ideas, this effort; becomes a regular part of the meetings of world leaders when they come together and they really coordinate and achieve agreement on how to deal with these issues."

James Goldstene

Scenario 2: Game changing technological and social innovation

The speed and spread of game-changing technologies like the printing press, the steam engine or the silicon chip provide a second, plausible narrative of swift and transformational change. The speed with which renewable energy technologies and systems are improving in efficiency and falling in cost is certainly impressive, although it is also increasingly clear that social as well as technological innovation will need to be a central part of any real solution to climate change.

“As we look back on this now from 2050, one wonders what all the fuss was about. We used to think that catastrophic climate change was a big problem because we supposed that it had to be solved by difficult treaties between national governments. But that assumed - quite wrongly - that the solutions would be costly and painful rather than attractive and profitable, for the simple reason - now so blindingly obvious in hindsight - that it was so much cheaper to save the fuel than to buy it in the first place, let alone burn it. So as the economic logic gradually overcame the dogma that it must not have been cost-effective to save energy or we'd have done it already, we really unleashed the dynamism of individual choice and corporate and social innovation - and that turned out to be much more powerful and faster than the public policy.”

Amory Lovins

“So [decarbonisation] becomes the norm - like digital computing has become the norm. In the optimistic frame, we may be only 3 to 5 years away from that, in the sense that if this carbon pricing [in Australia] is here to stay ...and \$23 a tonne actually grows to what it is meant to grow to, markets respond fast when that stability is there. Now, \$23 is not enough and we know \$40 is not enough either - but what it would do in the next 5 years at those prices is make the ...low-hanging fruit stuff ‘business as usual.’ Very quickly, once there is enough of a price to justify interesting technologies...they will be attractive to customers – remote controlling of your heating and your cooling, moving to smart cars and charging them when the power is cheap.”

Anna Skarbek

“We have two moments coming. One is the climate changing - the melting of the North Pole sea ice...Then there's a magical point in markets where they all suddenly tip. They're looking for ‘Where's the opportunity for growth and discovery and opportunity?’ There's a point coming in energy like that. China ramps up its response and the US starts to panic... Once the money is saying, ‘Hello – we can do this!’ then the policy will take off. Then that will become self-fulfilling – the collapse of the coal and oil industry.”

Paul Gilding

“And this is also something for the lay people because we are all savers...saving for [our] pensions. Pensions are perceived no longer reliable because governments are not committed to securing them. In order to reduce the pressure in the future, pension funds or wealth funds could play a crucial role in this transformation process. It's not only about being consumers, we have to educate people to become the most important investors. This could force the transformation of the capital market system...this would also be in my plot.”

Ottmar Eidenhoffer

“I believe we can seed processes that bring about emerging properties. I've never particularly liked great people or wonderful leaders. I don't think the world works like that. I see the world as a system and a system has properties that are much, much greater and more valuable and successful in delivering change than individuals. We have the internet,

we have mobile communications, we have many more freedoms than we had before in terms of time and in some respects, in terms of political structures. So I think we might see emergent properties ...the fact that we have accessed information that we didn't have before, that we are a globalised world where we may be more aware of things occurring elsewhere in the world so our immediate colleagues, family, friends, those we engage with, those with similar views, can be spread across the planet."

Kevin Anderson

Scenario 3: Visionary leadership and community mobilisation

A third pathway might be created through the kind of visionary leadership and community mobilisation that led to the achievement of women's rights and the overthrow of apartheid.

"How we got there is a collection of acts of leadership by leaders who emerged to seize the moment. Who just said 'no we cannot let our climate be so fundamentally changed. We can't afford what that's going to do... It will be business leaders leading their companies in different directions... supporting laws... calling for change. It'll be consumers demanding new products, it'll be companies providing new products, it'll be the media. It'll be people from all walks of life demonstrating true leadership, taking on the status quo, taking on a sense of negativism and 'it's too late-ness' and saying 'no we can't let this happen and we'll work together... As that awareness grows over the next five or 10 years, I'm convinced there will be a burst of leadership, spontaneous leadership from around the globe, around the sectors, who are just saying 'no we have to do something'. It won't be coordinated... it won't be controlled, it will just happen and it will happen if all of us in the next five years – get the word out."

Kevin Curtis

"In 2006 the timing was right [for passing the Californian Clear Air Act, AB32]. People understood the science, we had the right mix of politicians, we had a governor who was very energetic on the issue and all these things coalesced, to make that possible... You never know when that's going to happen - and that's where leadership really comes in. As soon as you see the opening you've got to strike; that's the challenge.

But even if you understand the science, it's still hard to connect yourself to the actual effects and so it's not surprising at all that people question our efforts to regulate in an area that might have an economic cost, when they don't see the actual impact of what we're doing. Or they'll say California alone is only a small percentage of the overall global emissions - why are we doing this - if not everybody else is... The primary response again is about leadership. That we are the incubator, that we're developing these programs so others can adopt them, and copy them. We can learn from them and they can learn from us. It really is an issue of ongoing and sustained leadership."

James Goldstene

"You need the kind of thing *Beyond Zero Emissions* are doing - creating a positive vision. You also need to stop projects. You need to actually empower people in all those communities across Australia who are being directly impacted by the massive expansion of fossil fuels and [gas] power plants. That will take community organising on a large scale. You have got to community-organise in support of a positive vision and to fight against the kind of negative business as usual thing."

Mark Ogge

"Looking back, we would see that there was a combination of institutional change and, social, cultural, political change that addressed this ephemeral fascination with markets and lack of faith in big infrastructure projects. People got inspired by this (post carbon transition challenge) and rallied behind it. They dropped their antipathy to big government projects and said, 'Hey, this will be an exciting and worthy adventure'. Or, we got there because people made it work at the local level. They were willing to undertake more changes at the neighbourhood, city and regional level. Either of those two require that people look at the world and how they live their life and how they view their interactions with government at all levels, differently than they do at this peculiar moment in our history."

Mark Delucchi

Scenario 4: Decisive action at a moment of climatic, political and economic crisis

It appears increasingly likely that it also will take a devastating series of crises on the scale of Hurricane Katrina and Hurricane Sandy to create the kind of 'Pearl Harbor' political tipping points in which visionary political leadership, community mobilisation, technological innovation and social creativity can be brought into the alignment needed to drive transformational change at the necessary scale

"The trigger is going to be some sort of natural disaster that wakes people up ...we're already seeing that happening, in that we're probably locked into irreversible change in the Arctic with the disappearance of the sea-ice. Before long the community will wake up to what is occurring and demand action, along the lines that: 'We have been looking at the problem for 30 year and done virtually nothing. Now we have to really start moving'. The pressure will then come on the business and political worlds for real action."

Ian Dunlop

"Most of us don't like to change. I don't like to change and I'll go to great lengths to avoid changing sometimes but you reach these tipping points and then everything changes. The United States before World War Two, if you'd conducted a poll on December 6th 1941, the day before the Japanese attacked Pearl Harbour, and said, 'Should we go to war?' probably 90% would have said, 'No, we don't want to get involved in another world war. If you'd conducted that poll on Monday, December 8th, probably 90% would have said, 'Yes, we've got to go,' and so it was just one event, that surprise attack. It was very successful from a military point of view on Pearl Harbour. I mean, the Japanese sunk half our Pacific fleet there in just one fell swoop but everything changed and we mobilised, we totally restructured the US industrial economy, not in decades, not in years but in a matter of months. Part of the key to that was banning the sale of automobiles."

Lester Brown

We started with this parallel narrative and we got lots of people interested in it. Perhaps it was a novel ...or a play...subsequently made into a film... and everybody said, 'Well, gosh, that's very credible.' It portrayed a very interesting possible future and it got people talking about it. They defended themselves against its real challenge by saying, 'Oh, that's just literature, you know, just a fantasy, so we can look at it just like we look at any other film.' Then, gradually, people talked about it and thought, "Oh, that's not so bad, in fact it's quite nice. Could it actually be realistic?"

Meanwhile, on the basis of that, the government encouraged a lot of research on all the things that we would need to do, as a kind of insurance policy... Once the scientific

community latched on to this, they started demanding more. 'We can see perfectly clearly there's a problem here and we think we can come up with lots of solutions. Give us the tools and we'll do it'. So it was more like - I hesitate to say the Manhattan Project - but something like that, on a world scale. Others have called it the 'Apollo-Gaia Project'.

At first the rest of the population carried on its merry way but then there was some kind of 'enabling event' that crystallised everyone's awareness that the situation was now different and demanded urgent, radical... actions. It probably needs some kind of exogenous event, like a piece of the Greenland icecap breaks off causing devastating tsunamis in the Atlantic. After such an event the long forgotten parallel narrative kicks in: everybody is prepared, psychologically primed. At that point you could have very rapid change..."

Peter Harper

I'll give you [several] reasons why the fairytale might come true. One is, very sadly, that a few disasters will happen. Hurricane Katrina changed a lot in America. Nobody, in particular not climate scientists, hope that disasters generate these type of dynamics, but invariably it will happen in the next decades and it will get worse... The second thing is leadership. What Merkel did with the German experiment is happening because Merkel had the guts really to say she was wrong. This type of leadership will be necessary, maybe in China, maybe in the United States, maybe in Australia even... The third thing is social innovation. For example I just went to a region in Germany where people say 'We want to have energy supply completely done on a communitarian basis. We the citizens will buy the power plants. We will buy the networks and the grids. We will do it.'

"The fourth thing, my wildcard, if you like, that could best overcome what I call the fossil nuclear complex, could be the fossil protagonists themselves. In a week from now we will receive a delegation from Qatar including many influential people. For OPEC countries there are two ways. They can say, yes we have another 50 years of oil, and we can and will live wonderfully of that. After that we will all move to Switzerland. That is one plot. But the alternative option could be: Shouldn't we use our wonderful capital which is precisely coming from oil, and gas, in order to - in a role-modelling way - transform ourselves into a sustainable society."

"That's precisely what the people in Qatar will tell you if you ask them. They say, yes we know. We can live happily for the next three or four decades which is when we will buy our properties in California, Monaco or London. Then we will sort of dissolve as a society. But there are some other people who say, I would like to see us around also in hundred years from now, and we have the means for doing it. We have the capital, we can buy all types of technology, we have the sun, we have the wind, we have everything you need. If one or two major OPEC countries launched a big transformation, a Great Transformation, on their own ground, then this would send a very strong signal to the world. So it would be the, if you like, the stalwarts of the fossil system who would overcome it themselves. This is a really strong story and that would be my favourite plot."

John SchellInhuber

5. The climate change elevator pitch

The final question we asked in these interviews was this: “What elevator pitch would you make to people in key global and national decision making positions in order to convince them of the need to take decisive action to address climate change?” Here are some of the responses.

“You’ve got to regard this as an insurance policy. Think about it in those terms. You’ve got potentially huge costs of damage, 2050 and beyond. We can’t say exactly what that’s going to be and there is a lot of uncertainty there but potentially very high costs, and a relatively small premium in costs that you need to be paying now in order to reduce those risks and that really does make good economic sense to be trying to protect yourselves from the potential worst excesses of climate damage if we don’t take rapid action.”

Adrian Gault

“I would say what I said to my old, old friend who lives outside of Sydney who is a very intelligent man, a lawyer, who’s been a sceptic, who’s a little less sceptical this time than he was two years ago when I saw him before. He’s saying ‘yeah, well it might be true, but we’ve got a hundred or two hundred years don’t we? I’m not going to worry about that.’ And I said to him ‘Go away and spend a day reading about this first from credible sources, educate yourself, read up, just spend a day or even half a day and then when you’ve done that, come back and let’s talk because I can’t talk to you like this now. It’s not going to be me that changes your mind. It’s got to come from them. And they’ve got to start out by listening with an open mind and believing that...you know what? The world might actually be round after all? And so what are we going to do about that? How is that going to affect our businesses, our future? So educate yourself.”

Jenny Clad

“I would tell them to speak the truth. Speak the truth about the severity of the climate crisis; speak the truth about the need to build political will and public education. Speak the truth about the fact that it’s solvable, once we get the political will and truly lead on this issue; not see it as a political problem, but truly see it as a massive problem and a massive opportunity. Again, to speak truth to the American people; speak truth to their staff and commit to solving it. That’s what I would say.”

Kevin Curtis

“I would first assume that they understand the issues, so I wouldn’t have to recap the science or the environmental need for action. I would focus on the importance and the challenge and difficulty of leadership, even when it’s hard; that they need to embrace this kind of transformative change which is something that would be reflected in their legacy - long after they’re out of office.”

James Goldstene

“I believe very strongly that we right now have the knowledge and the technical skill to make the world as much of a paradise and to improve human welfare and mitigate suffering and misery in the world as we need. I believe very strongly that we can do that and that the obstacles to us doing that are social, political, cultural and religious, which means that if we can get our head together on it, it would make an enormous difference in the welfare of people on this planet. I very strongly believe that. These are not technological and fundamental economic resource use problems and if we can convince people to focus on what matters – just the welfare of people, especially the welfare of people who are worst off – and to be excited about that, and to claim that as our vision, we can change the world. I actually believe that.”

Mark Delucchi

“Be honest about the climate and sustainability challenge we really face. Once you cross that threshold, then the solutions fall into place. It is very easy to become pessimistic about the changes we are talking about, and whether they can be achieved in the limited time required. We do, as a species, tend to leave things until the last possible minute, particularly major changes of the kind ahead. But on the positive side, having woken up and accepted the need for change, we are capable of moving extremely fast. The low-carbon world we are entering does not mean our quality of life deteriorates; on the contrary it will continue to improve if we are proactive about change. Certainly we have to re-think our values and consumption patterns, but we have to do that anyway as our current way-of-life is not sustainable. What the climate challenge has given us is the great opportunity to establish a genuinely sustainable world. It now needs the community to develop the pressure to make it happen.”

Ian Dunlop

6. Conclusion: Towards a just and resilient post carbon future

The rapidly approaching 'perfect storm' of climatic and ecological tipping points, deeply entrenched inequalities of power and resources and the remarkable capacity for human beings to demonstrate short sightedness and self delusion provides strong ammunition for those who regard the goal of avoiding runaway climate change as an impossibility. An honest assessment of the size and scale of the political obstacles standing in the way of an adequate and timely response to the climate crisis is certainly an essential guard against wishful thinking.

However while his role in formulating and driving the neo-liberal economic agenda makes his advice deeply ironic, Milton Friedman also provides us with a valuable reminder of the powerful role ideas can play in driving transformational change, particularly at moments of economic, social and ecological crisis.

"Only a crisis—actual or perceived—produces real change. When the crisis occurs, the actions that are taken depend on the ideas that are lying around. That, I believe, is our basic function: to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes politically inevitable."³⁷

Our hope therefore is that the ideas, experience and insights brought together in this report can make a useful contribution to well informed and decisive action at the point at which the transformation to a just and resilient post carbon future makes the leap from political impossibility to political inevitability.

In reflecting on research and policy priorities which will be important in achieving this goal we would like to suggest the following:

1. Which emissions reduction targets, trajectories and pathways are required to maximise the probability of avoiding catastrophic climate change?
2. Which combinations of technological and policy innovations and interventions have the greatest potential to achieve these emissions reductions targets?
3. What are the most promising and effective strategies for overcoming the key political and social barriers preventing rapid implementation post carbon economy transition strategies? This includes, in particular strategies capable of overcoming the following barriers.
 - Denial of the necessity and urgency of action
 - Power and influence of the fossil fuel industry and its allies
 - Political paralysis, short termism and 'moral corruption'
 - The dominant economic paradigm of unconstrained and unsustainable consumption
 - Technological, social and economic path dependencies and lock-ins
 - Financial and resource inequities and constraints
 - Governance and capability limitations
4. At a broader level, which actions are most likely to accelerate the political tipping points capable of triggering and driving the technological, social and economic transformations needed to avoid catastrophic climate change?

³⁷ Milton Friedman, cited in Naomi Klein, *Shock Doctrine*, Metropolitan Books, NY, 2007, p. 7

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