Climate Conflict:

Players and Tactics in the Greenhouse Game

A thesis submitted in fulfilment of the requirements

for the award of the degree

DOCTOR OF PHILOSOPHY

From

UNIVERSITY OF WOLLONGONG

By

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Bachelor of Arts (Honours)

University of Wollongong 2007

SCHOOL OF SOCIAL SCIENCES, MEDIA AND COMMUNICATION

2011

Certification

I, Patrick Richard Hodder, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy in the School of Social Sciences, Media and Communication, University of Wollongong, is wholly my own work, unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

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Patrick Richard Hodder

14 June 2011

Publications in support of this thesis

Hodder, PR, ‘Australian climate change politics under the Howard and Rudd governments’, Revised and resubmitted.

Hodder, PR, ‘Credibility games: climate change critics in the Australian quality press’, submitted for review.

Hodder, PR 2010, ‘Lobby groups and front groups: Industry tactics in the climate change debate’, *Melbourne Journal of Politics*, vol. 34, pp. 45-81.

Hodder, PR 2009, ‘The hidden dangers of an emissions trading scheme’, *Social Alternatives*, vol. 28, no. 4, pp. 49-53.

Hodder, PR and Martin, B 2009, ‘Climate Crisis? The politics of emergency framing’, *Economic and Political Weekly*, vol. 44, no. 36, pp. 53-60.

Hodder, PR 2008, ‘Carbon pollution: Reduction scheme or soft option?’, *Australian Review of Public Affairs*, available online, http://www.australianreview.net/digest/2008/09/hodder.html

Text from the first four papers and ideas from all six are used in this thesis.

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Abbreviations

AAC	Australian Aluminium Council
ABARE	Australian Bureau of Agricultural and Resource Economics
ABC	Australian Broadcasting Corporation
ABS	Australian Bureau of Statistics
ACA	Australian Coal Association
ACSC	Australian Climate Science Coalition
ACT	Australian Capital Territory
AEF	Australian Environment Foundation
AGO	Australian Greenhouse Office
AIGN	Australian Industry Greenhouse Network
APEC SC	Australian Asia-Pacific Economic Cooperation Study Centre
AP6	Asia-Pacific Partnership on Clean Development and Climate
AR4	Fourth Assessment Report
ASIC	Australian Securities and Investment Commission
ASPO	Association for the Study of Peak Oil and Gas
BBC	British Broadcasting Corporation
BCA	Business Council of Australia
BHP	Broken Hill Proprietary Company
BP	British Petroleum
CCS	Carbon Dioxide Capture and Storage
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
CPRS	Carbon Pollution Reduction Scheme
CRU	Climate Research Unit

CSIRO	Commonwealth Scientific and Industrial Research Organisation
EPS	Emissions Performance Standards
ETS	Emissions Trading Scheme
EU	European Union
GCP	Greenhouse Challenge Program
GDP	Gross Domestic Product
GISS	Goddard Institute of Space Studies
IEA	International Energy Agency
IPA	Institute of Public Affairs
IPCC	Intergovernmental Panel on Climate Change
LIA	Little Ice Age
MCA	Minerals Council of Australia
MRET	Mandatory Renewable Energy Target
MWh	Megawatt hour
MWP	Medieval Warm Period
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NGO	Non-government organisation
NOAA	National Oceanic and Atmospheric Administration
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
PCA	Principal Components Analysis
ppb	parts per billion

ppm	parts per million
PV	photovoltaic
RBA	Reserve Bank of Australia
RET	Renewable Energy Target
SAR	Second Assessment Report
TAR	Third Assessment Report
UCAR	University Corporation for Atmospheric Research
UEA	University of East Anglia
UN	United Nations
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UK	United Kingdom
US	United States
WMC	Western Mining Corporation
WMO	World Meteorological Organisation

Abstract

Climate change is bitterly controversial in public and political debate despite mainstream scientific consensus on its causes and consequences. Through a series of case studies I examine the strategies and tactics of three key players – government, industry, and scientists. I develop a framework adapted from Brian Martin's backfire model of outrage management to classify and compare the tactics of these groups. Applying a framework of tactics to the climate change debate gives insight into a pattern of techniques used by the protagonists.

Governments and industry are powerful players with access to a wide range of tactics. The Australian government led by John Howard relied mainly on denial, devaluation, deception, minimisation, framing, pressure, and some aspects of cover-up to manage its agenda. In comparison, Prime Minister Rudd's principal tactic was a sophisticated use of official channels to convey the impression his government was taking serious action on climate change. Australian industry has resourced a lobby group and a front group to exert a complementary strategic influence on both formal and public agendas. The lobby group used cover-up, reframing, participation in official channels, pressure, and political donations. The front group engaged in devaluation of scientists, deception, and denial of climate change. Sceptical commentators in the Australian print media are treated as a facet of the industry campaign. They used mainly rhetorical techniques including devaluation, reinterpretation, and reframing. Scientists are more restricted in their tactical repertoire and relied heavily on the legitimacy and authority of official channels. In the 'hockey stick' dispute between scientists and their critics where the resources of both sides are relatively evenly balanced, the response of observers indicates that perceptions of scientific conduct are crucial to the outcomes of the dispute. On a practical level, my analysis may enable participants to evaluate the potential choices and risks of various tactics in a strategic engagement.

Acknowledgements

There are many people who deserve thanks for helping me complete this thesis.

Firstly to my supervisor, Brian Martin, for his weekly phone calls, his experience, his insight and advice, and for encouraging me to submit my work as journal articles over the course of the PhD. It is hard to place a value on the regular contact that Brian maintains with his research students.

To my secondary supervisor, Sharon Beder, many thanks for your critical insight and help in tightening the thesis up.

Thanks are also due to those who commented on sections of this thesis, either in journal or thesis form: Hugh Saddler, Mark Diesendorf, Guy Pearse, Adam Lucas, Jody Warren, Mary Scott, Kerryn Hopkins, Brendan Riddick, Ian Miles and Richard Gosden and anyone I have inadvertently forgotten. Thanks also to Clay Thistleton for reading the entire manuscript.

I have been a student and PhD candidate at the Bega Campus of Wollongong NSW. I express my gratitude to Chris Dwyer, manager of the Bega Campus, for her ongoing support – Chris, you've been a huge help. To Chris Brennan-Horley who has shared a small office with me these past three years: thanks for your company Chris, and your help with teaching me all the technical stuff needed to pull a document together. And thanks to all my colleagues and students at the Campus for the sharing and shaping of ideas in a cooperative learning environment.

Finally and most importantly, thank-you to my family: Tina for her enduring patience and support, and to my children, Sam, Luka, Ruby and Rosa.

Introduction

Climate change is bitterly controversial in public and political debate despite mainstream scientific consensus on its causes and consequences. The stakes are high. Fossil fuels underpin almost all modern economic development and the corporations that produce and use them are economically and politically powerful. At the same time, according to the mainstream scientific consensus expressed in the assessment reports of the Intergovernmental Panel on Climate Change (IPCC 2007b, pp. 18-21), the consequences for humanity of unmitigated climate change are grave and the timeframe for action to avoid the worst consequences is very short. Yet some industry groups and certain sections of the media have downplayed the seriousness of the consequences, presented climate change as a contentious issue plagued by scientific uncertainty, and predicted that economic and social disaster will result from attempts to reduce emissions. With such high stakes, and with governments, industry and the wider business community, trade unions, scientific institutions, environmental nongovernment organisations (NGOs) and citizen groups all involved, the conflict is irredeemably political. Various aspects of power are at play including existing social, cultural, economic and political structures, the resources available to key players, and the strategies and tactics used by the protagonists.

This thesis looks at power and politics in the struggle over climate change through the prism of strategy, and specifically tactics. I do this by conceptualizing the climate change debate as a strategic conflict between on the one side, a fossil fuel industry alliance comprising lobby groups, industry-resourced think tanks and front groups, a few dissident scientists, and various media columnists associated with a network of corporate-funded free market think tanks, and on the other side, the majority of scientists, their professional organisations and institutions, and a range of environmental organisations. I draw on a framework of tactics that enables me to analyse and compare tactics across three case studies: industry and their allies (including media climate sceptics), governments, and scientists and their institutions. By focussing on tactics, I aim to clarify what has occurred in the climate change debate. Furthermore, my analysis shows that strategies and tactics matter to the outcomes of the debate, suggesting that tactics are a worthy topic for further research in the social sciences.

My focus on strategies and tactics implies attention to issues of agency and choice: what strategy do the players pursue, and what tactics do they employ? What are the ramifications and risks of a particular choice: what did a player gain/lose and their opponent/s gain/lose? What arenas do players engage in, and which do they avoid? Are some methods of engagement common to all the players, while other techniques are restricted to players with access to particular resources or to participants in particular arenas? What alliances are formed, and how might this enable the alliance to participate in more arenas? How do players conceal their actions and/or motivations?

However, strategy and tactics do not operate independent of structural considerations because access to resources such as money, infrastructure, and institutional and cultural authority can enhance or constrain tactics. For example, a well-resourced group may deploy a range of tactics across several arenas as a means of maintaining or strengthening a dominant position, while another group may have a very good understanding of tactics, but lack the resources to be able to implement many of them. Nevertheless, tactical choices are not necessarily determined by resources, and outcomes are not solely determined by structures. For example, in layman's terms, we sometimes say of a dispute that someone or some group 'was thin-skinned and over-reactive', 'shot themselves in the foot', or 'handed their opponent ammunition'. These comments refer to tactics (in this case a poor choice of tactics), but do not presuppose either access to resources or a lack of resources. People or groups with access to resources may make poor choices and people or groups in weaker positions may make good choices. These are important points, because as I demonstrate in chapters six and seven, players with access to institutional resources may undermine their own position with poor strategic choices and may provide opponents with the opportunity to exploit a chink in their armour.

Power has been defined in various (and contested) ways in the social sciences, often generalised as the ability to get others to act or behave against their interests or will, both consciously and unconsciously. But how does this occur? In *Getting Your Way: Strategic Dilemmas in the Real World* by James Jasper (2006, p. 9) argues that in defeating our opponents, we 'trick, cajole, bribe and cut off their alternatives'. Jasper further proposes that 'most of what we call power is successful strategic action'. Jasper's notion of power as

resources plus successful strategic action captures the notion of agency, but it underplays structural factors such as the bias of the system and what Marxists may refer to as hegemony. Indeed, as Stephen Lukes (2005, pp. 25-28) argues, structural factors may at times preclude the need for a dominant player to actively engage in visible action because the system helps shape citizen desires to a degree that secures compliance.

There are several relevant traditions that could be used for studying the climate change debate. I draw on various disciplines within the social sciences, primarily sociology and political science. Much of the sociological and political science literature on power provides theories, frameworks and concepts for studying resources and power structures, and how groups use power. The social sciences including the sociology of science provide several different conceptual approaches to exploring scientific controversies and their socio-political dimensions. However, very few of these theories or conceptual approaches say anything specific about how groups use tactics within the context of a strategic engagement, and none attempt to systematically analyse and compare tactics across a range of groups (as opposed to two opposing protagonists) within a particular issue or controversy.

Drawing on developments in the social sciences over the last few decades, I argue that dominance (or stalemate) in a debate or conflict cannot be adequately explained solely by reference to structures and resources. Structures, resources and agency all have a bearing on the outcomes of a conflict, yet a comparative analysis of the tactics used by a range of groups, situated within the context of (potentially shifting) power structures and resources, seems to be a somewhat neglected approach within the social sciences. My approach indicates some of the links between structures, resources and tactics, highlights particular patterns of engagement, and shows that seemingly disparate activities conducted by various groups can be usefully illuminated by studying the conflict as a strategic engagement, even when all the elements of a strategy may not be consciously planned or centrally co-ordinated. Furthermore, by providing insights into the conflict, the thesis may also enable participants to (re)assess their options in the debate.

The rest of the introduction is structured as follows. I begin the next section by assessing various concepts of power and power structures and their relevance to this thesis. This is followed by a brief discussion of media studies including the sociology of sources and source

strategies. I then consider social constructivism, particularly as it has been applied to the sociology of science, including criticisms, particularly those emanating from environmental sociology. I also explain why post-structural and postmodern approaches are inappropriate for this thesis, and justify my approach to truth and fiction. I then cover some of the contemporary approaches to climate change. Next I discuss the backfire model of outrage management and explain why I chose it as the basis for a tactical framework. I discuss the strengths and limitations of the model and the adaptations that I have made. This is followed by my methodology and a brief overview of the thesis structure.

Concepts of Power

Power and its role in politics have been at the centre of a long-running debate sparked by two sociological books that analysed ruling power elites: *Community Power Structure* by Floyd Hunter (1953) and *The Power Elite* by C. Wright Mills (1959). Hunter (1953, p. 113) argued that at the city-level, the top echelons of the business community dominated the power structure and the policy-making process. Mills (1959, pp. 3-4) found a distinct division in America between a powerless majority and a decision-making elite that occupied positions of power at the head of corporations, the state and the military. William Domhoff (1967, pp. 9-10; see also Domhoff 2009) found that the power elite were the leaders of a disproportionately wealthy governing or upper class that controlled the institutions of power. More recently, Leslie Sklair (2000, p. 7) has focussed on the transnational imperatives of modern shareholder-driven capital accumulation. Sklair (2000, pp. 4, 69-70) locates the 'global power élite' in what he terms an interlocking transnational capitalist class consisting of the 'owners and controllers of transnational corporations', 'globalising bureaucrats ... politicians and professionals', and 'consumerist élites' such as 'merchants and media'.

The ruling elite conception of power was challenged from the outset by a group of political scientists, in particular Robert Dahl and colleagues from Yale University including Nelson Polsby and Raymond Wolfinger. Dahl (1958, p. 466) argued that the claims were unscientific and ill-defined. The pluralist methodology was positivistic: as Richard Merelman (1968, p. 451) pointed out, the pluralists 'studied actual behaviour, stressed operational definitions, and turned up evidence ... [that] ... seemed to produce reliable conclusions that met the canons of science'.

The main preoccupation of Dahl and his colleagues was the scientific study of the decision-making process because this would allow the exercise of power to be measured. Dahl equated power with actions and gauged the outcomes by determining who had prevailed and who had lost on specific issues. Dahl (1961), Polsby (1963) and Wolfinger (1973) found scant empirical evidence in their studies for the existence of a ruling elite. Instead, they found that power was distributed relatively evenly amongst different actors and that different groups prevailed on different issues. Accordingly, Dahl and his associates argued for a conception of community power where power is distributed pluralistically between various groups.

The pluralist notion of power was criticised by Peter Bachrach and Morton Baratz (1962, 1963) as too narrow. They argued that power had a second face that was essentially undetectable by the methods chosen by the pluralists. Bachrach and Baratz argued that the ability to make decisions was in fact less important than the ability to prevent decisions being taken on particular issues and the ability to redirect decision-making towards a limited range of less contentious issues. Bachrach and Baratz (1962, 1963) called this manipulation of political institutions and processes ‘nondecision-making’. This crucially important ability to set the political agenda and exclude key potential issues was, by definition, unobservable with the pluralist’s sole focus on decision-making itself.

Nevertheless, nondecisions themselves are rarely investigated precisely because they are difficult to observe empirically. One exception was *The Un-Politics of Air Pollution: A Study of Non-Decisionmaking in the Cities* by Matthew Crenson (1971). Crenson (1971) compared East Chicago and Gary, two similar and equally polluted American cities on Lake Michigan. East Chicago took action on its air pollution in 1949, but Gary did nothing until 1962. Crenson (1971) provides evidence that the economic power of US Steel rendered air pollution a non-issue in Gary. The reputation of corporate power and the dependence on jobs and wealth provided by the corporation was enough to influence the city government to avoid the issue, and when eventually it was addressed, US Steel indirectly influenced the pollution ordinance (Crenson 1971, pp. 69-70, 124). During this time, US Steel ‘seldom intervened directly’ in the political arena (Crenson 1971, p. 107): in effect, its inactivity and ‘the reputation for power may have been more important than its exercise’ (Crenson 1971, p. 25). As Crenson (1971, p. 179) recognised, even if a community acts openly and competitively in

its decision-making, it may be non-pluralistic and 'unified in its non-decision-making' to the extent that certain issues are excluded from political life.

Lukes (2005, pp. 20-21, 25-28) accepts the critique that the pluralist methodology reproduces the bias of the system, but contends that Bachrach and Baratz are still too tied to the notion of observable conflict in assuming that nondecision-making can only be claimed in those instances where conflict is observed, and assuming that consensus is genuine if seeming acquiescence occurs. Lukes (2005, pp. 25-27) points out that ingrained social structures and cultural patterns may reproduce the bias of the system and that powerful interests may be able to shape community values and desires in order to prevent conflict from surfacing. In other words, Lukes argues that the two-dimensional view of power espoused by Bachrach and Baratz fails to examine how hegemony may operate in suppressing latent conflicts within society.

Lukes (2005, pp. 27-28) therefore makes a case for a three dimensional view of power where the third dimension includes the ways in which perceptions and interests are manipulated so that potential grievances are kept out of the political arena and conflict is avoided. Elements of the three dimensions of power may be discerned in the climate change debate. Although the dimensions overlap, three simplified examples are given here to illustrate some of the elements of power. Firstly, instances where one group has secured the result it wanted on the decision-making agenda would equate to the first dimension exercise of power. Secondly, where critics allege that the fossil fuel lobby influenced decision-makers to the extent that key elements of climate change policy did not make it onto the decision-making agenda (covered in chapter four on government), elements of the second dimension of power may have been in play. Thirdly, the current idea that the profitable exploitation of fossil fuels should take precedence over the wider interests of humanity and the sustainability of human civilisation suggests aspects of the third dimension of power, particularly when this belief is dominant and accepted by the majority as legitimate and common sense.

Media Studies

The debate sketched out in the preceding paragraphs between liberal pluralists and radical sociologists is reflected in debates over the functioning of the media. Aeron Davis (2002, p.

5) notes that liberal pluralist journalism scholars emphasise journalistic autonomy, professional values, and objectivity, and view the media ‘as independent “fourth estate” guardians acting in the public interest’. Dwayne Winseck (2011, p.16) observes that neoclassical studies in particular fuse ideas about free speech and competitive markets into the notion of a ‘“marketplace of ideas”’ whereby the media’s role in informing citizens about a range of issues underpins a functioning democracy. By contrast, radical media sociologists argue that media independence has been compromised because state and corporate elites have an undue influence on the news process, achieved via concentrated ownership patterns, ideology, and the impact of economic factors such as advertising (Davis 2002, p. 5; McChesney 2008 in Winseck 2011, p. 22).

Although Winseck identifies four broad political economy[1] approaches to the media (rather than just two, pluralist and radical), he (2011, p. 11) observes that:

> all approaches to the political economy of the media take it as axiomatic that the media industries — the structure of the markets they operate in, their patterns of ownership, the strategies of key players, trajectory of development, and so on — are important objects of study.

However, Davis (2002, p. 6) argues that radical media sociologists (as opposed to pluralist scholars) have traditionally been overly focused on the macro level structural and ideological forces that shape media content such as ownership and advertising, and have paid little attention to micro-level influences and individual agency. Recent attempts to chart new directions for critical media studies include Davis (2007, p. 10) who describes his approach as an ‘inverted political economy’ that examines the sites of elite influence and the practices of powerful media sources.

Source studies represent a strand within the sociology of journalism that has developed a sociology of the strategies adopted by sources in their interactions with media (Miller and Dinan 2000). The sociology of sources draws on ideas advanced by Pierre Bourdieu in his discussion of the sociology of science. Bourdieu (1975) developed a schema of strategies pursued by dominant actors within the scientific field and those pursued by new entrants.

[1] neoclassical (conservative and liberal), radical (monopoly capital and digital capitalism), Schumpeterian institutional, and cultural industries (Winseck 2011, p.3).

These strategies both reflect the structure of the field and serve to transform that structure. In other words, the dominant definition is not solely determined by the structure of the scientific field, but rather involves the mobilisation of resources by players with structurally unequal access to resources and capital (Bourdieu 1975, pp. 27-30). Applying these concepts to the media, Philip Schlesinger (1990, p. 79, emphasis original) argues that the strategies and tactics adopted by various sources in the struggle over media definitions therefore contribute to definitional outcomes, rather than media definitions being '*a wholly structurally predetermined outcome*'.

The sociology of sources therefore challenged a previously dominant argument in media studies put forward by Stuart Hall et al (1978), namely that powerful organisations such as the state functioned as primary issue definers with guaranteed privileged access to the media, and that the media reproduced those primary definitions. Critics such as Schlesinger (1990) and David Miller (1993) have argued that an overly structuralist account neglects the dynamic ability of various groups and individuals to contest and negotiate issues, and have pointed out that divisions within powerful organisations often mitigate against a unified definition of an issue. In particular, Schlesinger (1990, p. 77) argues that:

> Competition for access to the media takes place, but in which material and symbolic advantages are unequally distributed. But the most advantaged do not secure a primary definition in virtue of their positions alone. Rather, if they do so, it is because of successful strategic action in an imperfectly competitive field.

My approach to the activities of government, industry (including the media climate sceptics) and scientists sits within this notion of competitive strategic action within a structurally unequal playing field.

Social construction and the sociology of science

Social construction has been a prevalent approach in the social sciences since the term was introduced by Peter Berger and Thomas Luckman (1966) in their book about the sociology of knowledge, *The Social Construction of Reality*. Although Berger and Luckman accepted the existence of an empirical reality, they argued that knowledge and meaning are created socially and become embedded in the culture of society as shared meanings. These ideas

were further developed by Malcolm Spector and John Kitsuse (1987) in their book *Constructing Social Problems*. Spector and Kitsuse argued that social problems do not just exist, but that they are constructed by the claims-making activities of individuals and groups with the aim of having one particular set of claims or construction accepted as definitive.

This notion of social constructivism has been widely adopted by sociologists studying claims made in the areas of science and technology. This relativist approach, often described as the Sociology of Scientific Knowledge (SSK), has been exemplified in the Empirical Program of Relativism (Collins) and the Strong Program in Science and Technology Studies (Bloor and Barnes). It has been applied primarily to the content of scientific controversies and has subjected both sides in the dispute to a symmetrical conceptual analysis (Bloor 1976, p. 7; Pinch 1986, p. 3; Martin and Richards 1995, p. 513). The SSK approach is epitomised by the work of Harry Collins (1975, 1981, 1985), David Bloor (1976), Barry Barnes (1974, 1977, 1982), Michael Mulkay (1979), Andrew Pickering (1984) and Trevor Pinch (1986). A central claim of SSK researchers is that scientific knowledge is socially constructed. Constructionist claims about the fallibility of experiments and the role of scientific judgement in determining knowledge (e.g. Pickering 1984, pp. 5-6) contradict the traditional positivist conception of science which is based on the notion of an empirical reality where the facts are discovered by disinterested scientific researchers, and where those facts and interpretations can be tested by objective scientific experiments, and where the sociology of error is reserved solely for the side opposing the scientific consensus. Whereas the traditional positivist approach conceived of truth as residing in nature waiting to be discovered by science, SSK scholars argue that truth and falsity derive from ‘the interpretations, actions, and practices of scientists’ (Martin and Richards 1995, p. 513). Beyond this, Barnes (1977) and Donald MacKenzie (1978) developed the idea that interests were a primary factor in the development of knowledge, and that differences in theoretical explanantions were sometimes best accounted for by differences in the social interests of the disputing protagonists.

More recently, Steven Yearley has provided examples of how scientists and social scientists have constructed climate change science and climate change economics. Yearley (2008, 2009) draws specific attention to several issues including the various climate modelling communities and the different assumptions that they make and the literally different ways

that they construct their models, the inverted notion of peer review practiced by the IPCC[2], the IPCC use of negotiated expert judgement in the summary for policymakers, and the contested economic valuations placed on human life.

The application of social constructivism to scientific knowledge opens up the social factors that intervene between scientific endeavour and nature to sociological analysis, and subjects commonly accepted scientific claims to scrutiny. Indeed, I use elements of this conceptual approach including an analysis of scientific claims and a broadly symmetrical approach in my analysis of the conflict between scientists and their critics. However, I do so with an awareness of the limitations of relativism.

To begin with, an SSK approach requires neutrality and avoids judgement. By contrast, I use constructivism strategically. For policy purposes, I accept that the majority scientific opinion on climate change is most probably correct, but for the purposes of analysis, I treat scientific knowledge claims as tactical moves. Unlike postmodernists and perhaps some adherents of social constructivism, I maintain that there is some degree of objective reality and truth in science (as well as accepting that science is modified by social constructs and the influence of social interests). Clearly from a relativist perspective I could stand accused of partisanship. However, not to take a position on a debate of such importance for public policy (as opposed to a controversy restricted primarily to the scientific realm with little immediate public import such as some theoretical aspect of nuclear physics) would seem to be an abdication of moral responsibility. I am interested in the truth or falsity of the climate science claims made by both sides precisely because they do have a direct and significant bearing on human well-being. My interest in the outcomes therefore helps drive my analysis. As a result, I make a distinction between 'real' science and the strategic uses of science, not just by scientists themselves, but also by other players such as industry front groups, environmental NGOs, and governments.

Related to these points about the intersections of science and public policy and the intervention of various interests, Yearley (2005, p. 164) points out that one of the key

[2] Traditional peer review involves a single (or small number of) authors and a much larger pool of potential reviewers. Yearley argues that the IPCC reports invert this rule with a large number of authors and a small pool of potential reviewers.

findings of the Empirical Program of Relativism and the Strong Program in social constructivism is that:

> agreement in science results from people deciding not to contest any longer, rather than from the debate having arrived at a point at which no further disagreement is logically possible.

Yet in the climate change debate, despite closure having occurred within the climate science community itself, public and political debate still rages as the impartiality of the science has been challenged by various groups outside the scientific realm. This suggests that a narrowly construed and impartial focus on social construction within the scientific community risks firstly, undermining the majority scientific position by relegating it to the status of just another truth claim, and secondly eclipsing recognition that powerful vested corporate interests have both the incentive and the power to deploy a range of techniques to create controversy and preclude closure in the public debate.

Furthermore, the way that a problem is constructed is but one of a range of techniques that could be employed to gain advantage in a controversy. Consequently, I move beyond a broadly social constructivist preoccupation with how the climate change debate is constructed (or framed) and analyse a range of other tactics that are present in the struggle including cover-up, devaluation, official channels, and forms of coercion and bribery.

Another limitation has been a tendency within sociology, both in its classical origins and amongst proponents of strong social constructivism, to exclude nature altogether and focus entirely upon the social (Buttell et al 2002, pp. 4-5, 24; Catton and Dunlap 1978; Murphy 1994, 1995). Environmental sociologists William Catton and Riley Dunlap (1978) developed the term 'human exemptionalism' to characterise the prevailing (optimistic) sociological wisdom that humanity is somehow exempt from the ecological constraints that apply to other species. Given that the current human-induced increase in concentrations of atmospheric greenhouse gases appears to present a compelling example of the existence of natural limits in the form of potential feedbacks and detrimental impacts on the human world[3], any approach to the struggle over climate change that focuses exclusively on the social

[3] See Chapter 1.

constructedness of scientific endeavour and neglects webs of cause and effect between the natural and human worlds is inherently partial.

Finally, there needs to be an understanding of how social contructivism can cut both ways. By undermining the received authority of science, relativism and social constructivism in science has also opened up a space for deliberations about the extent of legitimate lay expertise and public participation in science, and the role of citizen judgement about the use of scientific knowledge (Collins and Evans 2002; Evans and Collins 2008; Wynne 1992, 1996; Yearley 1999). Alan Irwin (1995) and Brian Wynne (1996) provide examples where lay expertise and citizen knowledge and judgements either overlap, complement, sceptically assess, or contradict scientific expertise. The examples provided by Alan Irwin (chemicals/pesticides) and Wynne (nuclear power and nuclear fallout) may be seen as instances where scientific authority (potentially mobilised to serve particular industry interests) has been challenged by lay experts and citizens. These examples suggest potentially beneficial public outcomes may be derived from a critical approach to scientific expertise and authority, and the democratisation of science. However, an uncritically relativist approach may open up an under-examined space for advocates allied with particular vested corporate and/or ideological interests to enter the climate change debate under the cloak of citizen-expert legitimacy.

It should be clear from my interest in resources and strategy and the above discussion about relativism and social construction that post-structural and postmodern theories are unsuited to this thesis. As critics such as Greg Philo and David Miller (2000, p. 836) have noted, postmodernism rejects any grand narrative, mistrusts scientific rationality, celebrates the collapse of meaning, and is content to view the world as a sea of competing discourses. By contrast, this thesis holds to the notion that rational inquiry by scientists and social scientists can lead to valid understandings of the natural and social world, and that critiques of society may lead to better outcomes in the future. Furthermore, the interplay of ideology and interests is at the core of this thesis, particularly the power of transnational fossil fuel corporations and the implicit and explicit support they receive from government. Certainly there have been transformations in the structures of capitalism, but the growth of transnational corporations, the marketisation of society, and the ongoing spread of transnational consumer capitalism do

not seem to indicate the absence or weakening of defining power structures. On the contrary, as Domhoff (2009) has documented, the last thirty years have witnessed a profound increase in corporate power and a shift in resources from the poor to the rich.

Contemporary approaches to climate change

Much of the literature on the climate change debate has focused on the scientific and economic arguments advanced by various actors in an effort to determine firstly, whether climate change is happening and which side is right and which is wrong, and secondly what policies (e.g Stern 2007; Garnaut 2008b), if any, should be adopted to address the problem. Although some people have looked at strategies and tactics in the climate change debate, this has been restricted mainly to the activities of the fossil fuel lobby and to a lesser extent, government and media (e.g. Gelbspan 1997, 2004; Beder 2000; Rampton and Stauber 2001; Hamilton 2001, 2007a; Dessler & Parson 2006; Monbiot 2007; Pearse 2007; Union of Concerned Scientists 2007; Crowley 2007; Giddens 2009; Hoggan 2009; Oreskes and Conway 2010; Pooley 2010). The analysis has primarily been in terms in terms of how the fossil fuel lobby, sympathetic governments, and certain media players have helped delay or prevent effective policy action. Proponents of climate change have paid less attention to the activities of climate scientists, although critics have variously accused climate scientists of exaggeration, groupthink, subterfuge, bullying, fraud and conspiracy (e.g. Michaels 1992, 2004; Plimer 2009; Paltridge 2009; Montford 2010a; Carter 2010). More recently, Fred Pearce (2010e) has looked at the impact of the ‘Climategate’ emails and the methods of a section of the climate science community. There has been some discussion about the emergence of a climate change social movement and the most effective methods for citizens to bring about change, especially Mark Diesendorf (2009), and to a lesser degree, George Marshall (2007), James Hansen (2009) and Bill McKibben (2010).

Yet, the analysis by various authors has not been within the framework of an overall approach to the strategies, tactics, and counter-responses adopted by key players at different stages of the climate change struggle. With the exception of Diesendorf (2009), there does not appear to have been any research that has attempted to apply various models of strategic and tactical action to the interactions in the climate change struggle.

Looking at tactics is a big area and there is no agreed framework for analysing tactics. James Jasper (2006) looks at strategies, but he uses his study to identify contingencies rather than trying to uncover a pattern of methods that may have wider application. Within political science, agenda management theory appears to be the most relevant tool for the exercise. There are various techniques that governments can use to manage their agenda. Ann Harding (1985) provides one of the most comprehensive lists of techniques in her study of unemployment policy. Harding (1985, p. 225) compiles the following as possible agenda management techniques: symbolism, tokenism, setting up new organisations to deal with the problem, postponement, co-opting opponents, discrediting opponents, redefining a problem, shifting attention, denying the issue legitimacy, deception, threatening opponents, encouraging potential allies, trading concessions, and adjusting social indicators. Harding (1985, p. 244, emphasis original) also suggests a distinction between:

> *reactive* agenda management, in which a government responds to outside pressures, and *initiatory* agenda management, in which a government consciously attempts to shape the agenda on its own initiative.

However, one limitation of agenda management is that it assumes that it is primarily governments that manage the agenda. Yet corporations are also able to manage the political agenda (Rampton and Stauber 2001; Dinan and Miller 2008). Introducing a special themed issue on corporate power in *Critical Social Policy*, David Miller and Gerry Mooney (2010, p. 460) argue that 'the rise of [corporate] spin, public relations and lobbying is a key feature of the growth and spread of neoliberalism in the past 20 years'. The themed issue examines the role of corporate agency (including lobby groups, think tanks and business alliances) in shaping public policy, undermining democratic processes, and producing what Sharon Beder (2010, p. 496) refers to as '"business-managed democracies"'. Beder (2000) had previously examined the tactics that corporations use to try and shape the agenda on a range of environmental issues. From a corporate perspective, Edward Grefe and Marty Linsky (1995) provide a manual that documents grassroots strategies and tactics that corporations can use to influence public affairs and public policy.

Scientists and scientific institutions are also able to influence the agenda to some degree. However, scientific evidence may conflict with economic and ideological values held by

powerful competing stakeholders who are able to challenge the mainstream scientific position in a range of public and political arenas (Cullen 2006). Finally, there is a substantial literature beginning with Maxwell McCombs and Donald Shaw (1972) on the related issue of the media to set the public agenda and indirectly influence to some degree the political agenda.

A study of the strategies and tactics pursued by the key players in the climate change debate would be a huge project, with each player worthy of a study on its own. Yet there are insights to be gained from a comparative analysis of various players. Accordingly, my aim is to look at the package of strategies and tactics used by government, industry and scientists, arguably three of the better-resourced players in the debate.[4] However, apart from agenda management, little within traditional political science and sociology attempts to systematically study strategies and tactics. I therefore looked at the social movement and nonviolence literature where the study of strategies and tactics has been a key aspect of the literature, particularly as it relates to building grassroots social movements to challenge existing institutional arrangements (e.g. Moyer 1987, 2001). However, Bill Moyer is more concerned with charting the development of a conflict and ensuring that activists adopt the most appropriate and effective tactics for the different stages of the struggle.

Given that my interest was in developing a comparative tactical framework that might have applicability across various groups in a conflict, I decided to begin with the backfire model developed by Brian Martin (2007a). One of the advantages of the backfire model is that it takes many of the agenda management techniques, adds other important techniques not addressed by agenda management, and then categorises them into a workable framework. This not only simplifies the analysis, but also provides a basis for identifying and comparing patterns of activity. However, the backfire model was derived from studies of nonviolence versus violence with their own particular dynamics and has several assumptions and limitations that render it unsuitable and unwieldly when trying to apply it to situations beyond those for which it was originally intended. I detail these problems in the later section on the backfire model along with an explanation of my adaptations of the model and why I believe a tactical framework still has value in clarifying aspects of the climate change debate.

[4] For reasons of space, an analysis of media, trade unions, and citizens and citizen organisations such as climate action groups and non-government organisations (NGOs) is beyond the scope of this study.

Before proceeding however, it is probably worth trying to draw a distinction between strategy and tactic. A strategy is often portrayed as an intended plan of action. In *The Rise and Fall of Strategic Planning*, Henry Mintzberg (1994, pp. 23-27) points out that there is an assumption in much of the business literature that strategy is formulated as part of an analytical planning process. This leads to the notion of an intended or planned strategy. However, a planned or intended strategy relies either upon the future being similar to the past, or else a correct prediction of the size, scope, nature, and rapidity of future changes. If future change is significantly different to what was anticipated, it may render a strategy obsolete. Many planned strategies are therefore never realised. By contrast, an emergent strategy is a response to what is occurring on the ground. Emergent strategies may resemble a pattern of behaviour. They are usually developed by people with an intimate knowledge of the situation or process and usually contain important elements of learning. According to Mintzberg, most realised strategies contain a substantial component of emergent strategy within them.

I treat a tactic as a method for implementing a strategy. To illustrate the difference, here are two simplified examples of strategies and tactics. The first is a decision by a university to build up its research profile. This would be a strategy towards achieving the goal of greater reputation. A tactic used to achieve this strategy may be to hire highly qualified researchers. However, it is not necessarily this simple because some people would regard a decision to hire researchers as a strategy, and reserve tactics for the methods used to find, attract and hire the researchers. A second example is from Passchendaele in World War One where the Allied strategy was to break through the German lines. The tactics included bringing up artillery to bombard the German lines. However, the generals formulating the strategy were unaware that conditions on the ground had changed substantially after heavy rain and the artillery could not get close enough because of the mud. The planned strategy proved tactically impossible to implement in the manner originally intended.

Although these examples clarify some of the differences between strategies and tactics, they also reveal some of the blurred boundaries between them. Furthermore, as Mintzberg (1994, p. 27) points out, the very notion of an emergent strategy means that it can be difficult to determine in advance what exactly is a strategy and what is a tactic. But if strategy is seen as the over-arching plan or approach to ‘big picture’ goals, tactics are the methods used to

implement a strategy. The main focus of my research is on the tactics that players use to implement a strategy, or counter the methods and overall strategy of an opponent.

The backfire model

The backfire model was developed by Martin for analysing the tactics used by powerful perpetrators to minimise outrage from public awareness of an injustice (Martin 2007a). The model is derived from the ideas of Gene Sharp (1973) whose original context was in examining the use of violence by a powerful aggressor against an unarmed nonviolent opponent. Although influenced by Gandhi and his principles, Sharp (1973, p. 657) went on to develop more pragmatic ideas of strategic interaction including the concept of political *jiu-jitsu* where a violent attack against a weaker opponent rebounded against the attacker because the public reacted with outrage to the situation and support for the victim increased.[5]

Martin expands on the ideas of Sharp in two main ways. Firstly, Martin develops a model that considers a wider range of norm violations than just violence against nonviolence protestors. Secondly, Martin develops a model to classify the main methods that the powerful employ to ‘get away with’ their conduct, and also provides an understanding of the methods that activists can use to counter the tactics of the powerful. The backfire model therefore provides a tool for a more fine-grained assessment of the struggles within a conflict.

Martin (2007a, p. 205) observes that backfire requires ‘two essential conditions’ to be met. Firstly, an event must be seen by some people as ‘unjust, unfair, [or] disproportionate’. Martin (2007a, p. 205) points out that the public may regard the outcome of a dispute where two evenly-balanced protagonists engage voluntarily as ‘unfortunate but not unfair’. However, when the power dynamic is uneven and involves a powerful aggressor using violence against an innocent, peaceful or defenceless victim, the attack is more likely to be seen as unjust because it violates normal expectations. Secondly, backfire requires communicating the injustice ‘to receptive audiences’ (Martin 2007a, p. 206). Thus, backfire can only occur when a receptive audience is outraged by the actions of a powerful perpetrator against a weaker victim.

[5] See Martin (2007, pp. 174-176, 213-215) for a more detailed explanation.

However, many unjust activities by the powerful provoke little or no outrage. Martin (2007a, p. 206) argues that this is because powerful perpetrators are able to 'take actions that reduce the likelihood or scale of backfire'. Whereas the unjust actions of non-powerful perpetrators are usually discovered and punished by social rules or the law, the powerful often manage to evade such sanctions (Martin 2007a, p. 3). The backfire model classifies into five categories the tactics used by the powerful to get away with their actions and avoid outrage: cover-up, devaluation, reinterpretation, official channels, and intimidation and bribery (Martin 2007a, pp. 4-5). Although these methods could in theory be used by all, Martin (2007a, p. 206) notes that it is usually only powerful, well-resourced players that possess 'significant capacity to inhibit outrage from their actions'.

Martin (2007a) has noted generic limitations with the backfire model. The model does not suggest which tactics are most likely to be used and does not indicate how effective particular tactics are. As such, the model does not say anything about outcomes even if a tactic or range of tactics is used. Nor does it say anything about timing, which is often crucial in determining whether a particular tactic is effective at a particular point in time. Furthermore, the backfire model only provides a snapshot of a situation at a certain juncture: it does not indicate whether the tactics selected at a particular moment will still be effective later if people's values change. The model provides no information about whether a group possesses the resources to mobilise for a particular set of tactics, or indeed how to mobilise the necessary resources. Instead, the model assumes that powerful players with access to resources will be able to implement some or all of a range of tactics, and that those less powerful players will be more restricted in their choice of techniques.

Beyond generic limitations, however, the prior focus on injustice immediately illuminates one of the key problems that would occur in trying to apply the backfire model to a situation or dynamic beyond that for which it was originally intended. The backfire model is predicated firstly on the occurrence of something perceived as an injustice, and secondly on the existence of a powerful perpetrator and a weaker victim. Yet in the climate change debate, it is difficult to determine what the injustice is, who the perpetrators are, and who the victims are.

Martin (2007b) has proposed that climate change could be thought of as a 'slow injustice' perpetrated against future generations. Paul Harris (2010) has written at length about the injustice of climate change. Framing climate change in these terms reveals a power imbalance between the resources available to wealthy polluters and the absent voice of large parts of the current global population (and future generations) that fits the backfire dynamic of a powerful perpetrator harming a weaker victim.

Still, this definition of injustice differs significantly from the typical instances of more obvious injustice for which the backfire model was originally conceived. Injustices such as a massacre or a one-off industrial or environmental accident are discrete and site-specific, and it is usually apparent what the injustice was and who the perpetrator was. But climate change is diffuse, both over time and space, and the activities that contribute to it are insidious, ongoing and have been conducted in public over a prolonged period. Fossil fuels have been burnt in increasing amounts since the Industrial Revolution that began in England in the 1780s, and although most fossil fuels have been consumed in the industrialised countries of the west, large quantities are now being used in newly industrialising nations. Are the perpetrators of climate change the producers of fossil fuels, the business coalitions driving global consumer capitalism, or the growing numbers of affluent consumers in both developed and developing countries? These questions make identifying a perpetrator problematic.[6]

There are further difficulties in trying to identify the powerful player(s) in the climate change debate. The government could logically be seen as a powerful player, but is it necessarily a perpetrator? Within the industry sector, the Australian Industry Greenhouse Network (AIGN) could be seen as a powerful player, but the Lavoisier Group would not fit the conventional definition of a powerful player. Although scientific organisations have institutional power, the struggle between scientists and their critics is more evenly balanced and therefore it is not necessarily possible to identify a powerful player, or indeed an injustice. Trying to apply the backfire model to scientists and their institutions, or the media, would be messy and potentially unworkable.

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[6] Wilkenfeld (2007, no page given) argues that 'the continuing rise in global greenhouse gas emissions is not a byproduct of injustice or repression but of economic freedom in the West and the unrelenting economic growth by which repressive regimes such as China's buy legitimacy'. Wilkenfeld also points out that ' very few people want to be freed from consumption —most want the freedom to consume even more'.

These are serious methodological issues, and yet I believe that exploring the notion of a tactical framework still has value. I have, therefore, taken the classifications from the backfire model and adapted them into tactical categories that suit the climate change debate. This also permits the inclusion of other agenda management techniques where appropriate. Furthermore, it obviates the need to identify an injustice, a set of victims and perpetrators, or a potential instance of outrage or backfire.[7] In this sense, I treat the categories in the backfire model as a guide that indicates what sort of tactics to look for. In addition, as the following section explains, adapting the model means that in instances where the resources of the protagonists are relatively evenly balanced, I am not constrained in trying to fit the tactics of a player into either those that would nominally be adopted by a powerful perpetrator, or those available to a weaker opponent.

The backfire framework

This section covers the categories in Martin's backfire model and some examples of where it has been applied. I then indicate those instances where I have amended the classification and the model to better suit the dynamics of the climate change debate.

Cover-up involves preventing information about the activity from reaching a receptive audience. It is typically the first tactic of choice available to powerful perpetrators of an injustice and may entail conducting the activity in secret, removing the evidence, or denying that the event occurred. Of course, if cover-up is successful, then the potential for backfire is neutralised and the perpetrator has no need to resort to other methods (Martin 2007a, p. 4).

Devaluation is used to 'lower people's opinion about an individual or group' in order to reduce their status and therefore reduce the level of concern about how they are treated, or even build support for tough action against them (Martin 2007a, p. 4; see also Keen 1986). For example, if refugees are portrayed as potential terrorists, public fears may be mobilised and public sympathy may be reduced such that harsh measures may be seen as acceptable or even desirable by a portion of the wider population.

[7] This does not imply that issues of injustice and responsibility are not relevant to climate change.

Reinterpretation is a broad category and involves numerous techniques. Martin (2008) identifies lying, minimising, blaming and framing as sub-categories of reinterpretation. Many of these techniques have become a staple of public relations and 'spin'.

Official channels such as reviews, commissions, and court action are typically used by governments to minimise outrage by giving the appearance that justice is being done (Martin 2007a, p. 5)[8]. Apart from court action, official channels are not normally a method available to other players. Because official channels typically take a long time, much of the original public outrage has subsided by the time a verdict is delivered. The dissipation of concerned energy caused by the delay also means that there is less pressure on authorities to fully implement the recommendations of an official investigation.

Martin categorises intimidation as a method used to dissuade others from taking action on an issue. In contrast to reinterpretation which aims to persuade using rhetorical argument, intimidation implies a degree of coercion achieved by the threat of negative consequences. Given that intimidation, either verbal or physical, does not conform to democratic norms of public debate, it generally remains hidden, indicating that cover-up is also a significant component of its use (Martin 2007a, p. 5).

Martin describes bribery, the final method of inhibiting outrage, as a payment or other incentive designed to induce cooperation, suppress opposition, or silence debate. Bribery is particularly difficult to uncover because it is hidden and because the boundaries between bribery and funding can be subtle (Martin 2007a, p. 5).

The backfire model also provides activists and concerned citizens with ways to amplify outrage as a means of achieving a measure of justice. Martin (2007a, pp. 206-207) suggests ways to counter inhibition by exposing the event, validating the target, reframing the event and emphasising the injustice, mobilising public support and avoiding or discrediting official channels, and either resisting or exposing intimidation and bribery.

The following diagram taken from *Justice Ignited: The Dynamics of Backfire* (Martin 2007a) summarises the methods available to the two sides in the struggle to inhibit or amplify

[8] This is not to say that Royal Commissions, for example, do not uncover valuable evidence or provide victims with an opportunity to have their say.

outrage. In effect, this struggle over competing methods determines whether and to what extent outrage over a situation occurs.

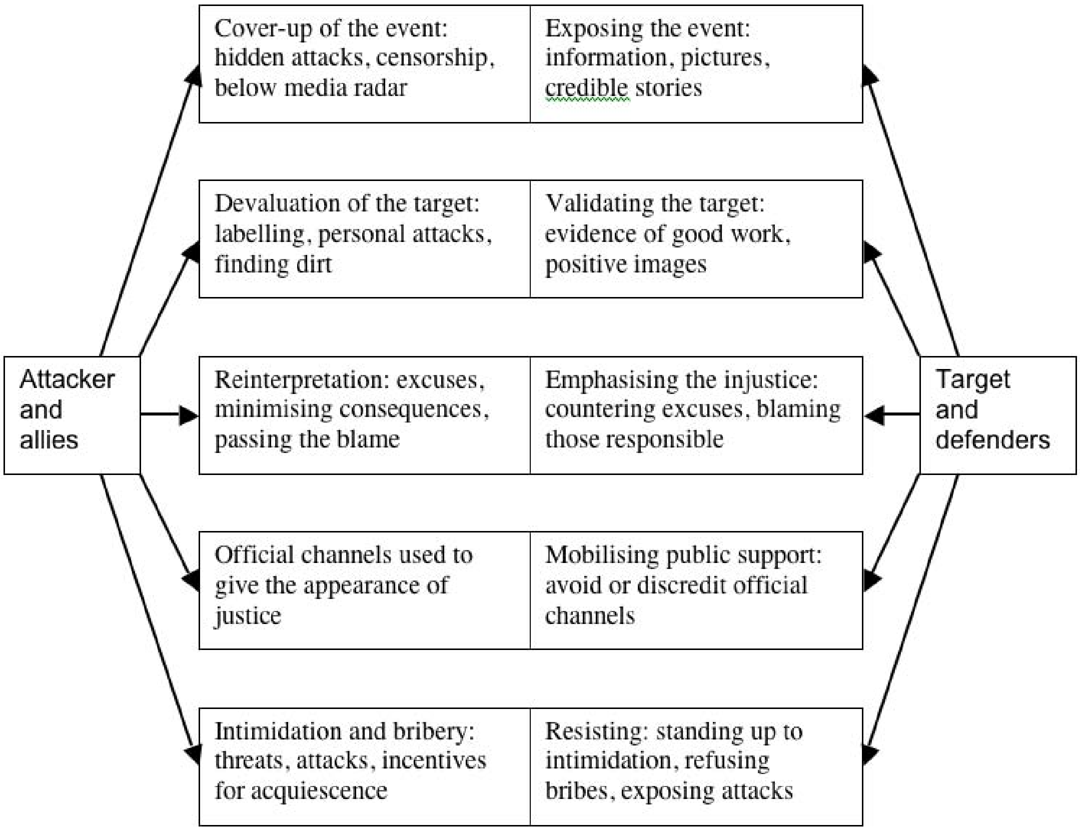

Figure 1: Methods used to inhibit or amplify outrage over an injustice (Martin 2007a, p. 207)

The backfire model has been applied in a range of case studies involving a perceived injustice, either deliberate or unintentional, including the 1968 My Lai massacre during the Vietnam War (Gray and Martin 2008), the treatment of refugees in Australia (Herd 2006), the Union Carbide and James Hardie cases of industrial hazards (Engel and Martin 2006), environmental disasters such as the Exxon Valdez oil spill (Lendon and Martin in Martin 2007a), censorship in Korean cinema (Yecies 2008), and potential struggles over new border control technologies (Martin and Wright 2006).

The backfire model provides a way to understand the methods used in struggles over injustice and also reveals the ways in which activists can counter the tactics of perpetrators. Key methods available to activists and citizen organisations include validating a victim, reframing

the event to emphasise the injustice, and mobilising public support. Hector Postigo (2009) provides an account of the methods used by the digital rights movement in a case involving information communication technologies. In some instances, exposing tactics such as cover-up, intimidation or bribery can itself lead to backfire against perpetrators. The model can therefore serve a dual purpose: to reveal the tactics used by the powerful to avoid backfire, and to indicate which tactics may be most relevant for those seeking to counter an injustice and amplify outrage.

However, splitting the categories of tactics into those available to powerful players and those that may be options for the victims of injustice and their defenders fails to account for some of the engagements occurring in the climate change debate, particularly those involving climate scientists and media critics. For example, scientists have a lot of institutional power, but the arguments of their opponents are amplified by a network of corporate-funded think tanks and front groups and by sections of the media, including both traditional media and new media such as blogs. The relative equality in resources means that the protagonists are using both the perpetrator methods and the target counter-methods. It therefore makes sense in this case to rearrange the framework so that for example, exposure, validation, and mobilising opposition to official channels are included in the repertoire of tactics alongside those of cover-up, devaluation, reinterpretation, official channels and reinterpretation rather than presuming that a player will use one set or the other.

I also amend some of the categories to more accurately reflect what is occurring in the climate change debate. I change lying to deception, bribery to inducements or donations and funding depending on the circumstances, and intimidation to pressure. Although Martin (2007a) classifies intimidation and bribery together, I separate funding, donations and inducements from pressure because some players use either one or the other and not necessarily both together.

It is also apparent that some tactics overlap whilst others are rarely used in isolation. For example, the denial of climate change may contain elements of devaluation, bribery of various forms typically requires an element of cover-up, and cover-up may involve deception. In addition, there are some tactics that do not fit the original model, and I develop categories for these during the analysis. In essence, I drop the requirement to identify an injustice and

backfire scenario, rename and rearrange the categories from the backfire model, and include other techniques as appropriate. However, I retain Martin's idea of a classification framework because this illuminates patterns of engagement.

Finally, by adopting a framework of tactics, I do not imply that agency is more important than structures. Although Martin argues that many unjust activities provoke little outrage because the perpetrators are able to take actions that minimise backfire, it may also be that the existing bias of the system inhibits outrage. For example, in *Power and Powerlessness: Quiescence and Rebellion in an Appalachian Valley*, John Gaventa (1980, p. 3) asks why rebellion does not occur in the face of inequality:

> why, in a social relationship involving the domination of a non-elite by an elite, does challenge to that domination not occur? ... Why do concerns not get voiced and why do interests remain unrecognised, and why does quiescence occur when one would intuitively expect to find rebellion?

These are key concerns for both classical democratic theories of participation as well as Marxist theories. Gaventa (1980, pp. 19-20) observes that pluralists might argue that quiescence is the result of social cohesion and that the system satisfies enough citizen demands to generate consent, whereas those drawing on Marxist theories might attribute the lack of rebellion to hegemony and argue that the system has successfully shaped the conceptions of the issues and the wants of the powerless to such a degree that they are oblivious to their real interests.

My concern, however, is not with developing explanations for social relations, or why the powerful are able to behave as they do, or indeed an explanation of the nature of legitimacy and why domination occurs and/or persists (in wider society or in a dispute such as the climate change debate). Nor am I specifically concerned with justice/injustice and the presence/absence of outrage. Rather, I use a tactical framework in order to build a picture of the tools at the disposal of various players, discern common patterns of action, and illuminate previously hidden or unconnected aspects of the debate. In studying a dynamic conflict such as climate change across several arenas, there are instances where a group or alliance may be able to exert more influence or may be dominant in one or more aspects of the debate, and other instances where the power resources are more evenly distributed. Rather than

displaying the exclusive dominance of a power elite or of powerful players, some aspects of the climate change struggle more closely resemble a pluralist conception of competing interests.

I therefore take an approach that draws on several conceptual tools. I apply aspects of a social constructivist approach to the more micro-scale aspects of the technical dispute between climate scientists and their critics. However, I integrate that technical dispute and the professional concerns of the scientists into a wider analysis of the power relations of the contending groups. While acknowledging structural concepts as an explanation for why particular viewpoints have been successful or dominant, for example the authority of scientific institutions, or the political economy bias within capitalism that privileges capital and the interests of elite wealth creating corporations over the interests of citizen groups, I also emphasise the active efforts that particular groups employ to either legitimate or undermine the current order.

As indicated earlier, besides analysing and classifying which tactics have been used, I also consider other aspects of the strategic engagement in the climate change debate. Both Martin and Jasper (2006)[9] make similar points about the relationship between tactics and resources. The following points are drawn from Jasper (2006), but similar understandings are also evident in the backfire model. Jasper notes firstly that tactics typically reflect the resources and opportunities of players. For example, payments and coercion are usually the preserve of players with access to specific resources. Secondly, powerful players have the resources to engage in multiple arenas, whereas less powerful players are often restricted to particular arenas. Thirdly, in a dynamic interaction, tactics are influenced by the moves of other players and the balance of power in a controversy. Fourthly, the choice of tactics may be influenced by the primary audience, and may be constrained by the arena in which they are used and how strongly the norms of engagement are enforced.

I use these critical insights on the relationships between power and tactics to help assess which tactics have been used, the extent of their use, how and why they have been used, and whether certain tactics are specific to particular sectors or types of organisations. I also examine the arenas for engagement, the alternatives and choices for engagement, the

[9] Jasper is more interested in specific dynamics and contingencies.

ramifications and risks that may arise from pursuing a particular option, the possible advantages of a certain course of action (or inaction), and the dynamics of strategic interaction, including counter-tactics.

Methodology

For convenience, I classified the key players in the climate change debate as industry, government, and scientists. The case studies within each category were chosen based principally on their activity and influence or prominence in the debate. The chapter on government compares the methods of the Australian federal governments led by John Howard and Kevin Rudd. The Howard government was selected because Howard downplayed the seriousness of climate change and refused to ratify the Kyoto protocol. By contrast, the Rudd government made an electoral commitment to ratify the Kyoto protocol and promised action on climate change.

The industry chapter has three case studies. The AIGN was selected as a behind-the-scenes cross-industry lobby group. The Lavoisier Group was chosen because it operates as an outspoken industry front group. Sceptical columnists in the quality press were included because of their links to the corporate-funded neo-liberal network.

The approach taken in the two chapters on scientists differs because the resources of the protagonists are more evenly matched and consequently it was not possible to separate out the methods adopted by scientists in isolation from the activities of their critics. I focus on the dispute over the ‘hockey stick’ reconstruction of climate change because it has been an icon of global warming and the site of protracted and bitter dispute. I look at the methods of interaction between mainstream scientists and their critics, and the responses of observers to the conflict.

Data sources

The principal data sources for this project are written documents. Books, journals, websites, media articles, speeches, submissions, papers, and conferences are selectively sampled. Although this may introduce a potential for bias, the analysis of strategies and tactics is based

on what participants said and did in response to particular circumstances and the actions of other players in the debate.

Both the AIGN and the Lavoisier Group have websites containing a comprehensive range of papers, submissions, conference proceedings, letters and other documents. In addition, Guy Pearse (2007) provides inside information on the activities of both the AIGN and the Howard federal Government. The Department of the Prime Minister and Cabinet (Howard), the Department of the Prime Minister (Rudd) websites, and the Commonwealth Parliament website were used to access the speeches and interviews of Howard and Rudd. The speeches of various ministers responsible for climate change and the environment were accessed through the Department of Environment (or similar) website. Articles on climate change in *The Australian* and *The Sydney Morning Herald* were accessed through the Factiva database using the following search terms: 'climate change', 'global warming', 'Kyoto', 'Stern', 'Garnaut' and 'carbon pollution'.

The chapter on scientists draws on scientific journal papers, the four IPCC assessment reports, and the reports of two official investigations into the 'hockey stick', the Wegman report and the report by the National Academy of Sciences. Three United Kingdom (UK) investigations, the House of Commons Science and Technology Committee (2010), Oxburgh (2010) and Russell (2010) were used to assess 'Climategate', as well as the investigation by *The Guardian* environment reporter, Pearce (2010a, 2010b, 2010c, 2010d, 2010e). Critical perspectives were taken from popular science books such as Montford (2010a). Many of the exchanges between scientists and their critics were accessed at websites and blogs including RealClimate run by climate scientists including Gavin Schmidt and Michael Mann, Climate Audit run by critic Steve McIntyre, and others such as the blogs run by Roger Pielke, Jr. and Keith Kloor.

Use of terms

'Climate change debate'

The term 'climate change debate' is used advisedly within this thesis. Large uncertainties notwithstanding, most scientists, politicians and climate change activists argue that the fundamental science of climate change is no longer a matter to be debated. Instead it is a

problem whose basic aspects have long been recognised. By contrast, what to do about the problem should be the subject of debate.

'Sceptic'

Australian climate scientist Barrie Pittock (2005) argues that scepticism involves the critical analysis of all sides of a proposition. By contrast, Pittock notes that sceptics in the climate change debate have engaged in selective criticism and promoted a few contrary findings rather than carefully weighing the balance of evidence. They have not developed a genuine challenge based on empirical evidence. Pittock (2005, pp. 78-81) argues that the so-called sceptics in the climate change debate are more accurately termed contrarians. George Monbiot (2007) and Clive Hamilton (2007a) both refer to sceptics as deniers or denialists. I generally use the term sceptic in this thesis because it is the widely recognised descriptive term. Where sceptic is obviously inaccurate I use contrarian or denier.

Limitations of the research

The study does not aim to determine the veracity of all disputed claims in the climate change debate or determine who is right or wrong. I give some background to climate science in chapter 1, but more specific rebuttals of the critical opinions covered in the section on media critics are provided elsewhere (e.g. Le Page 2007; Parris 2009; Abraham 2010; Enting 2010; Brook 2010).

The period of analysis varies with each chapter. The main focus of the government and industry chapters is between 2006 and 2010, but the two chapters on scientists go back to 1998. The case studies are predominantly but not exclusively from Australia. Each chapter is necessarily selective. For example, the chapter on scientists is restricted to the ongoing dispute over the 'hockey stick'. Although a small and arguably somewhat peripheral part of climate science, the 'hockey stick' phenomenon has been a prominent aspect of the overall climate change debate.

The section on media sceptics in the industry chapter is not intended as representative of media coverage of climate change. Media ownership in Australia, including newspapers, is very concentrated. Almost all of Australia's daily metropolitan newspapers are owned by

either Fairfax Media Limited or Rupert Murdoch's News Corporation (Tiffen 2008, p. 25). I examined editorials and regular opinion columns in the quality press[10] selected from *The Australian* and *The Sydney Morning Herald*. *The Australian* is a national daily broadsheet published by News Corporation and became Australia's first national daily newspaper in 1964. *The Sydney Morning Herald* is a daily broadsheet published by Fairfax Media Limited and is Australia's oldest continuously published newspaper. In recent times, *The Sydney Morning Herald* has been seen as more progressive than *The Australian* (Cahill 2004, p. 237).

There are several reasons for the focus on sceptical editorials and regular opinion columns in the quality press. Firstly, opinions expressed in the quality press aim to indirectly influence decision-makers in government and bureaucracy, and editorials and regular opinion columns are particularly important because they are regarded as independent and authoritative (Nimmo and Combs 1992; Chomsky 2004; Craig 2004). Secondly, editors and sceptical opinion columnists possess specific advantages as sources of information on climate change. In particular, they both operate from an optimal location for disseminating a well-defined message to the political decision-making class. By virtue of their pre-eminent location in the quality press, editors and opinion columnists have by-passed the requirement necessary of other sources, namely the cultivation of sympathetic contacts in the media. Furthermore, opinion columnists are well placed to discredit their opponents, not only because of their automatic presence in the media, but also because the presence of several columnists with similar perspectives endows them with timing and the potential for an almost immediate response on particular issues of importance. Thirdly, sceptical commentators (and to a lesser extent certain editorials) have taken an overtly partisan role in the climate change debate - one that contradicts the weight of scientific evidence and aligns with the position of industry and the rhetoric espoused by a network of radical neo-liberal organisations. Fourthly, I include economics commentators because, according to Ross Gittins (1995), economics commentators are prone to campaigning on issues (such as climate change) since they see

[10] After Craig (2004, p. 73) I use the term quality to denote 'a more comprehensive treatment of a range of serious issues'. The specific focus on the quality press means that I do not cover climate change deniers in the mass tabloid press such as Andrew Bolt who writes regular columns for the Melbourne *Herald Sun,* the Sydney *Daily Telegraph* and the Adelaide *Advertiser* and who has a very high readership both in print and through his blog.

their role as both explaining and changing government policy. Fifthly, the quality press is generally believed to abide by high standards of journalism, and the analysis allows an implicit judgement about the extent to which critical columnists in the quality press uphold high journalistic standards.

The editorial position of *The Australian* on climate change is the subject of bitter dispute (e.g. Hamilton 2007a, p. 196; Lloyd 2010; Editorial 2010). Editorials have institutional authority and therefore provide an indication of the general stance of a newspaper on an issue (Craig 2004, p. 81). As a full page spread in *The Weekend Australian* on 4th December (Lloyd 2010) points out, there have been several occasions where the editor states that *The Australian* accepts the scientific evidence on climate change. Nevertheless, there are also some editorials (e.g. Editorial 2007c, Editorial 2009c) that state ‘the evidence for man-made climate change is equivocal’, that portray contrarian viewpoints as an honest scientific position, and that are supportive of critics that attack the entire basis of climate change science. To be clear, there are uncertainties in climate science, some of which may prove to be irreducible. But much of the anthropogenic influence on climate change is understood with a high degree of certainty by the relevant scientific experts and institutional authorities. There is a difference between acknowledging disputes over genuine and recognised uncertainties and apparent editorial support by *The Australian* for criticism that challenges most of climate change science per se. Still, most editorial references in this thesis relate to the techno-centric approach of *The Australian* and its criticism of what it terms the eco-centric approach of its opponents.

I excluded occasional opinion columns because they do not fit the presumed independence and authority accorded to regular columnists. This meant I excluded several prominent contributors to the debate including Alan Moran from the free market think tank the Institute of Public Affairs, Alan Oxley, free trade lobbyist, chairman of the APEC Study Centre and host of the Asia-Pacific pages of Tech Central Station, and Des Moore, founding director of the Institute for Private Enterprise, Treasurer of the Bennelong Society and member of the Lavoisier Group and H.R. Nicholls Society.

This left a sample of critical editorials from *The Australian* and opinion pieces by regular columnists. Regular critical columnists at *The Australian* include former economics editor Alan Wood, finance columnist Terry McCrann, and regular commentators Janet Albrechtsen,

Christopher Pearson, and the late Frank Devine.[11] At *The Sydney Morning Herald*, the critical columnists were Miranda Devine and Michael Duffy.

Although I focus on the techniques that opinion columnists use to gain definitional advantage, by treating the activities of the media sceptics as part of a wider industry strategy, I implicitly connect my analysis to wider social science concerns about how power is wielded. Furthermore, by showing some of the parallels between the media communications of opinion columnists and the wider promotional communications of front groups targeted to selected politicians and political groupings, I expand the notion of source strategies to a wider range of audiences and forums than just the media.

Thesis structure

Given the nature of this thesis as a critical analysis of the methods used by various players in the climate change debate, the distinction between literature review and analysis is somewhat arbitrary: the literature is woven through the thesis and is used to both set the context for the various chapters and also to analyse the methods of the protagonists.

Chapter 1 outlines the mainstream science that underpins the climate change debate. By outlining the scientific context and illuminating the dimensions of the problem, this chapter provides a clear understanding of why the mainstream scientific community regards climate change as both serious and urgent. Chapter 2 provides some policy context by covering a range of options to address climate change. The chapter links to the political analysis in later chapters by pointing out which policies have been preferred by players such as government and industry and which have been ignored or kept off the agenda. Chapter 3 covers concepts such as agendas and interests that form part of the political analysis in subsequent chapters. The chapter also highlights the links between the policy analysis in chapter 2 and the political strategy of key players. Chapters 4 and 5 use the tactical framework to analyse the tactics of government and industry respectively. Chapter 6 provides the scientific and technical background to a particularly prominent public dispute over climate change. Chapter 7 builds on the previous chapter and uses the tactical framework to analyse the tactics of those

[11] I distinguish between Frank and Miranda Devine by using their first names in text, and in the in-text references by using (F. Devine) and (M. Devine).

scientists and critics involved in the dispute, and also considers the impact of scientific behaviour in public forums on the response of observers. In brief, chapters, 1, 2 and 6 provide scientific, policy and technical context; chapter 3 outlines theoretical concepts and chapters 4, 5 and 7 apply the framework to analyse the tactics of the key players. The conclusion demonstrates a pattern of tactics common to several of the players and ties the analysis into the wider social analysis of power. I also indicate further areas of controversy research to which my approach may be usefully applied.

Chapter 1: Climate systems and climate change

By providing the scientific background to climate change, this chapter sets the context for why most mainstream scientists regard climate change as such a serious problem and why scientific understanding of the problem has played such an important role in the debate. This chapter begins by explaining some of what is known about the climate system and climate change science. I cover some of the reasons why scientists believe human activity is influencing the climate, the key findings of the IPCC, deal briefly with some frequent criticisms of the anthropogenic greenhouse effect, and finish with a summation of the magnitude of the current changes.

The Earth's climate has varied dramatically over geological timescales and has been both far colder and far warmer than present. The period termed 'Snowball Earth' about 635-790 million years ago is thought to have had 'widespread, equatorial glaciation' (Kirschivink in Schopf and Klein 1992, p. 51). By contrast, the Earth is believed to have been about 4-7°C warmer than present about 40-60 million years ago, completely ice free at both poles, and with atmospheric carbon dioxide (CO_2) concentrations far higher than present (Hansen et al 2008, pp. 221-224; Archer 2007, pp. 142-143, 156-157; Archer 2009, pp. 79-83, 87-89). Since that era, CO_2 concentrations have decreased markedly. About 34 million years ago the Earth cooled enough for ice to accumulate at the South Pole and about 14 million years ago the Antarctic ice sheet developed a permanent core. About seven million years ago a permanent ice sheet formed on Greenland and mountain glaciers persisted at tropical latitudes (Hansen et al 2008, p. 222; Archer 2009, pp. 79, 139).

Ice core records from Antarctica date back 800,000 years and can be used to measure both historical temperatures and atmospheric CO_2 levels over this period. The ice cores reveal a distinctive saw-tooth temperature pattern between alternating colder glacial periods and shorter warm interglacial periods. The records also show that atmospheric CO_2 concentrations have fluctuated between about 180-280 parts per million (ppm) over the last 800,000 years with low CO_2 concentrations matching the glacial periods and high CO_2 concentrations matching the warmer temperatures (Lüthi et al 2008, p. 380). The shift from glacial to interglacial is relatively rapid, followed by a more gradual descent into the next ice age. During glacial periods, thick ice sheets covered much of what are now Canada, the

northern United States (US) and northern Europe. During interglacial periods, the ice receded to the poles and mountain glaciers. The last glacial maximum was 20,000 years ago when average global temperatures are estimated to have been 5-7°C cooler than the pre-industrial period of 1800 AD. The glacial ice sheets began melting 18,000 years ago. Our current warm interglacial epoch known as the Holocene began 11,000 years ago. Although there appear to have been significant regional climate variations such as prolonged drought or increased cold during this time, average global temperatures during the Holocene have varied by only approximately 1°C (Archer 2007, pp. 141, 156-157; Archer 2009, pp. 65, 92-93).

The Earth's climate is complex with numerous multi-dimensional interacting variables and feedbacks. Collisions with asteroids or meteors, as well as movements in plate tectonics and continental drift that have played out over very long timescales, have had an impact on climate. Continental drift and chance collisions are of less concern for recent climate change because they do not appear to have affected climate during the glacial/interglacial period of the last two million years. This latter period covers the existence of our human ancestors *Homo erectus* and the emergence of *Homo sapiens* about 150,000 years ago (Flannery 2005, pp. 54-55).

According to the IPCC (2007a, pp. 96, 449), global climate in the glacial/interglacial period has been driven by the solar radiation balance of the planet, and this balance can be altered in three fundamental ways. Firstly, by changes to the solar radiation reaching the Earth such as changes in the Sun's brightness or the orbital variations of the Earth, secondly by changes in the Earth's reflectivity (known as albedo) such as changes in snow and ice cover or the presence of aerosols in the atmosphere after volcanic eruptions, and thirdly, by changes in greenhouse gas concentrations that affect long wave energy radiation back to space. Other factors that affect climate include ocean currents that transport large volumes of warmer or colder water around the globe, influencing temperatures, evaporation, and rainfall.

The Sun is clearly a major influence on climate and one factor changing the solar radiation reaching the Earth has been the steady increase in the Sun's luminosity since the beginning of the solar system about 4.5 billion years ago (Lacis et al 2010, p. 358). However, this gradual change is insufficient to explain the sharp rise in temperatures over the last thirty years. Accurate measurements of the Sun's brightness over the last thirty years show no evidence of

an increase in solar radiation during this period. Although sunspot activity is also believed to influence climate with weaker sunspot cycles being associated with periods of lower temperatures, it is difficult to show a correlation between sunspot activity and temperature (Damon and Laut 2004, p. 370; Schmidt 2005a). Furthermore, Lockwood and Frohlich (2007, p. 11) point out that solar forcing has declined over the last twenty years at precisely the time when temperatures have risen markedly and conclude that:

> the observed rapid rise in global mean temperatures seen after 1985 cannot be ascribed to solar variability, whichever of the mechanisms is invoked and no matter how much the solar variation is amplified.[12]

Another factor influencing the amount of solar radiation reaching the Earth is the Earth's orbital cycles. In the 1930s, Milutin Milankovich measured the Earth's 100,000 year elliptical orbit around the Sun, a 42,000 year cycle involving shifts in the Earth's axial tilt, and a 22,000 year precessionary cycle in which the Earth wobbles on its axis. The combined effects of variations in the Earth's orbit, axial tilt, and precession influence the intensity and location of solar radiation, and the relative intensity of the seasons (Pittock 2009, pp. 28-29). The shifts in the intensity and distribution of solar radiation brought about by the Milankovich cycles are thought to explain, in part, natural climate variability, and the historical pattern of prolonged ice ages and shorter interglacial periods over the last two million years.

However, changes in solar insolation caused by the Milankovich cycles alone are insufficient to effect dramatic changes in climate unless amplified by another factor (Pittock 2009, p. 29). The scientific mainstream (e.g. Pittock 2009, pp. 29-31; IPCC 2007a) argues that the ice age/interglacial cycle cannot be fully explained without considering the role of greenhouse gases. Greenhouse gases occur in the atmosphere which is conventionally divided into four layers, the closest to Earth being the troposphere, and the next layer above being the stratosphere beginning at nine to fifteen kilometres altitude. The active weather systems occur in the troposphere, whereas the stratosphere has a stable airflow. The greenhouse effect occurs in the troposphere which contains 80 per cent of the atmospheric gases. The two main tropospheric gases in dry air, nitrogen (78 per cent) and oxygen (20.9 per cent) have no

[12] This paper is only one of the latest in a long line of studies that has reached the same conclusion.

greenhouse effect (IPCC 2007a, p. 115). The most abundant greenhouse gas is water vapour. The other greenhouse gases are long-lived trace gases, CO_2, methane, nitrous oxide and the halocarbons (IPCC 2007a, p. 115). According to Lacis et al (2010, p. 357), water vapour accounts for half the greenhouse effect, clouds 25 per cent, CO_2 20 per cent and methane, nitrous oxide and the halocarbons 5 per cent. The trace gases act as forcing agents, and water vapour and clouds act as feedback responses (Lacis et al 2010, pp. 356-357).

The basic physics of what became known as the greenhouse effect can be traced back to the early 1800s.[13] Scientific understanding of the greenhouse effect began in 1824 with the work of French physicist Joseph Fourier. Experiments by Irish scientist John Tyndall in 1859 established the absorptive properties of various greenhouse gases. In 1896 Swedish physicist Svante Arrhenuis performed the first manual calculations for climate sensitivity, which is the extent of warming that could be expected for a doubling of CO_2.

The behaviour of greenhouse gases in the atmosphere is asymmetrical because they allow passage of incoming visible light rays (short wave energy) from the Sun, but are more opaque to outgoing thermal energy (long wave infrared radiation). Although some of the Sun's rays are reflected back out of the atmosphere by clouds and aerosol particles, and by snow and ice on the Earth's surface, most incoming sunlight is absorbed by the land and oceans. As the Earth's surfaces warm, they emit heat. Greenhouse gases absorb a certain proportion of this infrared radiation near the Earth's surface and re-emit it in all directions, including back to the Earth and out to space (IPCC 2007a, p. 115). Without the presence of greenhouse gases, the surface temperature of the Earth would be approximately -18°C to -20°C. The trace gases that make up the natural greenhouse effect therefore maintain the current average surface temperature of the planet at around 14˚C (Pittock 2009, p.7).

CO_2 forms an important part of the life-cycle on Earth because plants and algae absorb CO_2 during photosynthesis and emit oxygen. CO_2 cycles between the land, oceans, and the atmosphere. When CO_2 leaves the atmosphere, it ends up in carbon sinks, such as forests, the Earth's crust, and the oceans (Pittock 2009, pp. 10-11). For example, the Carboniferous forests absorbed CO_2 from the atmosphere, and their subsequent fossilisation 'locked' CO_2 underground to form coal and oil deposits. When fossil fuels are burnt, CO_2 is released from

[13] Weart (2008) provides a detailed history in *The Discovery of Global Warming*.

storage. Increasing fossil fuel combustion since the Industrial Revolution, combined with the loss of much of the world's primary forests and the expansion of industrial agriculture, has led to a rapid and substantial increase in greenhouse gases such as CO_2, methane, nitrous oxide and halocarbons. Atmospheric CO_2 levels have risen from approximately 280ppm around 1750 up to 379ppm in 2005.[14] Methane concentrations have risen from a pre-industrial level of about 715 parts per billion (ppb) to 1774ppb in 2005. These levels are far in excess of the natural range for the last 650,000 years. Nitrous oxide has increased from 270ppb to 319ppb, and halocarbons were practically non-existent in pre-industrial times (IPCC 2007a, p. 2, 2007b, pp. 37-38).[15]

The greenhouse gases vary in their warming influence 'due to their different radiative properties and lifetimes in the atmosphere' (IPCC 2007b, p.36). For example, methane is far more powerful than CO_2 as a warming agent,[16] but has a much shorter residence time in the atmosphere of about eight-and-a-half years. Nitrous oxide persists for about 114 years and halocarbons can last for up to 270 years (IPCC 2007a, pp. 511-513). Many reports try to accommodate the impact of the full range of long-lived greenhouse gases by referring to measurements of greenhouse gas concentrations or CO_2 equivalence (hereafter CO_2e). Although methane and nitrous oxide are significant contributors to warming and could be effectively targeted by separate policy initiatives, I concentrate mainly on CO_2. This is partly for simplicity and partly because CO_2 constitutes the major proportion of all greenhouse gas emissions, which combined with its longevity in the atmosphere, makes it the most important of the human-influenced greenhouse gases.

Approximately half the additional CO_2 released by human activity ends up in the oceans where it changes ocean chemistry (and results in greater acidity), and half ends up in the atmosphere (Pittock 2009, pp. 10-11). However, this ratio is being altered because the increase in ocean temperatures decreases the capacity of the upper oceans to store CO_2, leading to further atmospheric accumulation (Archer et al 2009, p. 120). The airborne fraction

[14] By November 2010, the level had exceeded 390ppm (National Oceanic and Atmospheric Administration [NOAA] 2010).
[15] See also Ruddiman (2003) for a discussion of possible human influence on climate over the last 8,000 years due mainly to the release of greenhouse gases from forest clearing and agriculture.
[16] Methane is 72 times more powerful than CO_2 over a 20 year period, and 25 times more powerful over a 100 year period.

of CO_2 persists in the atmosphere for a very long time. Although most of the CO_2 is reabsorbed in the land/ocean system within about 200 and 2000 years, between 20-35 per cent remains in the atmosphere over the next 3000-7000 years (Archer et al 2009, pp. 117, 119, 131). This means that increases in atmospheric CO_2 concentrations such as those that have occurred since the Industrial Revolution may have cumulative and profound long-term effects on climate, potentially lasting tens or hundreds of thousands of years (Archer et al 2009, p. 118).

In 1958 Charles Keeling began accurate measurements of atmospheric CO_2 at Mauna Loa in Hawaii and documented a steady rise. During the 1960s and 1970s, scientists drew international attention to increasing atmospheric concentrations of CO_2 (Weart 2008). After a conference at Villach Austria in 1985, scientists 'raised the first collective scientific warning' about potential unprecedented temperature rises in the 21st century (Pittock 2005, p. 247). In 1986, the Scientific Committee on Problems of the Environment (1986)[17]concluded that a doubling of CO_2 concentrations during the 21st century could lead to global warming in the range of 1.5–5.5˚C. A subsequent scientific conference in Toronto in 1988 called for a reduction in greenhouse gas emissions to 20 per cent below 1988 levels by 2005 (Weart 2008, p. 149; Pittock 2005, p. 247).[18]

In 1988, the World Meteorological Organisation (WMO) and the United Nations Environment Programme (UNEP) established the IPCC. The IPCC is an expert group of scientists open to all members of the WMO and UN that assesses and summarizes the peer-reviewed scientific and technical literature. Unlike the previous scientific gatherings at Villach and Toronto however, the IPCC was a scientific and political hybrid composed largely of government representatives and therefore lacked the independence from government of the preceding scientific conferences (Weart 2008, pp. 152-153).

The IPCC has released four detailed assessment reports. Each report contains a short Summary for Policymakers designed for decision-makers, bureaucrats and government. Successive IPCC reports have presented a greater degree of certainty regarding human

[17] The Scientific Committee on Problems of the Environment was auspiced by the World Meteorological Organisation (WMO), the United Nations Environment Program (UNEP), and the International Council of Scientific Unions (ISCU).
[18] Since the Toronto conference, atmospheric CO_2 concentrations have increased by about 10 per cent.

influence on climate. The *Second Assessment Report* (*SAR*) is best known for stating that despite uncertainties and natural climate variations, ‘the balance of evidence suggests a discernible human influence on global climate’ (IPCC 1996, p. 4). The *Third Assessment Report* (*TAR*) declared that ‘most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations’ (IPCC 2001, p. 10). The *Fourth Assessment Report* (*AR4*) estimated that global average surface temperatures had risen by 0.74˚C ± 0.18˚C over the course of the 20th century (IPCC 2007b, p. 2) and concluded that ‘most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations’ (IPCC 2007b, p. 5, emphasis original). The IPCC (2007b, p. 7) also projected a temperature increase of 0.2˚C per decade for the next two decades.

The temperature rises during the 20th century may at first appear insignificant. However, given that the difference in global average temperatures between the last ice age and the current interglacial is only about 5˚C-6˚C, the 0.7˚C rise in the 20th century, coupled with a potential 0.4˚C over the next 2 decades is both significant and rapid (Pittock 2009, p. 3; Dessler and Parson 2006, p. 10). Furthermore, inertia in the climate system means that the climate response to increased greenhouse gas concentrations is delayed (Hansen et al 2005, p. 1431). Most of the extra energy that has been generated in the Earth’s system due to the rise in greenhouse gas levels has been stored in the world’s oceans. This ocean thermal inertia means that there is already committed further warming ‘in the pipeline’ of 0.6˚C from greenhouse gases that have already been emitted (Hansen et al 2005, p. 1433; Wigley 2005). This is in addition to the approximately 0.7˚C of warming that occurred in the 20th century. There are also further lags in the climate system between ice sheet melt and impacts such as major sea level rise. This means that significant future impacts such as major ice loss and sea level rise may already be locked into the system despite little visible evidence at present.

Further warming is also expected from positive ice albedo feedbacks. A feedback mechanism operates around snow and ice cover. Warming reduces snow and ice cover which in turn reduces the reflection of sunlight to space and increases the land and ocean surface areas

available for solar absorption. Increased heat absorption leads to further warming of the oceans and land surfaces. This positive feedback loop amplifies the original forcing.[19]

In addition to inertia in the climate system, there is also inertia in global energy systems. The rise in atmospheric CO_2 concentrations has been caused by anthropogenic emissions, mainly from burning the fossil fuels, coal, oil and natural gas, but also from deforestation (IPCC 2007a, p. 2). Power generation plants are long term investments and newly constructed coal-fired power stations are designed to still be operating in forty years time. Because atmospheric CO_2 is a long-lived stock, even reduced flows of CO_2 will still cause increased concentrations. Atmospheric concentrations will only stabilise or decline when flows (emissions) are less than what can be absorbed by terrestrial sinks.

The major uncertainties about future climate change involve the speed, scale and distribution of climate changes for a given level of CO_2. Underlying uncertainties include the overall direction and amplitude of various climate feedbacks, in particular clouds, as well as uncertainty about future emissions. The IPCC has tried to account for the uncertainties by producing a range of scenarios for future climate change accompanied by a probability distribution of the most likely scenarios. The IPCC (2007a, p. 13) gives a range of future temperature scenarios for the 21st century of 1.1˚C-6.4˚C above the range for the period 1980-1999. Projected future impacts include a range of deleterious effects on ecosystems and human societies, some of which are potentially catastrophic and irreversible.

A few Australian scientists such as Bob Carter (2010), Bill Kininmonth (2004), Garth Paltridge (2009) and Ian Plimer (2009) dispute the majority conclusions of the mainstream and argue that the IPCC is overly alarmist. Retired Australian CSIRO (Commonwealth Scientific and Industrial Research Organisation) climate scientist Garth Paltridge (2009, p. 77) acknowledges the greenhouse effect but claims 'there is very great scepticism … that the amount of warming will be enough to worry about, or indeed enough to notice'. Paltridge (2009, p. 105) also states that even a minimal warming scenario 'has not been solidly established, and it is certainly not accepted by the majority of scientists as proven fact'. These vague claims are rather disingenuous because firstly the supposedly majority sceptical

[19] The ice/albedo feedback also works in the other direction. Cooling causes increased snow and ice cover which leads to greater reflection of sunlight and further cooling.

opinion is not identified, and secondly, the key point in complex and uncertain science is not necessarily establishing cause and effect as proven fact, but rather assessing the balance of evidence about probable cause and likely effect. It is then up to politicians and citizens to make decisions about whether and how to act on the problem.[20]

Australian geologist Ian Plimer is more strident and claims the evidence presented in his book *Heaven and Earth* invalidates all the arguments for human-induced climate change. Plimer (2009, p. 31) asserts that 'in the Roman Warming from 250 BC to 450 AD, temperature was at least 2˚C higher than today'. He also claims that Greenland 'was at least 6˚C warmer than today', and that 'the Medieval Warming was global'. Yet as Ian Enting (2010, p. 5 #9, p. 6 #20, p. 7 #22) notes, Plimer fails to provide proper supporting evidence for these controversial claims. Likewise, Kurt Lambeck (2009), earth scientist and President of the Australian Academy of Science is scathing of *Heaven and Earth* and dismisses it as a work of opinion not of science. Lambeck states that he would fail it had it been written by an Honours student.

Contrarian scientists downplay the seriousness of human-induced climate change by invoking various arguments about why climate is likely to be minimally responsive to greenhouse gas forcing. Although there are numerous points of contention raised by sceptics, I consider four commonly raised objections. This brief discussion demonstrates that mainstream scientists and the IPCC appear to have either answered or acknowledged the main points raised by their critics.

A frequent objection is that climate has always varied and that current temperatures are just another manifestation of natural climate variability. Contrarians such as Australian palaeontologist and marine geologist Bob Carter (2007, 2008a, 2008b, 2009, 2010) argue that the current warm period is well within the bounds of natural climate variability. However, natural climate variability is not the disputed issue because both sides agree that climate has varied hugely in the past and that natural variation continues to influence climate now. It is true that the change so far has been small (but not insignificant). Indeed, the small increase in

[20] For example, the science of second-hand tobacco smoke inhalation and subsequent disease is still not completely understood as proven fact, but the weight of evidence indicates a cause and effect relationship. This evidence has been enough for many governments to enact various forms of smoking legislation with the aim of protecting public health.

temperature is what makes detecting the human signal difficult – it is obscured by the noise of natural climate variability. Debates about whether the climate is currently within the realm of natural variability are peripheral to the issue of what has caused the warming. Furthermore, claims about the bounds of natural variability tend to ignore the inertia in the climate system. Scientists such as James Hansen (2006, 2007b; Hansen et al. 2005, 2007a, 2007b, 2008) point out that the current level of atmospheric CO_2 could be sufficient to bring about polar ice sheet disintegration and sea level rise of several metres. Climate science therefore provides an early warning of future dangers. Whether current or even future climates are within the range of natural variability is largely irrelevant. The point is that changes of this magnitude are well beyond the experience of human civilisation during the Holocene. Therefore the key issue of dispute between mainstream scientists and their critics becomes the extent to which adding greenhouse gases to the atmosphere will alter climate.

Contrarians such as Bob Carter point out that ice core data shows increases in atmospheric CO_2 lagged temperature rises by about 800 years and therefore could not have caused rising temperatures in the past. Carter thereby implies that CO_2 has nothing to do with warming. Climate scientists (e.g. RealClimate 2004; Brahic and Le Page 2007) agree that other forces such as the Milankovich cycles and changing ocean currents may trigger a warming period and be responsible for the initial rise in temperature. However, they point out that as the temperature rises, CO_2 stored in the oceans and Earth is released. Schmidt (2005b, response to #19, emphasis original) argues that the ice-cores illustrate:

> a classic *feedback* - climate influences GHGs [greenhouse gases] (through ocean + biosphere interactions), and GHGs in turn influence climate (through the atmospheric greenhouse effect).

The subsequent release of CO_2 amplifies the initial warming process, and therefore, CO_2 may be responsible for half the warming associated with an interglacial period (RealClimate 2004). CO_2 amplification therefore helps explain how a small initial perturbation such as an orbital shift can result in major changes in climate. Finally CO_2 may have followed initial temperature rises in the past during purely natural events. Yet as Gareth Morgan and John McCrystal (2009, p. 207) point out, surely sceptics do not expect people to believe this

precludes CO_2 from causing warming when human activity changes the natural cycle by adding greenhouse gases to the atmosphere.

Another reason given by contrarians for not worrying about greenhouse gas emissions is that the relationship between CO_2 forcing and temperature change is logarithmic, not linear. Paltridge (2009, pp. 51-52), Plimer (2009, pp. 374-375) and Carter (2007, p. 64) argue the atmosphere is already saturated with CO_2 and that increasing atmospheric concentrations of CO_2 will have a rapidly diminishing additional effect on temperatures. According to sceptics there is, therefore, little need to be concerned about ongoing CO_2 emissions.

Spencer Weart and Raymond Pierrehumbert (2007) point out that the notion of saturation arose in 1900 shortly after Svante Arrhenius first argued that fossil fuel consumption would eventually warm the planet. Simple experiments with a tube of CO_2 conducted by Knut Ångström and Herr J. Koch appeared to show that changes to CO_2 concentration scarcely affected how much radiation got through the tube. Additionally, climate scientists at the time felt that the much greater abundance of water vapour in the atmosphere already blocked radiation in the same bands in which CO_2 was effective. The findings of Ångström and Koch were enough to convince the scientific establishment that the human-influenced greenhouse effect was flawed and did not merit further investigation (Weart and Pierrehumbert 2007).

However, the experiment by Ångström and Koch assumed that the atmosphere was like a single layer of glass (the greenhouse concept). This flaw went unrecognised until the 1940s. It was then that scientists began to comprehend the implications of varying moisture levels, air pressures, and temperatures in the various layers of atmosphere, and how this might affect the wavelengths at which both CO_2 and water vapour blocked radiation (Weart and Pierrehumbert 2007). It appears there is still vast potential for increasing CO_2 concentrations in the thin upper atmosphere, which would lead to increased heat absorption and greenhouse warming. Additionally, there is little water vapour in the higher and drier upper atmosphere, and what moisture exists there is less effective in terms of radiation absorption because of lower atmospheric pressure (Weart and Pierrehumbert 2007).

Mainstream scientists (e.g. Archer et al 2009, p. 120) also point out that the triggering of feedback effects and the decreased carbon absorptive capacities of the oceans are likely to

counteract the atmospheric saturation effect. Furthermore, the greenhouse gases methane and nitrous oxide are important contributors to global warming and their concentrations have increased substantially due to human activity since the Industrial Revolution and are predicted to continue rising (IPCC 2007a, p. 3). Unlike CO_2, the relationship between methane and nitrous oxide concentrations and radiative forcing is linear, not logarithmic (Stern 2007, p. 9).

In sum, even though a logarithmic relationship between warming and atmospheric CO_2 exists, the saturation argument used by critics is based upon a simplified understanding of the effects of CO_2 at ground level only and it seems likely to be counter-acted by the decreased capacity of the oceans to absorb additional CO_2. Furthermore, significant portions of the upper atmosphere have great potential for further greenhouse warming, and the saturation argument ignores the linear warming effects of other significant greenhouse gases.

One of the principal uncertainties in climate science is the precise effect of clouds. Sceptics argue that clouds constitute a net negative feedback in the climate system large enough to overcome other feedbacks and therefore restrain warming to negligible levels. This complex topic is covered by oceanographer David Archer (2007, pp. 74-77). A useful and accessible analysis for the lay reader is given by non-scientists Morgan and McCrystal (2009, pp. 182-208). Morgan and McCrystal (2009, pp. 202-205) make several points about the alleged negative cloud feedback. They note that human activity has raised atmospheric CO_2 by about 40 per cent since the beginning of the Industrial Revolution. Global average temperatures rose 0.8˚C during the 20th century, and according to the energy budget calculations, will rise a further 0.6˚C, adding up to a total of 1.4˚C of warming for a 40 per cent increase in CO_2 from 280ppm to 380ppm (see Hansen et al. 2005 for the scientific case). The IPCC (2007b, p. 72, emphasis original) state that it is ‘*very unlikely*’ that equilibrium climate sensitivity to doubled CO_2 will be less than 1.5˚C. Yet contrarians such as Carter, Plimer and Paltridge claim that future increases of CO_2 will have an unmeasurable impact on climate. A 1.4˚C increase in temperature appears attributable in large part to the 40 per cent rise in CO_2. It therefore appears implausible that a further 60 per cent increase in CO_2 would only realise the 0.1˚C rise in temperatures claimed by contrarians. This would require feedbacks such as clouds to have such a large negative feedback as to counteract all other positive feedbacks in

the climate system. Morgan and McCrystal note that climate models, despite their limitations, are unable to track the changes in climate over the past century if they are programmed with a negative feedback value for clouds and low climate sensitivity to CO_2. By contrast, when using a negligible value for cloud feedbacks coupled with higher climate sensitivity, they track past climate change reasonably accurately. Finally, Morgan and McCrystal (2009, p. 203) note that the notion of strong negative cloud feedbacks contradicts the 'observationally verified imbalance in the Earth's radiation budget'. Morgan and McCrystal therefore conclude that the IPCC estimate on the net positive impact of clouds and climate sensitivity is reasonable.

The IPCC (2007a, p. 12) best estimate for climate sensitivity is 3˚C for a doubling of CO_2 to 550ppm. Given the inertia in the climate system, it is possible that only 2˚C of that warming may occur this century,[21] with the rest happening during the following century. However, this presupposes firstly that emissions are reduced dramatically, and secondly, that the rise in temperature does not trigger further feedbacks that rapidly move the climate system towards further warming. Yet some recent scientific evidence since the last IPCC report suggests that a further 1-1.5˚C[22] of warming may trigger major and irreversible climate shifts (Lenton and Schellnhuber 2007; Lenton et al 2008; Ramanathan and Feng 2008; Hansen et al 2008; Smith et al 2009; Richardson et al 2009). Hansen et al (2008) also argue that paleoclimate evidence now supports the conclusion that fast climate feedbacks lead to a sensitivity of 3˚C, but that incorporating slow climate feedbacks over a millennial timescale yields a total climate sensitivity of 6˚C.[23] These findings suggest that the problem may be both more serious and more urgent than the picture painted by the IPCC.

In sum, what is understood about climate and climate change indicates that climates have varied hugely in the past and have been driven by a combination of natural factors. There are forcing mechanisms such as solar radiation and greenhouse gas concentrations, and there are feedback mechanisms that may either amplify or dampen the shift in climate. Ice core records indicate that previous warming episodes during the last two million years were probably triggered by Milankovich cycles and were amplified by greenhouse forcing as CO_2 was

[21] Temperature rises of 4˚C as early as the 2060s are also plausible (Betts et al 2011).
[22] 0.6˚C is already in the pipeline as committed warming even if all emissions stopped today.
[23] 6˚C is the figure that Arrhenuis calculated back in 1896.

released into the atmosphere when previously frozen earth and cold oceans began to warm. The key point of contention and uncertainty concerns the extent to which the rapid rise in human greenhouse gas emissions will impact on climate. Nevertheless, it appears that the IPCC estimates are reasonable, and may even be conservative.

Humanity originated during ice ages and has experienced and survived both glacial and interglacial periods with temperatures both much colder and somewhat warmer than present. For most of human existence, people have moved significant distances to adapt to climate change. Crucially, however, human civilisation and almost all of human development, culture, technology and population growth has occurred during the last 10,000 years of the current and relatively stable interglacial epoch known as the Holocene. Global temperature averages have varied by only about 1˚C during this entire period. Even at the lower boundary (best-case scenario) of the IPCC projections, it appears very likely that humanity in this century will face temperatures and attendant climate shifts never previously encountered during human civilisation. Worst case scenarios indicate climate change far beyond human experience.

Chapter 2: Policy Options

Introduction

By analysing a range of policy options, this chapter provides the policy background for the subsequent chapters on government, and to a lesser degree, industry. Policy is never neutral: it creates winners and losers, and policy debate, policy promotion and policy-making do not operate in a political vacuum. Policies are not, therefore, adopted (or ignored) on their merits alone: that is, the players in a conflict do not judge policies solely on their presumed ability to improve some aspect of a problem. Rather, players judge policy according to how it will affect their interests. These interconnections between policy and politics are developed further in Chapter 3. At this stage however, a broad understanding of policy is valuable for two main reasons. Firstly, a summary of the strengths and limitations of a range of policies allows a comparative analysis of policy options and a feel for what policies would be most appropriate, most effective, and would complement each other. Secondly, a clearer conception of the potential effectiveness and impacts of particular policies helps to disentangle policies from politics and enables an interrogation of the degree to which the policy preference of various players is influenced by ideology (or values), interests (e.g. financial considerations), and strategy (weakening an opponent and strengthening one's own position).

The list of policies presented in this chapter is not designed to be comprehensive, but rather to illustrate the scope of options available to governments as well as their limitations and implications. It includes broad market mechanisms as well as regulations and policies tailored to specific sectors. The analysis proceeds on the understanding that one of the main goals of government is to ensure policies complement rather than counteract each other.

Policy context

Climate change is such an all-encompassing issue that policy options range across many areas. Different policies may employ different methods for modifying behaviours. Across a spectrum of public policy issues, generic policy approaches typically some or all of the following methods: awareness and education campaigns, incentives and disincentives such as

pricing, and constraints such as regulatory standards and limits. Constraints generate opposition on the grounds that they are impositions that erode existing civil freedoms or rights. Nevertheless, many constraints already exist in society and are generally accepted as the norm – for example, restrictions on the use of violence in civil society, and restrictions on the use of deception in financial or legal transactions. However, less obvious constraints are widespread in society – for example, the lack of adequate public transport constrains transport choice in many parts of Australia, whereas public funding of road infrastructure means that car users are less restricted. Many policies contain more than one approach. For example, cap and trade combines a regulatory constraint, the emissions cap, with a price incentive linked to market trading. Generally, a policy or mix of policies that includes education, incentive and constraints is most effective.

Climate change policy is not necessarily only about decisions around fossil fuels and cleaner energy technologies. The IPCC (2007c, pp. 178-179) state that emissions growth is a function of population increase, economic growth per head of population (GDP [gross domestic product] per capita), the energy intensity of GDP and the emissions intensity of energy. This immediately points to some of the key fault-lines and assumptions in the climate change policy debate. Population growth and consumption-driven affluence are contentious because they impinge on conventional wisdom around the benefits of growth. Governments have focussed primarily on technical and technological solutions to reduce emissions and avoided issues of population and affluence. In effect, the strategy is to decouple emissions growth from economic and population growth. This means technological change needs to be far more complete and rapid because other factors are being ignored. Nevertheless, proven renewable energy technologies and energy efficiency programs could produce immediate results, whereas changing economic paradigms and reducing population increase require longer time-frames. The exception may be changes to immigration policy that countries such as Australia could implement.

Certain policies may be particularly susceptible to influence from vested interests. Governments may implement potentially effective policies, but loopholes obscured by the complexity of the scheme undermine its effectiveness. By contrast, some policies are not adopted at all. Some policies are vehemently opposed by particular groups and may not even

make the public agenda. There may be a correlation between the strength of opposition to certain policies and their potential effectiveness: that is the more effective a policy may be, the stronger the opposition to it from certain quarters and the less likely that a government would choose to use it. Moreover, while some policy options may be suited for a gradual reduction in emissions, they may be wholly unsuited for rapid reductions in emissions. Furthermore, even if a policy may be capable of achieving the desired results, it may be politically impossible to implement under current conditions. Similarly, given that tackling climate change requires comprehensive international agreement, some policies may be preferred because they are the most politically acceptable to the broadest range of nations at an international level.

Scientific evidence also influences policy choice. Definitions of what constitutes 'dangerous' climate change are contested. The conventional definition has been that stabilising CO_2 concentrations at 450ppm would keep warming to 2°C above pre-industrial temperatures and thereby avoid dangerous climate change. However, this definition is under challenge. Meinshausen (2006, pp. 269-272) points out that using the IPCC scenarios, restricting atmospheric concentrations of CO_2 to 450ppm would provide at most a 50 per cent chance of restricting global temperature rise to 2°C – hardly a prescription for avoiding danger under the terms of the definition.[24] Furthermore, as the previous chapter noted, scientific studies since the last IPCC report have warned that temperature rises of 2°C or above risk triggering irreversible climate impacts. This led Hansen et al (2008) to argue that atmospheric concentrations must be reduced to, at most, 350ppm to avoid dangerous consequences. In effect, some recent science indicates the task is in fact more difficult than previously assumed.

The scientific analysis raises questions about the economic, technological and political feasibility of achieving these targets. The IPCC (2007b, p. 67) emission scenarios show that for a temperature rise of 2-2.4°C (already well into 'dangerous' territory), global emissions must peak between 2000 and 2015 and must be reduced by between 50 and 85 per cent by 2050. Two recent studies by scientists using a global carbon budget approach (Meinshausen

[24] Meinshausen (2006, p. 270) also notes that only a level of 400ppm CO_2e or less would provide a 'likely' chance of warming less than 2ºC. According to climate scientist Gavin Schmidt (2007) levels of CO_2e were about 375ppm in 2007 (approximately the same as CO_2).

et al 2009; WGBU 2009) propose even more stringent reduction timeframes. Yet atmospheric concentrations of CO_2 are already at 390ppm and annual emissions are increasing inexorably. Two researchers associated with the Tyndall° Centre in the UK, Kevin Anderson and Alice Bows (2008, 2011), point out that 450ppm is practically unavoidable and that even with dramatic reductions in emissions, 550ppm seems out of reach. Indeed, they argue that continued economic prosperity is incompatible with the magnitude of emission reductions required to avoid dangerous climate change. The scientific and technical analysis is bleak. Although science contributes to policy, ultimately the parameters are determined by the economics and the politics of climate change.

The following sections cover some of the policy options available to government. Part of the discussion will question why certain policies have not been adopted and what changes would need to occur for them to gain serious consideration. The treatment is not intended to be comprehensive. I focus mainly on options that are currently being considered, but also on some policies that could make significant contributions, but are unfavoured at present. A distinction is generally drawn between economic or market solutions and what is often termed 'old fashioned' regulation. However, this distinction is not always clear-cut. Firstly, market instruments require a regulatory environment to function within. Some instruments require a greater degree of regulatory measures and monitoring than others. Secondly, complex problems may require a range of both market instruments and non-market regulatory measures. Related to this, most climate change policies create a carbon price. They do this explicitly through a carbon tax, or via an emissions trading scheme (ETS), or implicitly by restricting certain activities through the imposition of regulatory standards (Hepburn and Stern 2009, p. 49).

Economic or Market Instruments

Economic instruments such as a carbon tax or ETS are market-based approaches to environmental problems. They are based on the concept of 'market failure' which is the idea that environmental problems arise because the market fails to include factors such as pollution in the price mechanism. In other words, environmental impacts are 'external' to the price mechanism. For example, anthropogenic emissions of greenhouse gases have substantially altered the composition of the atmosphere, and according to the majority of

scientists, will have significant negative consequences for human social and economic systems. Yet, greenhouse gases have been emitted into the atmosphere at no economic cost to the producer or emitter. In effect, the atmosphere has functioned as a free waste dump. Because carbon pollution has been external to the pricing mechanisms of the market, fossil fuels have benefitted from an ongoing implicit environmental subsidy. This has left their prices lower than they would otherwise be if external impacts were factored into their price.

This logic implies that climate change would not have occurred if the market had priced carbon pollution correctly. Economic instruments are designed to rectify market failure and solve environmental problems by internalising the costs of polluting activity. Cost internalisation aims to influence the behaviour of producers and consumers by making polluting activity more expensive and therefore less attractive compared to less polluting alternatives. In theory, this should provide a market incentive for research and development in alternative energy technologies. Polluters have a choice to either avoid the cost by reducing pollution, or pay the extra price to continue polluting. Advocates claim economic instruments are more cost-efficient than ‘blanket’ regulation because the element of choice encourages those most able to reduce pollution to do so (Parkinson 2010, pp. 9-14; Peace and Stavins 2010, pp. 3-4). In theory, the costs of polluting activity are borne by producers and consumers, but the revenue raised by economic instruments, either from tax or the sale of pollution permits, should flow to governments and indirectly back to citizens.

Both a carbon tax and an ETS create a carbon price: a carbon tax by an additional surcharge, and an ETS because the scarcity value attached to the pollution permits raises their price leading to an increase in the price of polluting activity (Gittins 2007a). A key difference between a carbon tax and an ETS relates to the market variable that they attempt to control. In a market system, price and quantity determine the supply and demand for goods and services. It is possible to control either one of these variables independently, but not both of them simultaneously. A tax aims to reduce the quantity of pollution by raising the price of polluting activities. By contrast, an ETS imposes a limit on the quantity of emissions by restricting the number of pollution permits to a pre-determined amount.

Proponents note that provided the emissions cap has environmental integrity, an ETS has several advantages over a carbon tax. Martin Parkinson (2010, pp. 9-10), Secretary of the

Department of Climate Change, identifies four main advantages of an ETS over a carbon tax. Firstly an ETS establishes a maximum permissible level of carbon pollution that can be adjusted to meet certain quantum targets. Secondly, the trading aspect should allow for least cost abatement. Thirdly, an ETS and the carbon price adjust to upturns and downturns in the economic cycle. Fourthly, because a market for future carbon prices already exists under an operational ETS, 'it is easier for companies to hedge their carbon price risk in an emissions trading scheme than under a carbon tax' (Parkinson 2010, p. 10).

Some climate advocates, for example Hansen (2009, p. 212-216), use the shortcomings of an ETS to argue the advantages of a carbon tax, in particular its alleged simplicity and transparency. However, several economists (e.g. Parkinson 2010, pp. 10-11; Garnaut 2010; Hamilton 2009, pp. 4-5) point out that a carbon tax is likely to be equally complex and subject to as much special interest pleading and distortion as an ETS.

Emissions Trading Schemes

An ETS establishes a market for pollution by distributing tradeable pollution rights to eligible firms within an institutional and regulatory framework. Proponents argue that so long as the credits are 'robust', carbon trading increases the efficiency of an ETS by delivering the cheapest options for carbon abatement (Parkinson 2010, pp. 13-14). However, carbon trading itself has risks. Opponents argue that the value of international carbon credits is suspect, with many offset mechanisms in developing countries based on dubious emission reduction schemes that have harmful environmental and social outcomes (e.g. Bachram 2004, pp. 4-9; Beder 2006, pp. 180-82, 188-89; Lohman 2006, pp. 219-309). For example, there is no guarantee that avoided deforestation in one area will not lead to deforestation in another area. Furthermore, many offset mechanisms treat the combustion of fossil carbon such as coal and green carbon stored in trees as equivalent. This assumes that forest schemes can compensate for continued fossil fuel emissions.

Moreover, there are potentially huge risks inherent in carbon markets. In particular, large scale carbon derivatives trading including speculative secondary markets trading in poorly verified carbon offsets, or subprime carbon, could ruin the environmental and financial integrity of the global carbon market (Chan 2009, pp. 2-4). Future secondary carbon markets

are potentially far larger than the secondary markets implicated in the 2008 global financial crisis.

In addition, carbon trading may allow countries to avoid reducing domestic emissions. For example, Australia could continue on its current trajectory of increasing emissions and meet a reduction target by purchasing carbon credits on the international market. In its White Paper on the design of the Carbon Pollution Reduction Scheme (CPRS), the Australian Government (2008d, sec. 11- 9) stated that its 'final policy position is to allow an unlimited number of eligible international units to be accepted for Scheme compliance'. This means that firms may choose to purchase carbon credits on the international market if that is cheaper than reducing domestic emissions. This is a supposed advantage of emissions trading because it provides opportunities for least-cost abatement and is therefore more economically efficient. However, it may undermine the quest for global cooperation on emissions reductions. It could be seen, particularly by developing countries, as an attempt by Australia, the country with the fifth highest per capita carbon emissions of any nation, to avoid any commitment to domestic emissions reductions.

Carbon trading therefore highlights a key area of dispute. Proponents argue that trading facilitates least-cost abatement. Opponents argue that a market scheme does not necessarily restrict pollution. Instead, it offers polluters a choice to reduce emissions, or continue polluting the environment and cover their emissions by purchasing credits. Sharon Beder (2006, pp. 196-97) points out that trading may discourage innovation and perpetuate bad practice rather than reduce or eliminate emissions. Moreover, by legitimising pollution as an entitlement, trading undermines the ability of citizens to generate outrage against environmental damage caused by corporations (Beder 2006, pp. 218-19). An ETS favours industry because it allows corporations to proceed with business-as-usual and removes the stigma from their activities.

A second inherent flaw of an ETS is the volatility of a market price for carbon both in the present and in the future (Harrington 2010, p. 1). Energy systems are a long-lived investment, typically at least 50 years. Given that the future price of carbon under an ETS is unknown, energy investment decisions are clouded in uncertainty. The predictability of the carbon price over the next fifty years is essential for a relatively smooth transition to a low carbon

economy (Harrington 2010, pp. 1, 10). Price not only determines the investment decisions for fossil fuels, but also the investment decisions for renewable energies. The recent collapse in the European Union (EU) carbon price has destroyed the economic incentive to invest in clean energy. The fluctuations of the price mechanism do not provide a sufficient means for driving the growth of a clean energy sector (Harrington 2010). Critics argue that any scheme that relies on a market price for carbon is beset by uncertainty and will be unable to deter continued investment in fossil fuels or deliver the required amount of new investment in clean energy technology.

William Nordhaus (2008, p. 25), an economist who has long worked in the area of climate change, points out that economic theory states that with market mechanisms to combat pollution, 'the public should capture the revenues through taxes or auctions, and there should be an absolute minimum of exemptions'. Under an ETS, pollution rights may be auctioned or allocated free of charge to the major polluters. Auctioning has several advantages. Firstly, it complies with the polluter pays principle to the degree that polluters should pay for the cost of their pollution, or at least the market value of their pollution. Ultimately, the aim of reducing emissions caps and creating higher permit prices is to force the dirtiest polluters out of the market. Secondly, the requirement to bid for permits provides an incentive for firms to cut their pollution (Garnaut 2008b, pp. 331-332). Those that cannot easily reduce their pollution may pass the cost on to their customers which provides a price signal to consumers to either reduce their consumption of that product or switch to a lower cost and less polluting alternative. This would increase the demand for cleaner alternatives. If a firm cannot pass the cost on because of competitive pressures, then it must absorb the permit cost which would reduce its profitability. Thirdly, the revenue from the permit auction passes to the public purse via the government. This revenue may be used for various purposes such as funding the deployment of cleaner energy technologies and reducing income taxes (see section on ecological tax reform).

However, the theory of an ETS often diverges from the practice because governments are subject to enormous pressure from industry. One of the easiest ways for governments to induce industry to accept some form of policy action on climate change is to offer free permit allocation to the major polluters. But free permit allocation undermines the economic and

environmental integrity of an ETS, involves a substantial transfer of wealth from the public to the worst polluters and inverts the polluter pays principle (Gittins 2007a; Garnaut 2008b, pp. 314-15, 343; Daley and Edis 2010, p. 4). Furthermore, European experience with free permit allocation shows that major polluters still charge higher prices to the consumer (Lohmann 2006, p. 91; Macgill and Betz 2008, p. 1). The consumer therefore ends up paying twice for the pollution, and the government delivers windfall profits to big corporations. By rewarding the worst performers and punishing cleaner alternatives, free allocation of permits distorts the market and erodes any incentive to reduce pollution and invest in cleaner alternatives (Macgill and Betz 2008, p. 2).

Carbon Tax

A carbon tax is a price-based measure levied on the carbon content of fossil fuels (Beder 2006). Advocates claim that a key advantage of a carbon tax is the price certainty that it provides. Price certainty is an important aspect of business investment decisions, for example, decisions to invest in alternative production processes or clean energy technologies. Proponents also argue that a carbon tax is a relatively transparent and straightforward policy to administer, particularly if applied 'upstream', for example at the point of fossil fuel production or refining.

Compared to an ETS, the main disadvantage of a carbon tax is that it provides no environmental certainty because raising the price of carbon does not deliver a pre-determined reduction in emissions. Energy elasticity or the responsiveness of energy to price is 'imprecise and uncertain', but studies indicate demand for energy is more responsive to price over the long-term (Lipow 2008, pp. 1-2). The Energy Futures Forum made up primarily of fossil fuel corporations and convened by the CSIRO modelled the carbon price needed to achieve a target of 575ppm by 2100 under a range of different scenarios based on varying degrees of assumed international cooperation. The scenarios run by the CSIRO (2006, pp. 2-4, 64) contain carbon prices far higher (up to $623 per tonne) than anything currently entertained by the Australian government. Yet, recent scientific evidence suggests that emissions reductions of far greater magnitude are needed than the modest reductions envisaged in the Energy Futures Forum scenarios. There is as yet no demonstrated

mechanism that suggests a tax could reduce Australian emissions by, for example, 90 per cent over 2000 levels by 2050.

Conclusion on market instruments

Even if it were possible to overcome the political obstacles to the effective implementation of an ETS or a carbon tax, market measures suffer a crucial limitation, and this relates to what economic instruments are designed to achieve. Beder (2006, pp. 192-93) points out that economic instruments encourage incremental changes to achieve an economically optimal level of pollution at least-cost, rather than an environmentally optimal reduction in pollution over a short time period. Market measures appear ill-suited as mechanisms to drive rapid technological and structural change of the magnitude required to achieve the almost complete decarbonisation of energy supply.

Most economists argue that the price incentives in a market system are more efficient than regulation. An increase in demand for a product leads to rising prices in the short term. The price signal then induces suppliers to increase production until supply matches demand and the market regains equilibrium. In this example, the price signal serves as a mechanism to bring forth increased supply of a product. Yet as economist Tim Leunig (2009) observes, the same mechanism may not work if the process is reversed and a deliberate price increase is used to ration demand for essential goods and services such as fossil-fuel based energy when the government has determined that supply must be reduced. Relying solely on the price mechanism in these circumstances will mean that the rich can still afford to consume high-carbon goods, but the mass of poorer people will miss out.

Finally, even with a steadily rising carbon price, there is no demonstrated mechanism whereby higher energy prices automatically lead to investment in low or zero emission technologies and the mass consumption of such technologies (Beder 2008). Proponents assume the market will provide the alternatives, but government intervention and investment is often required to overcome market barriers.[25] For example, public transport requires government investment. Meanwhile, vehicle emissions and building performance require

[25] Some economists such as Robert Stavins, a long-time proponent of market mechanisms, recognise that some additional policy may be needed to overcome market failures (Stavins 2009, pp. 198-199).

government regulatory standards and codes (Beder 2008). This contradicts the claim made by many proponents of market mechanisms (e.g. Nordhaus 2008, p. 22) that ‘raising the price of carbon is a necessary and sufficient step for tackling global warming’. A carbon price may be necessary but it is insufficient. Indeed, regulatory standards may deliver an implicit carbon price. Other policies to overcome market failure and expedite a faster transition to a low carbon economy are required. The strengths and limitations of some of these other policies are explained in the following sections.

Feed-in tariffs

Feed-in tariffs are a type of economic instrument that pays a guaranteed premium rate for electricity fed into the grid from renewable sources. The price signal is most useful for encouraging the uptake of currently expensive technologies such as grid-connected solar thermal power stations and solar PV (photovoltaic) which are unable to compete on price in the market, but have large potential once they have developed economies of scale through building market share. Feed-in tariffs have the advantage that they do not require government funding. The tariffs are set by government, but paid by the utility, and therefore ultimately by the consumer (Diesendorf 2007, p. 310). Solar electricity generated during daylight hours coincides with peak electricity demand, particularly for summer air-conditioning. Therefore, a feed-in program is best developed in conjunction with programs mandating the installation of domestic solar water heaters as solar panels do not provide night time generating capacity to run conventional off-peak electric hot water systems.[26]

The design of a feed-in tariff has a significant impact on the effectiveness of the scheme. Tariffs can be either gross or net. A gross feed-in tariff pays a premium on all electricity generated from a renewable source and provides a larger incentive for households to purchase grid-connected solar PV systems because the returns on the investment are greater and the pay-back period is shorter. By contrast, a net feed-in tariff only pays a premium price for any surplus electricity generated over and above any electricity consumed, and therefore may provide only minimal incentive.

[26] By contrast, new solar thermal technology being developed in Spain with molten salt storage has the potential to deliver electricity outside of daylight hours.

A gross tariff has been used in Germany to promote the uptake of solar PV. Since introducing feed-in legislation in 2000, Germany has had significant growth in its solar industry and is a world leader in installed solar PV (Gan et al 2007, pp. 147, 152; Wüstenhagen and Bilharz 2006, pp. 1685, 1688-89). In Australia, the ACT and NSW have adopted a gross feed-in tariff and Tasmania, South Australia, Victoria and Queensland have adopted a net feed-in tariff.

Another consideration is whether the tariff is applicable to both micro and macro systems. Restricting a feed-in tariff to small household systems means that there is no incentive to develop large systems suitable for warehouses and shopping centre developments, and no incentive for macro systems such as solar thermal power stations. Yet solar thermal power stations have far greater potential to reduce emissions at lower cost than purely domestic systems. Furthermore, the scale of macro systems is likely to drive economies of scale much faster. This would lead to falls in the cost of renewable energy systems, and encourage investment in domestic solar manufacturing capacity.

Possibly the most crucial component of a feed-in scheme is a stable tariff for a guaranteed period at a significant price. Policy instability undermines the tariff system which leads to boom and bust cycles that retard the development of renewable energy systems (Toke et al 2008, p. 1138; Stewart-Rattray and Diesendorf 2009, p. 6). The tariff policy of the NSW state government illustrates the confusion that can arise from ill-considered policy. In 2010 the NSW government introduced a gross tariff of 60 cents a kilowatt hour for household generated solar power until 2017. This was suddenly cut in October 2010 to 20 cents a kilowatt hour. Sustainable energy expert Mark Diesendorf had previously suggested that a better policy would have been a 40 cent tariff over a 15 year period that would have stimulated investment and enabled stable industry growth (in Curtin 2010).

In sum, feed-in tariffs are particularly useful for encouraging solar thermal power stations, and have limited application for domestic solar PV. Reasonable tariffs guaranteed for a reasonable period and designed to include macro-scale energy systems are essential to ensure least-cost development, drive economies of scale, encourage domestic manufacturing, and ultimately produce a cost competitive and sustainable industry.

Renewable Energy Targets

A renewable energy target (RET) is a legislated target mandating energy retailers to purchase a certain amount of renewable energy in the form of renewable energy certificates. An RET is an industry development measure designed to increase the size of the renewable energy industry. It could be phased out over time as renewable energy costs fall. An RET suits the cheapest forms of renewable energy and has led to a large increase in macro wind energy investment. Diesendorf (2007) suggests that an RET should therefore be used in conjunction with other measures to stimulate research, development and deployment of a range of technologies.

Definitions of what counts as renewable electricity generation are critical in attaining sustainable outcomes. Otherwise the effectiveness of an RET could be diluted by components that are counter-productive, or better encouraged by other measures. The Rudd government (Australian Government 2009a, p.2) decided to allow native forests to count as renewable fuels for electricity generation. Scientific research by Brendan Mackey et al (2008, p. 6) found that native forests in south east Australia are a premium carbon sink on a global scale, absorbing much higher levels of CO_2 than previously realised. Mackey et al (2008, p. 7) argued that the best use of native forests was to leave them to continue their ecological services. Logging high-value native forest carbon sinks would therefore be counter-productive, and a perverse outcome of allowing native forest biomass to count as a source of renewable energy.

An example of a technology better encouraged by other measures is solar water heaters. Wilkenfeld (2008) points out that solar water heaters do not generate electricity and are not purely solar, typically relying on fossil fuels for 30 to 40 per cent of their annual heat load. Wilkenfeld argues that they are therefore a more efficient use of fossil fuel electricity and could be better encouraged by a rebate on the purchase price. Including solar water heaters in an RET dilutes the target and means the scheme may only effectively mandate for 15 rather than 20 per cent of actual electricity supply from renewable sources by 2020 (Wilkenfeld 2008).

An RET is opposed by industry, free-market think tanks and by many economists and political commentators. Industry opposition is based mainly on the imposition of costs on industry sectors, but also draws on ideological opposition to notions of central planning and ‘picking winners’ as opposed to more market oriented schemes. The AIGN (2009) argues that an RET is an unnecessary high cost scheme when Australia is implementing an ETS to reduce emissions. The AIGN argues that an ETS sets a cap for emissions and allows for least cost abatement – a situation that would be distorted by an RET. Similar arguments are made by Alan Moran from the free-market think tank, the Institute of Public Affairs (IPA) (2009), and by the Business Council of Australia (BCA) (2009). The AIGN, IPA and BCA all invoke the authority of the Productivity Commission which they note made similar points in its prior submission to the Garnaut Review. A similar message is conveyed by editor-at-large Paul Kelly (2009) of *The Australian*.

Like other government measures, an RET can be undermined by selective provisions for industry. In May 2009 the Rudd government decided to exempt the largest polluters known as the emissions-intensive trade-exposed industries from participating in the RET (Australian Government 2009a, pp. 3-4; Coorey 2009). This means the largest polluters face no incentive to reduce emissions, and further distorts the market by giving the largest polluters a government-sanctioned competitive advantage over their cleaner rivals.

Subsidies and Rebates

The issue of subsidies and rebates is highly contentious. Neo-liberal think tanks and economists accuse the renewable energy sector of lobbying for unjustified subsidies. Yet, Governments have historically offered substantial subsidies to the fossil fuel sector. Ongoing subsidies directed to fossil fuels[27] in Australia currently total over $9 billion per annum (Riedy 2007, p. iv).[28] Many of these subsidies are perverse: they increase emissions and they reduce economic efficiency. According to the International Energy Agency (IEA) (2010, p. 13), ‘eradicating subsidies to fossil fuels would enhance energy security, reduce emissions of

[27] Approximately $2 billion in subsidies is for electricity and other stationary energy, and about $7 billion is for transport.
[28] Global subsidies for fossil fuels fluctuate with changes in international prices, domestic policies, and demand. In 2008, they totalled $558 billion and in 2009 they were $312 billion (International Energy Agency [IEA] 2010, p. 13).

greenhouse gases and air pollution, and bring economic benefits'. This would deliver what the IEA (2010, p. 13) call a 'triple-win solution'.

Australian governments have provided subsidies and rebates to help reduce greenhouse gas emissions. The Howard federal government introduced rebates on solar PV systems and increased the rebate up to a maximum of $8000 in the lead-up to the 2007 election. This program has been continued by the Rudd government until the end of June 2009 and has resulted so far in the installation of 29,000 solar systems. Critics of the scheme argue that the rebates are economically inefficient because solar PV is too expensive and there is very little emissions reduction for the financial outlay. An evaluation by Andrew Macintosh and Deb Wilkinson (2010, p. 24) found the scheme was inequitable, ineffective, expensive, and offered limited assistance to domestic solar manufacturing. Parkinson (2010, pp. 7-8) notes that even if all Australian households had a 1.5 kW PV system, it would only reduce emissions by a fraction of the 5 per cent needed to meet Australia's current 2020 emissions target. In Australia, governments have promoted solar rebates to show they are serious about tackling climate change. Yet the manner in which governments have used solar rebates in isolation from any other effective measures indicates their deployment is tokenistic.

Regulation

Much early environmental regulation such as the Clean Air Acts in the US and the UK stipulated the permissible level of pollutants resulting from particular activities. Most of the regulation relevant to climate change deals with energy efficiency measures and emissions standards. Examples include building codes to reduce or eliminate artificial heating and cooling requirements, vehicle fuel consumption standards, vehicle emission standards, and emission standards for power generation.

Australia's relative abundance of cheap coal has meant there has been little economic incentive to conserve energy or use it more efficiently. It is therefore possible that Australia could significantly reduce greenhouse gas emissions by taking advantage of low-cost opportunities for energy efficiency (Hamilton 2001; Saddler et al 2004a). Economic theorists argue that there are no efficiency gains to be exploited because rational firms would have already taken advantage of them. In practice, lack of knowledge and various other barriers

mean that energy efficiency in Australia is an under-exploited and readily available source of emission reductions (Hamilton 2001, pp. 22-23; Saddler et al 2004a, pp. 56-75). Regulation is an important mechanism for overcoming market failure and achieving energy efficiency gains. Diesendorf (2007, pp 311-15) lists a range of measure including mandatory energy rating and labelling, a range of minimum energy performance standards, and the banning of perverse electricity charges that could drive substantial efficiency gains.

I look briefly at four regulatory measures: mandates for solar water heating, vehicle fuel and emission standards, emissions performance standards for electricity generation, and a moratorium on new coal-fired power stations without carbon capture and storage (CCS). I also consider some potential drawbacks and difficulties in their implementation.

Solar water heaters

Heating water uses just over a quarter of residential energy (Diesendorf 2007, p. 154). Solar water heaters rely primarily on sunlight to heat water, with about a third of total energy requirements being met by gas or electric boosting (Wilkenfeld 2008). A range of measures could help the uptake of solar water heaters (see Saddler et al 2004a, pp. 146-147; Diesendorf 2007, pp. 323-324). For example, solar water heaters could be mandated for all new and substantially renovated homes. There could also be a plan to phase out electric resistance hot water heaters. In addition, peak load pricing that reflected the costs of day-time electricity generation could be introduced (Diesendorf 2007, p. 323). This would support the development of both solar water and solar PV technologies which both reach optimal production in day-time periods.

Nevertheless, Wilkenfeld (2007, no page given, emphasis original) argues that ‘solar water heaters are barely cost-effective compared with efficient natural gas water heaters’ and that ‘electric-boosted solar water heaters actually have *higher* emissions than conventional gas water heaters’. This again points to the need to clearly identify policies that reduce emissions effectively and efficiently.

Vehicle fuel and emission standards

Various countries have vehicle fuel and emission standards which are generally tightened progressively over time with the aim of reducing emissions per vehicle. Consumption and emission standards set a minimum legal limit with which all vehicles must comply before being eligible for sale. Limits and standards are an important element of reducing emissions per vehicle.

However, improving fuel and emission standards does not guarantee a reduction in overall emissions unless emissions are reduced to zero. The reason is that compulsory improvements in fuel consumption, other things being equal, would equate to an effective reduction in relative fuel prices for a given distance travelled. In effect, improvements in fuel consumption would equate to a fall in the price of fuel such as petrol. The gains could be spent increasing overall distance travelled up to a similar level of fuel spending, thus negating the gains in emissions reduction.

Moreover, emissions standards reduce emissions per vehicle. Yet increases in the total number of vehicles on the road – due to increases in population and/or affluence – could override the gains from standards. Emission standards are important in reducing per capita emissions if the gains are not spent in further consumption, and they are an improvement on no standards even if growth in population and affluence continues. But emissions standards only address one aspect of the problem. Efficiency gains and mandated improvements in fuel standards could be aided by rising prices (due to taxes or supply constraints e.g. peak oil[29]), thus reducing the tendency to increased consumption.

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[29] Petroleum geologist Colin Campbell, founder of the Association for the Study of Peak Oil and Gas (ASPO) states that ‘Peak Oil refers to the maximum rate of the production of oil in any area under consideration, recognising that it is a finite natural resource, subject to depletion’ (ASPO 2011a). There is an extensive literature on peak oil in peer reviewed journals going back to the 1960s (see ASPO 2011b). At the point of global peak in (*conventional*) oil, half the world’s total reserves of conventional oil will have been used. This helps explain why international agencies such as the IEA (2008, p. 6) assume that future demand will be met by *unconventional* oil supplies such as tar sands and oil shales. The distinction between conventional and unconventional sources of oil (and gas) is crucial for several reasons (including geopolitics), but some pertain directly to climate change policy. Firstly, it cannot be assumed with the peaking of conventional oil (and gas) that the overall supply of oil and gas (conventional plus unconventional) will peak soon. Fossil fuels may be finite, but they are still abundant. Secondly, the extraction of unconventional fossil fuels may be significantly more polluting in terms of overall greenhouse gas emissions than extracting conventional fossil fuels.

Emissions performance standards for electricity generation

Regulation can also be used to impose an emissions performance standard (EPS) on power stations to limit CO_2 emissions. Current Australian emissions typically range from 0.4 tonne CO_2/MWh (megawatt hour) for gas, 0.8-1.0 tonne CO_2/MWh from black coal, and up to 1.5 tonnes CO_2/MWh from brown coal (Diesendorf 2007, p. 217). The California government (2006) limited long-term investment in power generation to plants that emit less than 0.5 tonne CO_2/MWh. However, the government did not need to confront vested coal interests to introduce this legislation because California has no large coal-fired power plants, and the 20 per cent of electricity used in California that is generated by coal comes from interstate (see Milford et al 2005, p. 1).

Diesendorf (2007, p. 311) suggests a similar policy could be applied in Australia. Standards for new power stations could be set at 0.5 tonne CO_2/MWh and reduced to 0.1 tonne in 2020. Phased reductions could be implemented for existing stations beginning at 0.7 tonnes in 2012 and reaching 0.5 tonnes CO_2/MWh by 2022. Gas, the lowest emission fossil fuel, is likely to be a critical interim technology over coming decades until renewable energy technologies are mainstreamed. An EPS would ensure that new power stations are either zero-emissions renewable energy or low emissions gas-fired combined-cycle or cogeneration plants (Diesendorf 2007, p. 311).

An EPS also avoids a potentially perverse and unintended outcome of an RET. Under an RET, it is possible that mandated increases in renewable energy could squeeze more expensive gas-fired power out of the market, and yet have no impact in reducing the share of dirty coal-fired power in the overall electricity market (Garnaut 2008, p. 356). Direct regulation such as an EPS provides the greatest certainty for reducing carbon emissions from existing power generation and for preventing the development of new emissions intensive electricity.

However, regulation as a tool to reduce energy emissions faces major obstacles. Environmental regulation has been strenuously opposed by industry, sections of the media and corporate-funded think-tanks and front groups (Beder 2006, p. 9). Unlike an ETS that merely adds to the cost of doing business, an EPS aims to phase out coal-fired power stations.

As such, regulation would be subject to far more intense opposition from industry interests than an ETS. This raises the stakes for government and would crystallise debate around coal and policy action. Regulation is not even on the public agenda. Given that regulation will not be contemplated by government without overwhelming and sustained community pressure, EPS standards for power generation are not a likely policy option at present.

Moratorium on new coal-fired power stations

A moratorium on the commissioning of any new coal-fired station is the centre-piece of a major grass-roots campaign in the US organised by the Sierra Club (2010) that has prevented the construction of over one hundred new coal-fired power stations since 2001. The idea of a moratorium on any coal-fired power station that does not incorporate carbon capture and storage (CCS) in its start-up design has been promoted by climate scientist and advocate James Hansen. He identifies coal as the key culprit in climate change and has argued in scientific papers (Hansen et al. 2008, p. 229), in letters to heads of State (2008a), and in testimony in court (2008b, p. 11), that the coal industry must be scaled back and that the world cannot afford to burn coal beyond 2030.

A legally-enforceable moratorium has been applied at various times in Australia to uranium mining and the growing of genetically-modified crops. Public pressure and the perceived weight of public opinion are significant factors in a government declaring and maintaining a moratorium. A moratorium appears very unlikely at present given the extent to which coal currently underpins global electricity production, particularly in an era where conventional oil supply is peaking in various locations around the globe and where renewable energy is such a small fraction of global energy supply.

A moratorium would signal the need for a radical transformation of energy supply. Although a moratorium does not involve closing down existing power stations, it effectively prevents the construction of any more unless and until, CCS or equivalent technology renders coal zero-emissions. Combined with regulatory power station emission standards, it could constitute a planned phase-out of coal fired generation. However, moratoriums are purely symbolic ideas unless accompanied by a raft of policies designed to rapidly deploy micro and macro-scale renewable energy technology.

Various forms of regulatory standards are an essential component of a response to global warming. Indeed, they may be sufficient to provide an implicit carbon price. However, they need to be accompanied by public and private investment in new energy infrastructure as well as policies that address other sectors of the economy. The next sections cover some of the energy options, followed by a brief discussion of some other policy areas.

'Clean coal'

Coal is the major source of electricity globally, and demand for coal is predicted to grow over the next decade (IEA 2010, p. 5). Given that coal is such an integral part of energy supply, many participants in the energy and climate change debate view CO_2 capture and storage (CCS) as an important and perhaps critical part of a solution to climate change (e.g. IEA 2008, p. 3; IPCC 2005; Stern 2007, pp. 250-251, 314, 419, 592-594, 596-597; Massachusetts Institute of Technology 2007, pp. x-xv; Garnaut 2008, pp. 485-489, 493-496; Monbiot 2007, pp. 84-87, 99).

'Clean coal' is a malleable term. It covers various technologies designed to reduce emissions from burning coal. These include various forms of coal gasification and fluidised bed combustion which burn the coal more efficiently and reduce emissions somewhat,[30] but still leave coal as a far more polluting fuel source than gas. Currently available technology is only capable of making coal burning slightly less dirty. By contrast, CCS is an unproven technology that purports to reduce emissions by 80-90 per cent. This would involve capturing of CO_2 emissions from specially designed and integrated coal-fired power stations and transporting and storing the gas in safe underground deposits.

In Australia, both major political parties maintain that coal is integral to the Australian economy. Australian governments under both Howard and Rudd have portrayed themselves as realistic by stating that coal will remain the dominant fuel source for the foreseeable future (Australian Government 2004; Rudd 2009a). Both Howard and Rudd assert that CCS is a practical response that reconciles the reality of growing global energy demand with the need

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[30] Improving combustion technology does not address other problematic aspects of coal mining and combustion such as land degradation, water pollution, air quality and the impacts of coal on human health (Diesendorf 2007, pp. 218-224; Lockwood et al 2009).

for emissions reductions. According to Howard (2006a, p. 3), CCS merged ‘economic opportunity with environmental responsibility’, while Rudd has stated that CCS is ‘a key component of the solution to climate change’ (Rudd 2009a). Besides official rhetoric, both governments made financial commitments to clean coal. The Howard government Energy White Paper (Australian Government 2004) allocated $500 million to the Low Emission Technology Demonstration Fund. The Rudd government (Australian Government 2008a) contributed $500 million to a National Clean Coal Fund.

However, some energy experts are critical of the government’s approach to the technology. Hugh Saddler (2004) argues that there is an inherent contradiction in government funding for clean coal. Both the Howard and Rudd governments have been unwilling to expose Australian industry to the effects of a carbon price claiming it will destroy our international competitiveness. However, CCS is likely to be considerably more expensive than conventional coal because extra energy is required to separate the CO_2 in the post-combustion phase and extensive infrastructure is required to transport and bury the CO_2 underground (Saddler et al 2004b). Saddler (2004) points out that if the same criteria of cost-competitiveness that the federal government applies to renewable energy supplies are applied to clean coal technology and geo-sequestration, they will be uneconomic to install. If there is no carbon price, then CCS will not be implemented. Yet, if a carbon price is implemented, currently available and proven renewable technology such as wind power, as well as fossil fuel energy sources such as gas, would be price competitive in the energy market and would achieve immediate emissions reductions.

This leads to the second major problem with CCS: the delay factor. Even if CCS became technologically feasible by 2020, it would make a very small contribution in emissions reductions by 2030. According to the IEA (2008, p. 12), over half the electricity stock currently in operation globally will still be operating in 2030, including all the coal-fired power stations built before CCS becomes commercially implemented. Saddler, Reidy and Passey (2004b, p. xii) estimate that even if CCS was commercially available in Australia by 2020, it would only reduce cumulative emissions by 2.4 per cent between 2005 and 2030. The delay factor inherent in CCS means that the technology will have minimal impact in the

near future.[31] Many activists assert that clean coal is therefore a deceptive term used by governments and the coal industry to legitimise the continued expansion in the coal industry by holding out the promise of clean coal by 2030 or some time after.

Drawing on recent studies in the energy literature, some activists also argue that there may be a further reason for avoiding massive investment in CCS. A number of reports (Zittel and Schindler 2007; Mohr and Evans 2009; Patzek and Croft 2010; Höök, Zittel, Schindler and Alekett 2010; Rutledge 2011) suggest that peak coal – the point at which global coal production reaches its maximum point – is likely to occur within the net two decades. Although Australia and India have recently increased their reserve estimates, all other major global producers have revised their estimates downwards, some by significant quantities (Zittel and Schindler 2007, pp. 4-8). The US has the world's largest coal reserves and is the world's second largest coal producer after China. Yet, the US passed peak production in terms of coal energy content (as opposed to volume) in 2005 (Zittel and Schindler 2007, p. 6). Heinberg and Fridley (2010) argue that the combination of rising global demand and peaking of coal supplies will inevitably lead to rising coal prices. Taken together, various assessments of CCS indicate that money may be better invested in more sustainable energy technologies and that investment in 'clean coal' is likely to be both expensive and futile.[32]

Nuclear power

Nuclear power has been promoted as a low-carbon source of electricity capable of making a valuable contribution to climate change goals because the operation of a nuclear reactor does not emit CO_2 (Massachusetts Institute of Technology 2003, 2009). However, Diesendorf (2007, pp. 248-254) argues that it is important to consider the following points about the entire nuclear fuel chain when evaluating these claims. Firstly, the construction and decommissioning of a nuclear power plant causes significant emissions. Secondly, the emissions from mining and milling depend on the grade of ore available. High grade ores

[31] There are currently no fully-integrated industrial-scale CCS plants operating anywhere in the world. Furthermore, in 2010 the Queensland state government cancelled its ZeroGen 'clean coal' power station project (ABC 2010b).

[32] Nevertheless, as with arguments about peak oil (see footnote 29, p. 63), estimates of peak coal production should be treated with caution because the global coal burn needs to decrease well before a potential peak in coal production occurs. Furthermore, technological changes in the future may reduce coal extraction costs and lead to an increase in economically recoverable reserves of coal.

generate low levels of emissions because the ore body is more concentrated. However, high grade ores may only last a few decades if nuclear energy is substantially expanded. They do not therefore represent a long-term sustainable substitute for fossil fuel energy. By contrast, low grade ores require ten tonnes of ore to produce one kilogram of yellowcake. This leads to such a large increase in emissions that nuclear power derived from low grade ore would produce emissions ‘comparable with those from an equivalent combined-cycle gas-fired power station’ (Diesendorf 2007, p. 253). This indicates that although nuclear power may qualify as a relatively low-emissions technology, it does not provide a long-term zero emissions alternative to fossil fuels.

Although nuclear power is enjoying a renaissance in several countries outside of the long-established liberal democracies, two aspects of the nuclear chain pose significant risks, both now and far into the future. Firstly, nuclear weapons can be obtained from a civilian nuclear power program leading to the risk of nuclear proliferation (Diesendorf 2007, pp. 260-264). Secondly, ‘uranium mining produces vast quantities of long-lived, low-level radioactive waste’ which accumulates on-site (Diesendorf 2007, p. 249). Spent nuclear fuel produces highly radioactive waste for which there is no reprocessing in either the US or the UK. Most waste is in temporary storage on-site as there is not a single site for long-lived high-level radioactive waste in existence anywhere in the world. This inability to deal with waste indicates there are still substantial obstacles to be overcome before a nuclear program could be considered viable. Nuclear is therefore a highly political issue, and in liberal democracies the issues of proliferation and waste must be resolved by governments and citizens (Helm 2009).

Even if the political conflicts over nuclear waste and the potential for weapons proliferation are resolved, decisions by the private sector about whether to invest in a nuclear program will proceed on the basis of economics. The cost of nuclear power is contested. However, nuclear power receives implicit public subsidies. For example, decommissioning costs are not factored into the cost of electricity produced from a nuclear power plant. In the UK, the cost of decommissioning existing nuclear power plants was estimated to be £90 billion (Morgan 2006). In Australia, Garnaut (2008b, pp. 475-476) did not consider nuclear power to be

economically competitive with other energy sources. Nuclear power therefore remains constrained by issues of sustainability, risk, and relatively high cost.

Renewable Energy Plan

Environmental NGOs (non-government organisations) and climate action groups have produced studies that examine both the technical feasibility of a rapid transition to a low carbon economy as well as a range of policy measures that could attract private sector funding for the transition. Beyond Zero Emissions and the University of Melbourne Energy Research Institute have produced a *Zero Carbon Australia Stationary Energy Plan* (Wright and Hearps 2010). The plan estimates the cost of a transition to a zero-carbon energy infrastructure at $350 billion over the next decade.[33] This covers the rapid deployment of proven renewable technologies for stationery energy such as concentrated solar thermal power stations and wind power generation, upgrading power-supply infrastructure to incorporate demand management and distributed supply, and redesigning transport systems to run on electricity provided by a renewable grid. The plan provides a technological blueprint for how Australia could achieve a zero carbon economy within ten years.

The cost of a transition to a zero carbon economy raises the issue of funding. O'Connor and Chenoweth (2010) produced a study for the Australian Conservation Foundation that examined a range of policy measures beyond a carbon price that governments could use to facilitate large scale private sector investment in renewable energy systems.[34] Recommendations include a Clean Energy Finance Corporation, climate bond issues, direct participation in low carbon projects and targeted tax measures (O'Connor and Chenoweth 2010, p. 7).

Public Investment in Clean Energy Technology

Despite its current unpopularity in many government circles, government investment in infrastructure needs reconsidering, particularly for projects that 'enjoy a commercial rate of

[33] Stephen DeCanio and Anders Fremstad (2010) note that the investment required to achieve a global zero emissions energy supply is roughly comparable to that expended by the United States in pursuing its foreign policy objectives including the purchase of oil and gas.
[34] The ACF (2010, pp. 13-14) also makes a case for government investment in, and public ownership of, some energy infrastructure.

return well above the cost of borrowing', (Lateral Economics 2010, p. i). Most major infrastructure has been built with public funding and/or the grant of public land and resources: ports, airports, railways, water and sewerage supplies, phone networks, power supplies and roads (Shellenberger et al 2008; Lipow 2010). Governments in some states of Australia still own some energy infrastructure and many parts of the energy supply system in Australia currently need replacement or upgrade. For example, the electricity grid requires significant investment in extension and upgrading to deal with distributed energy supply systems and also to better balance supply and demand. Infrastructure projects are large and costly, but governments can borrow money more cheaply than private corporations. As Lateral Economics (2010, p. 21) point out, government investment and ownership of infrastructure could provide far superior returns to society than public private partnerships because governments can build the infrastructure at a lower cost and the returns on investment flow to the public purse.

Shellenberger et al (2008, p. 113) argue that 'massive public investment is required to bring down the price of clean energy and accelerate its deployment worldwide'. For example, Shellenberger et al (2008, p. 117; see also DeCanio and Fremstad 2010) point out that 'the price of solar comes down roughly 20 per cent every time production capacity is doubled'. Furthermore, based on historical precedents, a high level of public investment will pay for itself over time and will likely trigger large-scale private investment (Shellenberger et al 2008, p. 116). There is therefore a strong case for substantial government investment in clean energy infrastructure. Moreover, an investment-driven approach is likely to encounter less public opposition than a carbon price and could easily complement a low carbon price.

Transport and Integrated Urban Planning

Over half the world's population inhabit cities, and the trend to greater urbanisation will continue under business-as-usual conditions. Given this sustained urbanisation, policies that address the planning and design of cities and urban transport are crucial in the effort to reduce greenhouse gas emissions. West Australian academic Peter Newman is an expert in urban design and transport and has produced numerous studies that address the impacts of both climate change and peak oil on cities and how best to respond to these challenges.

Peter Newman, Timothy Beatley and Heather Boyer (2009) point out that peak oil and climate change will pose substantial challenges to human civilisation. They argue that politically engaged citizens can help build the strong communities that are essential in enabling cities to embrace the technologies and make the changes necessary to prosper under new and potentially rapidly changing conditions. Priorities include the development of a carbon neutral built environment and building renewable energy infrastructure sufficient to power urban areas. Urban design is also crucial because walking and transit (trains, trams and buses) cities are far more resilient and far less emissions intensive than automobile dependent cities (Newman et al 2009, pp. 86-89). Greater urban density[35] facilitates walking and cycling and is easily married with public transit options (Newman and Hogan 1987). Cities that incorporate these design principles are likely to be more socially cohesive and inclusive (Newman et al 2009, pp. 47-54). However, these are not outcomes that will somehow magically be provided by the market following the imposition of a carbon price. Instead, there is a need for citizen engagement with policy and a strong role for government with planning policies on urban density and public investment that prioritizes walking and transit options over and above car dependency.

Forest policy

Deforestation is a major global contributor to climate change responsible for about 17 per cent of total greenhouse gas emissions (IPCC 2007b, p. 36, fig. 2.1). Forest policy is therefore a key aspect of addressing climate change. Options include using avoided deforestation as an offset credit in an ETS, or designing and implementing separate forest policies to address deforestation and switch production to plantation sources. Australia has significant potential to improve carbon sequestration through its forests because it has relatively large tracts of forest as well as cleared land suitable for revegetation (Garnaut 2008, p. 164). The development of comprehensive carbon accounting for forests and agriculture ‘is particularly important for Australia’ because of the high potential for bio-sequestration in these areas (Garnaut 2008, p. 165). It is important to distinguish between various forms of carbon to more accurately ascertain the best mix of forest policies for carbon sequestration and timber production (Blakers 2009).

[35] Paul Mees (2009, p. 7) argues that ‘density is not destiny’, and that transport policy is the key component of a rapid move toward sustainable cities rather than efforts to increase urban density.

Margaret Blakers (2009) of the Green Institute has produced a set of carbon accounts for Australia that distinguishes between various forms of carbon (Table 1). In Table 1, fossil carbon relates to the emissions from burning fossil fuels. Biocarbon relates to the carbon in forests, biomass and soils with the potential to store, absorb or release carbon. Biocarbon is divided into green carbon and production carbon. Green carbon relates to native forest. Emissions result from clearing and degradation (mainly logging) and uptake occurs with the storage potential of native forests and regrowth of logged forests. Importantly, native forest logging (degradation) is not counted as a source of emissions under the Kyoto protocol. The greatest carbon uptake occurs in native forests and this is also the area with the greatest potential for easy increases in carbon uptakes. The south east forests of Australia (southern Queensland, NSW and Victoria) are one of the most important carbon stores on the planet (Mackey et al 2008, p. 6).[36] Production carbon refers to plantation forests, agriculture and waste. Plantation forests absorb carbon during their growth period. Agriculture emits carbon through animal husbandry, burning and soils, although there is potential for improved agricultural practices to significantly increase soil uptake of carbon.

Table 1: Australia's 2006 Kyoto (green highlight) and UNFCCC greenhouse accounts in Mt CO_2e. Emissions in pink. Source: Blakers 2009, p. 10, table 3a.

Activity	Fossil carbon	Biocarbon			
		Green carbon		Production carbon	
	Emission	Emission	Uptake	Emission	Uptake
Energy/industrial processes	429				
Agriculture (includes non CO2 emissions only)				90	
Land use, land-use change and forestry					
Native forest clearing		63			
Native forest degradation and growth		31	-57		
Pre 1990 plantations				2	
Post 1990 plantations and reforestation			n.r.		-23
Croplands				n.r.	n.r.
Non-forest native vegetation, grazing land		n.r.	n.r.	n.r.	n.r.
Other				2	-4
Waste				17	
TOTAL 2006 Kyoto account (576 net)	**429**	**63**		**107**	**-23**
TOTAL 2006 UNFCCC account (550 net)	429	94	-57	111	-27

n.r. = not reported

[36] See earlier section on Renewable Energy Targets, p. 59.

One policy option for Australia to reduce its green carbon emissions and increase green carbon uptake would involve the cessation of native forest logging and its replacement with plantation forestry. According to forest economist Judith Ajani (2007, pp. 1-2, 17, 63-65), plantations currently account for 80 per cent of all forest jobs and production and there is enough plantation timber in Australia to meet all of Australia's structural and pulpwood needs. Switching all production to the plantation resource would provide further options for value-adding and increase job opportunities in forestry because native forest operations revolve almost completely around low-value woodchip exports. However, plantation sawmillers must compete against heavily subsidised native forest logging operations (Ajani 2007, pp. 2, 65-66).

Ending native forests logging is feasible because a competitive plantation industry already exists in Australia. The policy would increase industry competitiveness, improve job security, and deliver improved carbon sequestration, biodiversity conservation, and water catchment management. It would seem to be an attractive option for governments because it is economically rational and environmentally beneficial. Carbon accounting that accurately reflects the value of native forests as a long-term store of carbon is an essential part of sustainable forest policy.

Agriculture Policy

Agriculture is the second largest source of emissions in Australia after stationary energy, comprising 16 per cent of total emissions. Australia has higher than average emissions from its agricultural sector, mainly due to methane livestock emissions (Garnaut 2008, pp. 162-3). Given Australia's large landmass, land-use is likely to be of primary importance for bio-sequestration and Australia's efforts to reduce emissions in the future (Garnaut 2008, pp. 164-5; Jehne 2008). Although native forests have more potential for storing carbon per hectare, Australia's agricultural lands are vastly bigger in area. The government would like to include agriculture in an ETS at a future stage because it perceives agriculture as a low cost means of reducing emissions (Saddler and King 2008).

However, Saddler and King (2008) detail several seemingly overwhelming difficulties posed by the inclusion of agriculture in an ETS. Firstly, unlike energy emissions, the accurate

measurement of agricultural emissions is problematic and hindered by the fact that many non-anthropogenic factors contribute to agricultural emissions. This undermines the levels of confidence necessary for the effective functioning of an ETS. Secondly, practical abatement techniques are difficult to establish. Thirdly, an ETS typically targets a small number of large industrial polluters. By contrast, the agricultural sector is primarily composed of 130,000 small businesses.[37] Nevertheless, Saddler and King (2008) maintain that improving agricultural practices to reduce emissions is hugely important and consider a range of options to achieve emissions reduction including herd management, soil and fertiliser management, carbon sequestration, and policy instruments other than an ETS.

Carbon sequestration in agricultural land has several benefits. Agricultural practices since European settlement have caused a 50 per cent decrease in soil carbon (Jones 2007, p.2; Jehne 2008, pp. 9-11). Even a conservative estimate of an additional 20 tonnes of stored carbon per hectare in Australia's agricultural lands would make a substantial contribution to the draw down of atmospheric carbon. Increasing carbon in agricultural lands also increases soil productivity and improves water retention. Irrespective of climate change, increasing soil carbon would bring huge benefits to Australian agriculture (Jones 2007, pp. 2-3). Christine Jones argues that positive changes in soil carbon can be measured easily and that Australian agricultural land could become a net carbon sink as opposed to its current status as a net source of carbon emissions. On various properties, she has helped implement several 'biologically friendly' methods for regenerative agriculture that have measurably increased soil fertility and carbon levels, and have improved the commercial viability of the farms (Jones 2007, pp. 4-5).[38]

Immigration Policy

Australia has the sixth highest per capita emissions in the world and the highest in the developed world, almost twice the OECD (Organisation for Economic Co-operation and Development) average (Garnaut 2008b, pp. 153-154). Immigrants to Australia are likely to

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[37] There is organised opposition to agriculture being included in carbon schemes. For example, David Crombie (in Gray 2009), president of the National Farmers Federation argues that agriculture does not fit the CPRS and should be excluded forever.

[38] Similar views are expressed in a range of papers devoted to regenerative agriculture including Dewar (2007) and LaSalle and Hepperly (2008).

have a lower per capita emission rate on arrival, but adoption of an Australian lifestyle will lead to an increase in their emissions up to the Australian average. Therefore, immigration into Australia is likely to lead to an increase in overall global emissions compared to a policy of no net immigration. Net in-migration will raise Australia's total domestic emissions and make it harder for Australia to meet emission reduction targets.

Australia's fertility rate remains below replacement levels even though former federal Treasurer Peter Costello (2007) provided financial incentives in the form of a baby bonus and increased family payments in an attempt to raise fertility levels. This means that future population growth will be primarily driven by net increases in immigration. Australia's population was just over 22.5 million in January 2011 (ABS 2011). The Rudd government expanded the Howard government immigration scheme to just over 170,000 a year in 2008-09 (Australian Government 2009b, p.4, 2010). This rate of population increase would raise Australia's population to approximately 31.6 million in 2050 (Birrell and Healy 2008, p.2). This is about a 40 per cent increase in total population, and other things being equal, would be equivalent to a 40 per cent increase in total emissions.[39] Immigration at current levels will therefore make achieving a 60 per cent decrease in emissions by 2050 much more difficult.

Bob Birrell and Earnest Healy (2008) clarify the dilemma. The Rudd government aims to reduce total emissions by 60 per cent on 2000 levels by 2050. In figures 2 and 3, this is shown by the star on the right-hand axis. In 2000, total emissions were 491Mt CO_2e. A cut of 294.6Mt would reduce the total to 196.4Mt CO_2e in 2050. Figure 2 (next page) shows the magnitude of the reduction required if Australia's population remained relatively constant with nil net migration. Achieving the emissions target would mean an emissions reduction per person from the current level of 24 tonnes CO_2e to 9.4 tonnes (Birrell and Healy 2008, p. 2).

[39] However, by 2050, it is expected that average GDP will be double current levels (Birrell and Healy 2008, p. 2).

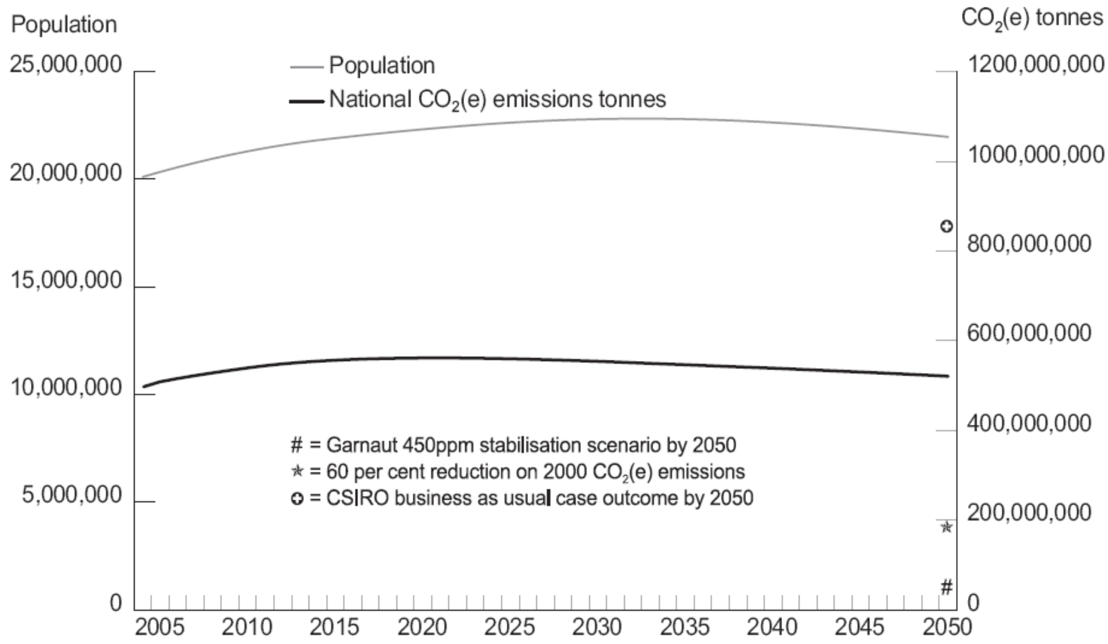

Figure 2: CO_2e emissions under 'business as usual' assumptions (RHS), except for nil net migration (population LHS), 2004 to 2050. Source: Birrell and Healy 2008, p.11, fig. 4.

Figure 3 (next page) shows the difference if Australia's population increased to 31.6 million in 2050. Total emissions under business as usual assumptions would rise to about 800Mt CO_2e, about 600Mt CO_2e above the target. Achieving the government's target would require emissions to be reduced to 6.2 tonnes CO_2e per person (Birrell and Healy 2008, p. 3).

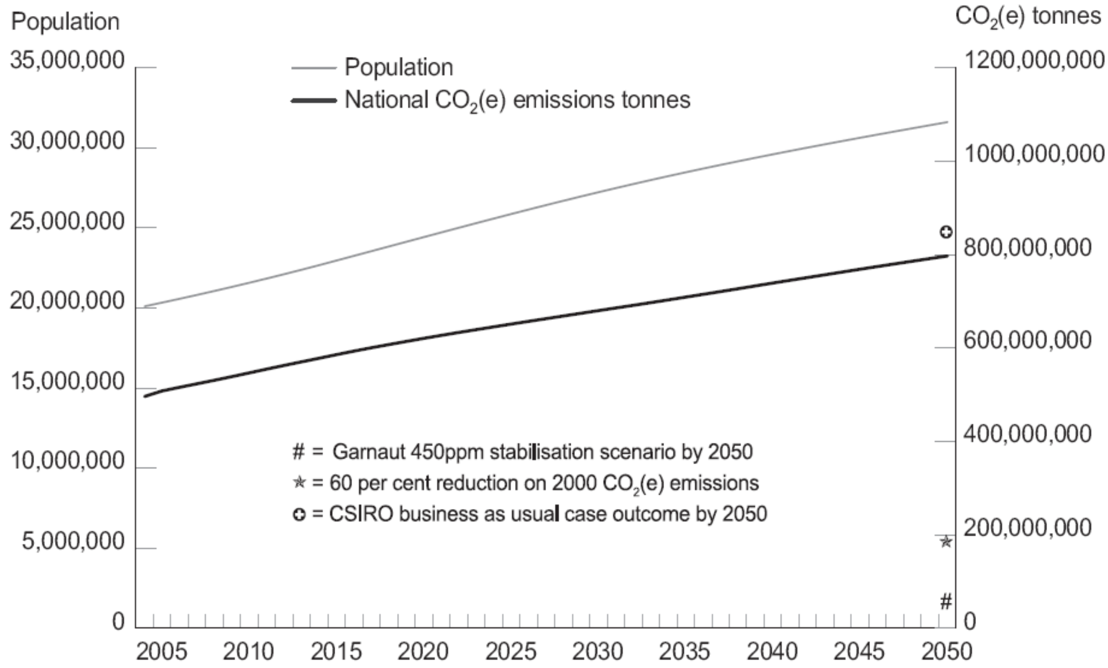

Figure 3: CO_2e emissions under 'business as usual' assumptions (RHS), including population growth to 31.6 million (LHS), 2004 to 2050. Source: Birrell and Healy 2008, p.7, fig. 2.

Stabilising Australia's population via net nil in-migration would therefore achieve substantial reductions in greenhouse gas emissions on business-as-usual projections. By contrast, population growth requires greater reliance on other aspects of policy such as a potentially much higher carbon price (Birrell and Healy 2008, pp. 13-14).

Economic growth and a Green New Deal

Most governments are committed to economic growth. Our economic model is a model of growth: it becomes unstable without growth, and the recessions and depressions that result from a lack of growth cause economic loss, social misery and social instability. Economic growth beyond population increases leads to increasing average material wealth. Increased personal wealth leads, in general, to the increased production and consumption of energy intensive goods and services such as bigger houses, more manufactured goods such as cars, and international travel. Economic growth and growing affluence are, therefore, drivers of emissions growth and drivers of climate change. Implicit within this model of economic growth is an assumption that increased material wealth and technological improvement is, to some degree, a substitute for environmental loss.

The global financial crisis was caused, in part, by unsustainable levels of consumer debt driven by a systemic need to perpetuate growth (Jackson 2009, p. 21). However, a continuation of high consumption growth is ecologically unsustainable. The current system is incurring huge ecological debts including climate change, biodiversity loss, soil erosion and loss of soil fertility and scarcity of fresh water (Jackson 2009, pp. 32-33; Simms et al 2010). Moreover, half of the world's consumption is carried out by less than a billion consumers located in the US, EU and Japan (Helm 2009a). Conventional economic theory assumes that this lifestyle can be made available to all the world's citizens. Yet if this small proportion of the world's citizens has pushed growth beyond sustainable limits, it cannot be replicated by the rest of the world's population. This indicates huge political problems.

The notion of sustainable economic growth is based on the idea that huge improvements in resource efficiency combined with technological change such as clean energy technologies will decouple economic growth from environmental degradation. Ernst von Weizsäcker, Amory Lovins and Hunter Lovins (1998) and Paul Hawken, Lovins and Lovins (1999) have explored many of these ideas. Applied to climate change, it means that economic growth could proceed at the same time as emissions are reduced. This notion is a foundation of both the *Stern Review* (2007) and the *Garnaut Review* (2008b).

The idea of a Green New Deal gained momentum in the wake of the global financial crisis in 2008. The notion of a Green New Deal embodied the concepts of clean energy and economic stimulus. A clean energy revolution requires huge investment in new energy. The IEA (2008, pp. 5, 14-15) has estimated that between 2010 and 2030, new energy infrastructure will require in excess of $35 trillion.[40] Economic recovery from the global financial crisis was boosted by government stimulus packages that revived consumer confidence and spending as well as by huge rescue packages for financial institutions totalling $7 trillion dollars by October 2008 (Jackson 2009, p. 19). A Green New Deal combines these two ideas – spending on new energy technology and spending to stimulate economic recovery – with a stimulus package heavily focussed on green spending. This includes improved energy efficiency in buildings, renewable technologies for energy generation, a smart grid suitable for distributed power generation, and public transport. A study by the University of Massachusetts Political

[40] The 450ppm Policy scenario is $5.1 trillion above the 550ppm Policy scenario which is itself $4.1 trillion above the $26 trillion Reference scenario.

Economy Research Institute (Pollin et al 2008, p. 10) found that this would create millions of new jobs in green industries, and more jobs overall than the equivalent spending on household consumption.

A Green New Deal fits within the paradigm of sustainable economic development because it assumes sufficient decoupling can be achieved to reconcile economic growth with ecological limits. Furthermore, elements of a Green New Deal may be essential to tackling climate change, in particular massive spending on renewable energy technologies, electricity grids, energy efficiency and public transport. However, there are difficulties with this approach. Even with massive investment in renewable energy technologies, there is no evidence that ecological harm can be decoupled from economic growth at a faster rate than growth itself. If that is the case, the essential dilemma facing the current economic model remains: economic and therefore social stability requires economic growth, but continuing economic growth entails ecological destruction and potential social collapse.

There is no working model for economic stability without growth. Indeed, one explanation for the contradictions in climate change policy and the difficulties in achieving effective action is that governments face a seemingly irreconcilable dilemma between the necessity to promote continued economic growth and secure social stability, and the fact that self-same growth is producing climate change. A Green New Deal may form part of the solution, but it does not resolve the essential dilemma of current forms of human development. Jackson (2009) suggests we need an end to consumption-driven growth and greater investment in public goods. His book *Prosperity without Growth* provides an overview of ways that social and behavioural change could be facilitated by the signals governments send and by the laws and regulations and tax schemes that governments deploy.

Conclusions on Policy options

Policy options cross a range of sectors which indicates the all-encompassing nature of climate change and the importance of a whole-of-government approach to the problem. A price on carbon, either explicitly through a tax or implicitly as a result of regulatory standards is important but insufficient to achieve the speed and scale of reductions in emissions that scientists say are required. A range of regulatory measures such as stringent emission

performance standards for both stationary energy and transport would provide greater certainty regarding emissions reductions and would provide an implicit carbon price. Sitting within a more explicit ‘command and control’ policy paradigm, regulatory standards could be designed to achieve rapid emissions reductions. However, they are vehemently opposed by industry because their compliance mechanisms are much harder for industry to avoid than market-based mechanisms. Furthermore, within the neo-classical economic paradigm, regulation is deemed clumsy and inefficient compared to the choice and least-cost options offered to polluters by market mechanisms.

Feed-in tariffs for micro and macro scale solar PV and solar thermal systems are proven market-interventionist methods for generating investment in currently higher-priced renewable energy systems. Feed-in tariffs for macro scale systems would help develop renewable power station capacity. Large scale government investment in the deployment of proven renewable energy infrastructure including the development of smart grids is vital, and particularly prescient in Australia where large sections of the existing electricity grid currently need replacing and upgrading. Urban design and development and public transit also require government planning and citizen engagement rather than relying on market-based approaches.

Forest and agricultural policies are important because Australia has significant carbon sequestration potential in both its existing native forests and agricultural lands. The comparatively few remaining native forest operations could be shifted to the hardwood and softwood plantation sectors. Meanwhile, increasing the levels of soil carbon in agricultural and rangelands has a dual benefit: besides sequestering atmospheric carbon, it should also improve soil productivity. Further public investment in carbon capture and storage for coal-fired power stations is hard to justify. The technology is unproven, uneconomic, and too far from commercialisation. Discussions about economic growth are still marginal, and much other policy can be implemented in the short term even if the economic growth model remains an unresolved dilemma.

Policy could therefore encompass regulatory measures (e.g. emissions performance standards; ending native forest logging), various market-based (carbon price) or market interventionist approaches (e.g. feed-in tariffs), and government planning and investment in

urban design, public transport, and electricity grid upgrades. This combination of policy measures is not necessarily the most market efficient when assessed under current neo-liberal economic paradigms. But given that the problem is as serious and urgent as the mainstream science indicates, effectiveness in terms of the speed and scale of change may be a more important policy attribute than efficiency.

Chapter 3: Agendas and Interests

Introduction

This chapter covers aspects of agenda setting, agenda building and agenda access, interest group theory, and agenda management. These theories, drawn primarily from the political science literature with contributions from sociology, have a bearing on the methods of various industry organisations and media commentators as well as the political and policy responses of government to climate change. As such, this chapter provides some of the theoretical underpinning for the analysis in chapter 4 of how governments have managed climate change on their agenda, and in chapter 5 of how industry has mobilised to defend their interests and influence the public and governmental agendas.

There are two broad agendas in liberal democracies (Cobb and Elder 1983, p. 14). Although terminology varies, they are generally referred to as the public and governmental agendas. The public agenda may be divided into the media agenda and public opinion. The governmental agenda itself may be divided into the issues that are up for discussion in the various forums of government, and the narrower formal agenda where governmental officials are poised to make a decision (Kingdon 2003, p. 4). The interplay between the various agendas is complex and the means by which an item makes an agenda or is excluded from an agenda are varied. Progress between public and governmental agendas is often uneven because the dynamics of political attention and the ability of officials to process information vary considerably over time (Jones and Baumgartner 2005a). Furthermore, definition of the issue may be modified significantly during processing, and formal consideration may not occur, particularly if the issue might arouse significant opposition, either from powerful interests with access to government or from within government and the bureaucracy (Pralle 2009, p. 785; Cobb et al 1976, p. 130). I begin with a discussion of the public agenda and then move on to agenda building and agenda access, problem definition, interest group theory, and agenda management.

The media and public agenda

In 1963, Bernard Cohen first advanced the idea that the selection of issues by the media is important. He noted that the press 'may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think *about*' (Cohen 1983, p. 13, emphasis original). Maxwell McCombs and Donald Shaw (1972, pp. 181-185) were the first to provide empirical evidence that demonstrated a strong correlation between press coverage and what people perceive as important issues. This led them to conclude that the media set the public agenda. The quality press, broadly defined as elite newspapers with a high standard of serious journalism, play a critical role in the agenda setting process because they set an agenda that the rest of the media follow (Chomsky in Achbar and Wintonick 1992; Chomsky 2004, p. 2).

Media treatment – such as journalistic norms – can also influence public perceptions of an issue. Balanced reporting is a norm where both sides in a dispute are accorded equal weight in media coverage. In the climate change debate the vast majority of climate scientists and their scientific institutions are opposed by a contrarian minority. In their study of the US quality press, Maxwell Boykoff and Jules Boykoff (2004, pp. 126, 134) argue that granting equal status and equal media coverage to both sides is a distortion of the actual scientific debate and has led to serious informational bias. By contrast, accurate reporting would accord coverage that mirrored the stature and prevalence of both sides in the debate. This approach has been adopted by much of the German media which will 'seek to hear numerous qualified opinions rather than doggedly searching for an opposing voice regardless of that voice's qualifications' (Becker 2005, p. 98). Furthermore, the German media would not publish contrarians with an obvious conflict of interest such as financial links to corporate-funded think tanks (Becker 2005, p. 98).

Framing is a second tier of agenda setting by the media that influences how issues are perceived (Craig 2004, pp. 80-82). Frames are sets of concepts that shape people's understanding of how the world works. By presenting stories in certain ways such as using metaphors and labels, frames create impressions and evoke ideas that help define how an issue is understood. Frames also delineate the range of feasible decisions and preferred solutions (Beder 2002; Lakoff 2006, pp. xv, 4; Fletcher 2009; Kepplinger 2007, p. 10). The

choice of frames can therefore marginalise or exclude other ways of seeing a problem and other ways of addressing an issue and can therefore ‘shape how an issue is dealt with in the political process’ (Pralle 2009, p. 785).

One of the key audiences for the quality press are the elites that exercise power in society (Chomsky 2004, p. 2). Editorials and regular opinion columns in the quality press are particularly important sources of influence on decision-makers because they are regarded as authoritative commentators on political affairs. As the ‘official voice’ of a newspaper, editorials have an institutional authority and can participate in public affairs by editorialising for or against a particular cause (Craig 2004, p. 81). Regular opinion columnists derive their authority from their position as ongoing political commentators. Opinion columnists present themselves as credible and informed people with a disinterested concern for public affairs. They typically articulate opinions, set and evaluate agendas, and provide advice (Nimmo and Combs 1992, pp. 8-15). Editorials and opinion columns have an indirect impact on the formal policy agenda of government because they help mould elite opinion, (Gittins 1995, pp. 13-14).

The media are therefore active participants in shaping both public opinion and policy options because their interpretations help construct the debate (Craig 2004, p. 71; Carvalho 2007). The media have an impact on political affairs because politicians act in the belief that media coverage influences public attitudes about the importance of particular issues (Gavin 2009, pp. 766-767). Politicians may end up making decisions based either on their perceptions of media-influenced public opinion (Gavin 2009, pp. 766-767), and in response to or anticipation of, media coverage of decision-makers themselves (Kepplinger 2007, pp. 8-9). Nevertheless, Neil Gavin (2009, p. 767) cautions that the influence of the press over government policy may be more ‘contingent and variable’ than its ability to set the public agenda. And as the later section on agenda management shows, politicians are themselves well positioned to interpret events and influence public understanding of an issue (Stone 2002, p. 9).

Agenda access and agenda building

There are different avenues by which issues may receive governmental attention. Issues may be placed directly on the governmental or even formal agenda, or they may cross over from the public agenda to the governmental agenda for policy consideration after receiving significant public or media attention (Cobb et al 1976, p. 132). Roger Cobb, Jennie-Keith Ross and Marc Ross (1976) posit that the process by which an issue may be placed on the agenda is linked to the power structure of society. Using the media and public agenda is often termed an outside strategy. Non-powerful players such as NGOs and environmentalists have generally relied on the media to broaden awareness of their cause and place an issue on the public agenda (Cobb et al 1976; Soroka 2002). Stuart Soroka (2002, p. 268) notes that environmental issues are normally ‘unobtrusive’: they lack direct impact in the lives of most people. Therefore, an environmental issue requires media attention to have impact (Antilla 2010, p. 241). It could be argued that climate change is especially unobtrusive for the majority of citizens in wealthy, developed countries because the long-term nature of greenhouse gas accumulations in the atmosphere combined with the inertia of the climate system means that the major impacts of climate change will be experienced in the future.

Although media coverage is undoubtedly important, climate change does not fit neatly into the solely media-driven perspective. Firstly, the creation of the IPCC in 1988 has meant that climate scientists have had direct access to the policy agenda of bureaucrats and national governments, for example via the Summary for Policymakers that accompanies each report. In addition, various national science academies have also produced numerous reports for government. Furthermore, climate change has moved beyond being solely an environmental issue and has now become a central concern of economic policy (e.g. Stern 2007; Garnaut 2008; Parkinson 2010).

Climate change has appeared on the public agenda at various stages over the preceding decades, for example during the negotiations for the Kyoto protocol, but it gained a greater degree of sustained media coverage from late 2006 to the end of 2009. The increased media coverage was prompted by a cluster of events that included the documentary *An Inconvenient Truth* (Guggenheim 2006), the *Stern Review on the Economics of Climate Change* (2007), the IPCC *AR4* (2007), and a prolonged drought in eastern Australia. During this period, popular

cultural drivers such as the Al Gore documentary fused with official institutional factors such as economic and scientific reports from respected bodies, as well as the impact of extreme weather/climate events. Media attention was further heightened by the decision of the Rudd Labor opposition to use climate change as an election issue during 2007.

Problem definition

Climate change is only one of numerous issues vying for attention on a finite public agenda. An agenda prioritizes problems because agendas have finite carrying and processing capacities, and attention is a limited resource (Hilgartner and Bosk 1988, pp. 55-56; Jones and Baumgartner 2005a, p. 10). However, problems do not simply arise out of background conditions, but are instead defined and constructed (Gusfield 1981, p. 3; Hilgartner and Bosk, 1988, p. 53; Rochefort and Cobb 1994, pp. 4-6). The definition of a problem often reflects conflicting conservative and progressive worldviews about individual or social responsibility (Rochefort and Cobb 1994, p. 15; Stone 2002, p. 203). These value conflicts are important because they determine firstly whether a condition is considered a problem, and secondly whether a problem is '"appropriate for governmental action"' (Kingdon 2003, pp. 110-111). If a condition is not seen as problematic, then nothing is done about it. However, even if it is seen as problematic, conflict may arise over whether the problem is seen as something that governments can do anything about.

Deborah Stone (2002, p. 188) points out that defining political problems involves not just identifying a cause, but also assigning responsibility for the problem. 'Causal stories' and the allocation of responsibility have significant consequences for policy outcomes including the distribution of rewards and burdens to perceived victims and perpetrators (Stone 2002, p. 189; see also Kingdon 2003, p. 110). Stone (2002, pp. 188-209) identifies two key causal stories, accidental and intentional. 'Intentional cause' signifies wilfully or knowingly causing harm. It arouses concern amongst a receptive audience, directs blame at the perpetrator, and may attract the attention of policymakers. 'Accidental cause' involves natural occurrences and fate for which no-one is to blame and unlike human activities, natural events are unresponsive to policy decisions. Attributing effects to a natural cause has important implications because the tactic can 'checkmate' or stymie proponents of a policy response (Stone 2002, p. 401). Several scholars (e.g. Rochefort and Cobb 1994, pp. 4-5; Stone 2002,

pp. 188-209; Pralle 2003, p. 242) have therefore concluded that problem definition is a strategic political exercise that has important ramifications across a range of areas including participation, agenda access, public policy, political alignments and political outcomes.

Controversy rages on the public agenda over problem definition in the climate change debate.[41] Scientists and their professional institutions and bodies have defined climate change as a problem caused by human activity. Furthermore, by negotiating treaties such as the Kyoto protocol, governments have signalled that they view climate change not just as a problem, but as a problem amenable to policy solutions such as an ETS. By contrast, critics such as Bob Carter (2010) and Ian Plimer (2009) define climate change as a natural condition unaffected by human activity, and therefore not amenable to policy intervention. Climate change is thus de-prioritised as an issue for government policy intervention.

Prominence on the public agenda often results in an issue being debated on the governmental agenda (Jones and Baumgartner 2005a, p. 26). For example, climate change moved to the governmental agenda when Howard commissioned a Prime Ministerial Task Group on Emissions Trading, and crossed to the federal decision-making agenda with election commitments from both the Howard government and the Rudd opposition to implement an ETS. Yet by early 2010, the Rudd government had decided to abandon its proposed ETS, a decision informed by electoral considerations and a perception that public support for policy action on climate change had decreased (Hartcher 2010b). This dynamic is analysed further in the chapter on government.

Interest groups and direct access to government

A direct approach to government is often termed inside access. Industry generally approaches government directly to ensure its interests are protected and promoted. Although many interest groups may gain direct or inside access to government, the level of access and the degree of influence exercised is primarily a function of the value of the group's resources to government (Maloney et al 1994, pp. 23, 25, 29; McKinney and Halpin 2007, p. 343). William Maloney, Grant Jordan and Andrew McLaughlin (1994, p. 23 emphasis original)

[41] There is a significant difference between the public agenda and the scientific arena because there is overwhelming scientific consensus on the causes and consequences of climate change.

identify several criteria for a '*resource-rich* group' including '*the ability to organise*' around specific demands; '*organizational cohesion*'; '*strategic location* – the control of "resources indispensable in society"'; 'economic significance; size (membership); knowledge (technical expertise or political sophistication) [and] implementation power'. The economic power of corporations gives heads of industry enough political leverage to gain privileged access to government and lobby for their interests.

By applying selective pressure, special interest groups may be able to prevent particular items from being considered in the political process (Bachrach and Baratz 1962, pp. 948-49; Kingdon 2003, pp. 67, 164; Cobb and Ross 1997, pp. 15-20; Crenson 1971). Lukes (2005) called the ability to influence the political agenda in this fashion the second dimension of power: over and above the ability to secure a preferred decision is the ability to prevent certain issues from ever actually progressing to the decision-making stage. This approach is most successful when proponents such as industry hold the same set of values as the officials they are dealing with in government and the bureaucracy (Maloney et al 1994, p. 27). There is evidence that privileged access and selective pressure has occurred in Australia in the climate change debate. Former Liberal Party and industry insider Guy Pearse (2007, pp. 229-232, 234-237) claims that the fossil fuel lobby in Australia exerted unprecedented influence at high levels of government. This influence and the outcomes are covered in greater detail in the chapter on industry.

The presence of a problem and the prevailing political context including the state of the public agenda may be sufficient for an item to make it onto the governmental agenda. But John Kingdon (2003, pp. 142-143) argues that if an item is to proceed further and gain priority on the formal decision agenda, it must have a viable policy solution. Yet, even with a seemingly viable policy solution, there are risks for government in proposing legislation. Even if powerful interests fail to prevent an issue from eventually making the decision agenda, they may still be well-placed to extract concessions and modify proposed legislation to suit their interests (Kingdon 2003, pp. 67, 164). For example, industry interests including both corporate CEOs and industry association executives lobbied the Rudd government and

extracted significant concessions under the proposed Carbon Pollution Reduction Scheme (CPRS)[42] (Wilkinson and Cubby 2008; Pearse 2009, pp. 62-66).

At the same time that industry associations and corporate CEOs were lobbying the Prime Minister and other senior Ministers directly, other industry organisations were conducting outside strategies such as media releases and advertising campaigns to communicate to a broader audience. For example, during the critical discussion period about the government's proposed ETS, the Australian Coal Association (ACA) (2009a)[43] carried out a prominent national television advertising campaign about the potential impacts of climate change policy on investment, jobs and wealth. The direct lobbying combined with a media campaign supports the findings of Binderkrantz (2005, pp. 694-715) that many interest groups pursue inside and outside strategies simultaneously.

Agenda management

Governments face a dilemma as they bow to pressure from powerful interests and yet try to maintain broad support for policy action. Stone (2002, pp. 157-158) suggests that some degree of ambiguity about what a policy actually entails may be essential in building support for difficult policy from diverse interests. With contentious legislation, politicians try to appease both sides. This may lead politicians to reassure the public by portraying their actions as resolutely tackling a problem, and yet satisfy special interests by concealing a different outcome that favours powerful interests in the legislation (Edelman 1985, p. 39; Stone 2002, p. 159).

Even after governments have made concessions to maintain broad support for their proposed policy, a bill may be substantially amended or even rejected in the legislative arena. Furthermore, subsequent changes in the political environment such as the collapse of a political alliance or bi-partisan agreement may leave the government looking disorganised and weak (Kingdon 2003, pp. 177-178). As a consequence, the problem may fade off the

[42] The CPRS was being developed as a Green Paper (Australian Government 2008c) at that time.
[43] These television adverts featured 'ordinary' Australians talking about losing their jobs and businesses. They have since been withdrawn from YouTube. However, the screen shots, webpage and radio adverts are still available from the link in the references.

governmental agenda because participants realise that the further investment of resources will not secure a return and could be politically damaging (Kingdon 2003, pp. 103-104).

A similar sequence of events occurred in Australia during 2009 and 2010. The Rudd government's CPRS passed through the House of Representatives on 4th June, but was rejected by the Senate on 13th August 2009. The government conceded to extra industry demands on compensation and also to demands from the Liberal National opposition led by Malcolm Turnbull to postpone the introduction of the scheme by a year until 2011 (Rudd 2009b).The government retained a bi-partisan consensus with the Turnbull opposition with the aim of reintroducing the legislation six months later. However, the concessions made by the government and the retention of bi-partisan agreement on the imminent introduction of an ETS fuelled internal conflict in the Liberal National Coalition between those supporting action on climate change and those against.

According to *The Sydney Morning Herald* political editor Peter Hartcher (2009b), Rudd deliberately vacated the battleground on climate change between May and October 2009 to ensure media attention focussed on the bitter wrangling within the opposition. Hartcher notes that the tactical ploy to divert attention onto Coalition in-fighting may have worked, but the wider strategic context shifted significantly against the government. Prominent climate sceptics such as Nationals Senate leader Barnaby Joyce became unchallenged opinion leaders as Rudd remained silent and 'failed to lead opinion, failed to marshal his arguments, failed to explain his policy, failed to carry the country' (Hartcher 2010a). One of the outcomes was a significant slippage in the percentage of people who saw climate change as a problem and a reduction in the numbers supporting the CPRS. Furthermore, the international climate change conference in Copenhagen failed to secure any binding post-Kyoto agreement. As the public mood in Australia shifted following an unchallenged campaign of climate denial by several Coalition politicians, Malcolm Turnbull was ousted as opposition leader in a leadership spill. His successor, Tony Abbott, who had recently declared that 'the science around climate change was absolute crap',[44] was elected on a platform to oppose the CPRS. The bi-partisan political consensus on climate change policy in Australia was suddenly fractured as Abbott renounced any Coalition support for an ETS. With little chance of securing its legislation, and

[44] Reported by Craig Wilson (2009), editor of the *Pyrenees Advocate*, at a Liberal Party function in Victoria, September 2009.

having lost much public support, the government shelved its climate change legislation and shifted attention away from climate change and onto other aspects of its legislative program.

There are other dynamics at play that also influence the progress of public policy. Frank Baumgartner and Bryan Jones (1991, 2009; Jones and Baumgartner 2005a, 2005b) have developed a model of public policy called punctuated equilibrium that focuses in particular on how political systems process information. Baumgartner and Jones (1991, p. 1044) note that public policy appears to be characterised by periods of stability and incremental change followed by bursts of activity and policy reversal. A key element contributing to policy stability is the development of relatively independent subsystems of government consisting of selected government officials and relevant external interests. Subsystem groupings are often forged by powerful industry groups. They develop policy based on shared assumptions and outlooks between industry and government officials, and can remain shielded from broader democratic participation, influence and change for significant periods (Cobb and Elder 1983, pp. 184-185; Baumgartner and Jones 1991, p. 1045). In Australia, there has been close cooperation between the Industry department and representatives of the fossil fuel industry. This may be one reason for the stability in energy and climate change policy over the period of the Hawke, Keating and Howard governments from the 1980s until late 2006 (see Pearse 2007, pp. 218-224, 228-243, 267).

One force that may counteract the stability and status quo engendered by subsystem groupings are changes in the public understanding of an issue. Changes in the policy image or popular perception of an issue can sometimes lead to rapid institutional change by breaking apart previously stable subsystems (Baumgartner and Jones 1991, pp. 1046-1051, 2009, pp. 25-38; Pralle 2003, p. 236). Furthermore, shifts in image can change the political context as the public agenda may diverge significantly from the governmental and decision agendas. The role of government may then become an issue on the public agenda, particularly if the government is seen as having ignored an important issue. The shift in popular mood can cause political incumbents to adopt new policies at election time including ones they may have previously discredited (Cobb and Elder 1983, pp. 180, 185). This occurred to some extent in late 2006. As public opinion shifted, there was a greater questioning of the role played by the Howard government on climate change. Following the release of the *Stern*

Review on 30th October, *The Sydney Morning Herald* ran two editorials (2006a, 2006c) on the 1st and 7th November that were scathing of the approach taken by Howard. On 10th December, Howard (2006d) renounced his previous position by announcing a decision to implement an ETS by 2012.

A final consideration is the interaction between policy and politics when governments try to impose burdens on powerful groups. Stone (2002, p. 2) points out that 'politicians always have at least two goals', a policy goal and a political goal, and that policy can serve as both a tool to solve social problems and a tool for political purposes such as enhancing re-election prospects. The impact of policy upon re-election prospects is influenced in part by the effect of the policy on a target population. This effect includes the power of the target population and its ability to mobilize against the policy, and the reaction of others about the validity of aiming policy toward that target (Schneider and Ingram 1993, p. 335). Anne Schneider and Helen Ingram (1993, pp. 335-337) suggest that the position of a group in society is determined by two factors: its power and socially constructed perceptions of the group. Schneider and Ingram produce a simple matrix to classify different groups as powerful or weak and social constructions as positive or negative. 'Advantaged' groups such as business have power and a positive image; 'contenders' such as unions and the rich are powerful but have a negative image; 'dependents' such as mothers and children are weak groups with a positive image; and 'deviants' such as criminals are weak groups with a negative construction.

Schneider and Ingram (1993, p. 337) argue that even though politicians must be able to explain and justify a particular policy in terms of its beneficial impact on a given problem, policy must defer to both the power and public perceptions of the target group if it is to enhance re-election prospects. The most straightforward policies are those where government can demonstrate a logical reason for rewarding advantaged groups or punishing deviant groups. By contrast, directing policy towards contenders provides challenges for government. Although contenders may not have the ability to secure tangible rewards like advantaged groups, they may have the power to hinder the imposition of burdens, thereby frustrating effective policy implementation to some degree.

The categorisation of many groups is contested and image manipulation is a key aspect of policy agendas. For example, the perception of the fossil fuel industry is contested: are they businesses that underpin Australia's comparative advantage, generating wealth, jobs in regional areas, and energy security? Or are they major polluting industries wreaking havoc on climate and threatening the future of human civilisation? If the fossil fuel industry is seen as economically vital, governments may propose self-regulation and voluntary actions. If these fail to reduce pollution and politicians remain under pressure to deal with the problem, then some form of charge to discourage pollution may be introduced. These policies are typically complex and opaque, the burdens are symbolic, and the benefits to industry are hidden. This would allow government to reassure the public that the problem is being tackled whilst delivering the tangible outcome to the organised group (Schneider and Ingram 1993, pp. 338-340; Edelman 1985, p. 39). Although the possibility of media exposé may constrain excessive government subterfuge, benefits hidden within complex technical policies are difficult to explain to the public, especially when governments present their policy as a landmark effort to bring the problem under control (Schneider and Ingram 1993, p. 342).

The struggle over agendas is a key component of political debate. Although governments are well-placed to manage the agenda, powerful interest groups such as industry are sometimes able to mould the agenda to suit their interests. The following chapters analyse the tactics used by various players in the climate change debate. This includes the methods used to influence various public and governmental agendas as well as to counter the influence of other players in the debate.

Chapter 4: Government

Introduction

The aim of this chapter is to analyse and compare the methods chosen by the Australian federal governments of John Howard and Kevin Rudd to manage the issue of climate change on their agenda. To better understand the options taken by both governments and the tactics they employed in pursuit of their strategies, it is important to have an overall grasp of the context. Climate change is likely to require a range of policies as well as choices between alternatives, some of which were considered in chapter 2. Chapter 3 outlined some of the literature around problem construction and agenda management including political issues that influence policy choice. As noted in the preceeding chapters, the political context helps determine which policy options are chosen and which are discarded or remain unconsidered. Governments help determine the political context, but they are also influenced by other players such as industry, media, scientists and citizens and their organisations. Furthermore, climate change as a problem does not exist in isolation from other concerns, either nationally or internationally. On a national scale, a range of pressing issues demand government attention. Internationally, climate change is subject to wider geopolitical considerations. Governments must therefore manage climate change along with other problems and wider strategic considerations. An understanding of the historical and geo-political context, alongside the previous exposition of the policy options, helps explain the strategic choices made by the two governments.

I begin by outlining some of the policy and political challenges that make addressing climate change so difficult because this clarifies some of the dilemmas that governments face at both the national and international level and explains in part why policy progress in Australia and internationally has been so slow. This is followed by an outline of Australia's greenhouse gas emissions profile which is essential for understanding not only the unique challenges and opportunities facing Australia, but also the strategic uses that governments have made of emissions statistics, both domestically and internationally. I then trace the development of climate change as a political issue in Australia including key international developments that

have impinged upon domestic politics. This sets the scene for the final section which analyses the tactics chosen by Howard and Rudd to manage climate change on their respective agendas.

Political challenges

Climate change is one of the most challenging issues facing governments (Garnaut 2008b, pp. xvii-xviii).[45] The challenges stem not just from the scale and urgency of the problem. Measures to address climate change also face huge policy and political obstacles at both the national and international level. This section begins by reviewing the issue of seriousness and urgency and then covers some of the factors that have made climate change such an intractable policy problem.

The weight of scientific evidence indicates that the consequences of unmitigated climate change later this century and beyond are significant and potentially severe (IPCC 2001, 2007b). The IPCC indicated in both its 2001 and 2007 reports that the problem was urgent. More recent scientific conferences and reports (Richardson et al 2009, p. 6; McMullen and Jabbour 2009, pp. 8-11; Allison et al 2009) have concluded that climate change is happening faster than previously anticipated. This does not mean the impacts are immediate or even widely visible to the majority of citizens in wealthy developed nations at present: the major impacts are predicted for the future. As chapter 1 indicated, there are several-decades lags between emissions and warming, and between warming and the onset of critical changes such as ice-sheet melting and impacts such as major sea level rise. A certain level of emissions and subsequent atmospheric concentration of greenhouse gases implies a commitment to future warming, and to future changes and impacts. The urgency derives from the inertia in the climate system because the timeframe for trying to avoid locking in the worst outcomes may be less than a decade, or may even have passed (Risbey 2008, pp. 28-30; Ramanathan and Feng 2008; Hansen et al. 2008, p. 229; Anderson and Bows 2011, pp. 40-42). This illustrates

[45] In various ways, Peter Newman, Timothy Beatley and Heather Boyer (2009), David Holmgren (2009), Richard Heinberg (2009) and Anthony Giddens (2009) treat climate change and peak oil (energy security) as twin problems to be addressed simultaneously. Certainly, climate change is, to a greater or lesser extent, an energy problem. However, I treat climate change as a single issue, partly for simplicity, and partly because it may be a grave mistake for climate policy to assume any peak in fossil fuel production in the foreseeable future.

the first dilemma for governments: policy action to reduce greenhouse gases emissions is required before climate change is tangible to the majority of citizens.

The next difficulty concerns the central role of fossil fuels in modern society. Energy is central to human development and fossil fuels have facilitated the industrialization that has driven economic growth over the last two hundred years. Fossil fuels underpin nearly all major activity in the modern world from electricity generation to transportation and industrial processes to modern agriculture. In developed countries with high standards of living, governments are preoccupied with maintaining short-term economic growth because the current economic model only functions with growth: a lack of growth is a recession or depression accompanied by unemployment and widespread social hardship. In other parts of the world, such as newly industrialising countries like China and India, growth is a priority because economic development is seen as a way to lift people out of poverty. According to the UN (2010, p. 7), 'worldwide, approximately 3 billion people rely on traditional biomass for cooking and heating, and about 1.5 billion have no access to electricity'. The UN points out that ensuring universal access to modern levels of energy is an essential component of reducing the worst impacts of poverty. Developing nations therefore face compelling imperatives underpinning their pursuit of growth and development.

Continued economic growth under business-as-usual conditions implies a vast and rapid increase in greenhouse gases emissions. Atmospheric concentrations of CO_2 are about 390ppm and emissions are increasing inexorably. Fossil fuel consumption is growing rapidly, and coal, the most carbon-intensive of all the fossil fuels, is increasing its global market share (Helm 2008, pp. 212). China alone is adding approximately two new coal-fired power stations every week and plans to add 1000GW of new coal-fired electricity generation by 2030. Chinese generating capacity in 2030 will be equivalent to the US and the EU combined (Helm 2008, p. 212). Likewise, rapid growth in coal-fired generation is occurring in India. In addition, China and India together are projected to add a billion cars by 2050 (Helm 2008, p. 214). This rapid increase in fossil fuel energy and transportation systems is mirrored by a projected rapid increase in CO_2 emissions.

Current agreements such as the Kyoto protocol are inadequate to deal with the scale of this problem. The Kyoto protocol allocated binding targets to developed countries only, but action

taken in China and other developing countries such as India matters to emission and climate outcomes. At the Bali climate negotiations in December 2007, the UN stated that the scientific evidence meant that developed countries needed to reduce emissions by 25-40 per cent below 1990 levels by 2020 to have a 50 per cent chance of stabilizing temperatures at 2°C (Howden 2007; Garnaut 2008b, p. 280, box 12.1).[46] The Copenhagen climate conference in December 2009 failed to reach agreement on a successor to the Kyoto protocol with far more modest targets. With huge unmet needs for development in many parts of the world, countries such as India have insisted that development will not be compromised (Singh in Nessman 2009). But global greenhouse gas emissions cannot be reduced and atmospheric concentrations stabilised without the cooperation of all major emitting nations. Yet, there are severe political obstacles blocking any effective global targets-based agreement that includes all major emitters.

Obstacles to international agreement

Political obstacles to international agreements are shaped by how nations conceive their national interests and how they approach negotiations. National interest is a contested term used by different groups with different meanings. Governments commonly present themselves as the guardians of national interest. Hedley Bull (1976, p. 110) observes that the noted British thinker on international relations, Martin Wight, proposed patterns of thought on international relations:

> the element of international anarchy stressed by the Machiavellians, the element of international intercourse, stressed by the Grotians and the element of the community of mankind, stressed by the Kantians.

Bull notes that these groups are also known as the realists, rationalists, and revolutionists respectively. For the realists, international relations involved conflict and the prescription was for each state to pursue its own interests. The notion of international moral restraints did not arise. For the rationalists, international relations involved both cooperation and conflict and

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[46] See Holmes Hummel (2008) for a detailed discussion of the source of this claim. Hummel also points out that global emissions would need to peak between 2000 and 2015. The seeming impossibility of achieving a peak in global emissions by 2015 has caused Kevin Anderson (2010), former Acting Director of the Tyndallº Centre for Climate Change Research in the UK to argue that politicians are talking about a 2ºC target while designing policies that will lead to 4ºC of warming.

states were bound by the rules they helped create. For the revolutionists, international relations were not about states but rather about ‘relations among human beings’ and the ‘community of mankind’ (Bull 1976, pp. 104-105). Bull (1976, p. 106) notes that these groupings are approximations and that ‘the three traditions’ could be seen to form ‘a spectrum’ of thought.

In a speech to the National Press Club titled ‘Advancing the National Interest’, Foreign Minister Alexander Downer (2002) quoted a statement from Wight’s book *Power Politics* (1979) that ‘A foreign minister is chosen and paid to look after the interests of his country, and not to delegate for the human race’. This suggests an approach to global problems strongly informed by realism. The Howard government framed its response to climate change and the Kyoto protocol in terms of a national interest based on an economic rationale.[47] A hierarchy of arguments privileged economic and trade issues above global environmental issues in the government’s conception of the national interest. By contrast, Rudd’s climate change advisor, Ross Garnaut (2008b, p. xix), argued that Australia had a strong interest in securing an effective global agreement on climate change because Australia was uniquely vulnerable to the impacts of climate change. A realist state-centred approach encounters fundamental difficulties when confronted with a new type of global problem like climate change that raises ethical and environmental issues and requires international cooperation.

Although individual governments cannot solve climate change by acting alone, a national government determined to pursue what it perceives as its own interests can undermine international cooperation. Economists such as Nicholas Stern (2007, p. 42) and Garnaut (2008b, p. xviii) have argued that nations have an incentive to let others bear the costs of making initial reductions. This is variously referred to as a ‘free rider’ problem and a ‘prisoner’s dilemma’. These dilemmas are compounded by disputes over responsibility for the problem. Responsibility is critical because allocation of responsibility involves the allocation of costs: that is, those deemed responsible for the problem should pay in proportion to their responsibility for causing the problem. Assigning liability implies a redistribution of costs and benefits between countries with consequences for international competitiveness and

[47] Both Kate Crowley (2007) and Peter Christoff (2005a) point out that immediate economic self-interest was not the sole factor influencing the position taken by the Howard government. Longer-term economic perspectives, a rejection of multilateralism, and developing closer ties with the Bush administration in the US were also important.

political stability (Boehmer-Christiansen and Kellow 2002, p. 2). This has profound implications for competing national interests and presumes that sovereign actors will be motivated, at least in part, by overriding and mutual global interests.

There are four important areas of contention around the allocation of responsibility for climate change. Firstly, the distribution of burdens arising from the impact of climate change is uneven. The more immediate impacts are already being felt and will be felt in many of the more marginal places inhabited by Indigenous and traditional peoples, as well as poorer developing regions that have contributed little to the problem (Hassol 2004; Stern 2007, pp. 104-109; Macchi et al 2008; Annan and Fust 2009; Galloway McLean et al 2009). The costs and benefits of fossil fuel consumption are unevenly distributed: the developed countries have benefitted, but the immediate costs are felt elsewhere. This raises issues of social justice and implies that the victims should be compensated for the adverse effects caused by another party. These issues were addressed by Article 3.1 of the United Nations Framework Convention on Climate Change (UNFCCC) (1992, p. 4) that noted the common but differentiated responsibilities of nations and agreed that 'the developed country Parties should take the lead in combating climate change and the adverse effects thereof'.

Secondly, countries such as China and India still produce a fraction of the per person greenhouse gas emissions of Australia or the US (Baumert, Herzog and Pershing 2005, pp. 21-2; MacKay 2008, p. 13). Figure 4 (next page) shows selected per capita emissions. The average Chinese person produces only a quarter of the emissions produced by the average Australian, while the average Indian produces only a tenth. Developing nations argue that the huge disparity in current per capita emissions means that developing nations have a right, based on principles of equity and fairness, to continued economic growth with the aim of raising their populations out of poverty. As a result, the burden of emissions reductions should be shouldered by the wealthy developed nations.

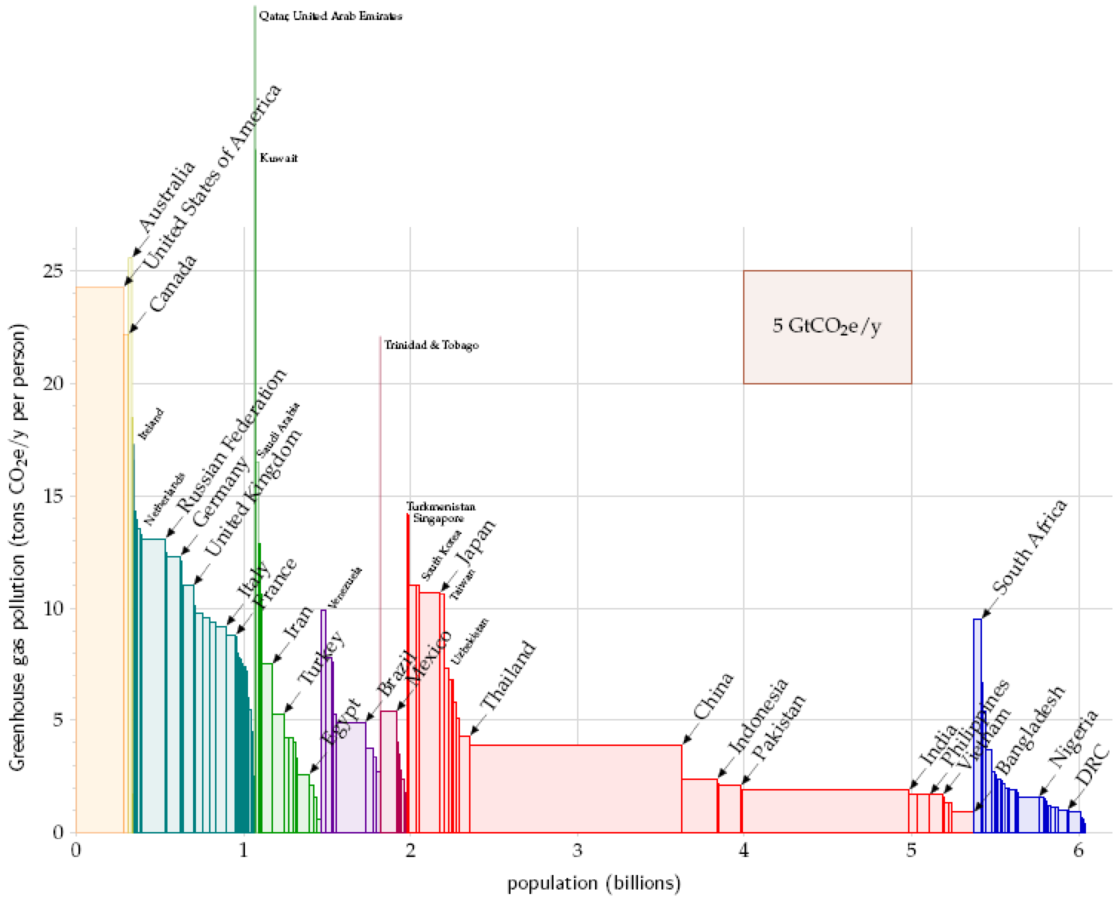

Figure 4: Per capita emissions in 2000 by country in GTCO2e/y. Source: MacKay 2008, p. 13.

Thirdly, although China is now the largest emitter of greenhouse gases on an annual basis (this is known as an annual flow of emissions), the increased stock of carbon dioxide currently in the atmosphere (which is the accumulation of all the annual flows over approximately the last two centuries) results overwhelmingly from emissions by wealthy OECD countries (Baumert, Herzog and Pershing 2005, pp. 31-32; MacKay 2008, p. 14). Historical responsibility for cumulative emissions is shown in figure 5 (next page). Because CO_2 has a long residence time in the atmosphere, the stock of greenhouse gases in the atmosphere is the critical factor causing the problem. The increased stock of greenhouse gases results from emissions primarily by the UK, US, and Germany, and responsibility for causing climate change lies in great part with those countries. Similar findings have been replicated in other studies. The German Advisory Council on Global Change (WGBU) produced a global carbon budget designed to provide a reasonable chance (which the WGBU

[2009, p. 25] defines as a 75 per cent probability) of holding to the 2ºC guard rail. It then allocated national budgets on an equal per capita basis. The WGBU (2009, p. 25) found that even if historical responsibility only extended back to 1990 (even though burning fossil fuels began in the UK in the 1780s with the Industrial Revolution), then the US, Germany and Russia have already exceeded their carbon budgets and are ‘carbon-bankrupt’. Even under this limited definition of historical responsibility, Japan and other developed nations such as Australia are very close to using up their entire budgets as well.

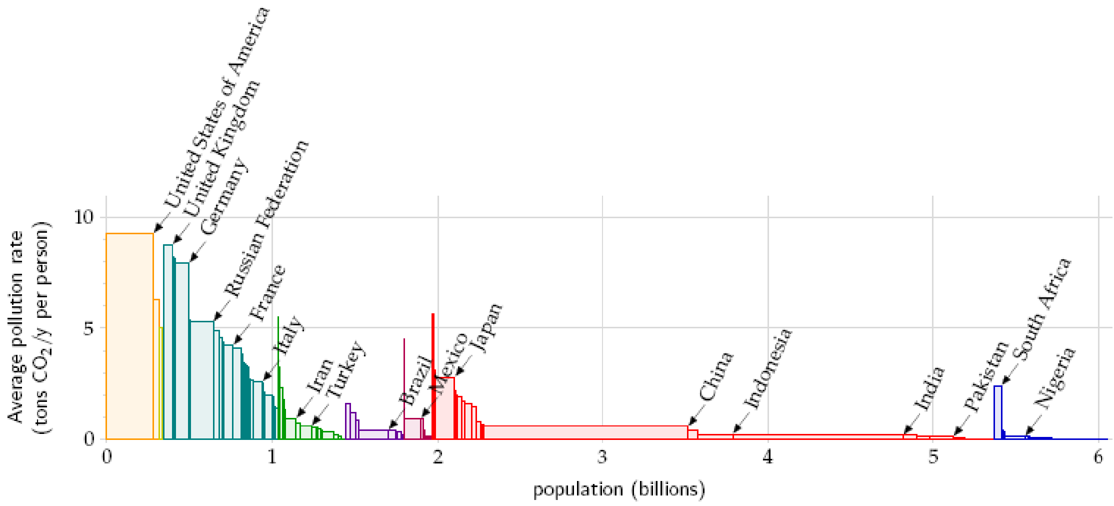

Figure 5: Historical responsibility: Cumulative emissions of CO_2 per country 1880-2004. Source: MacKay 2008, p. 14.

Fourthly, recent analyses by Dieter Helm, Robin Smale and Jonathon Phillips (2007), Jiahua Pan, Jonathon Phillips and Ying Chen (2009), and Steven Davis and Ken Caldeira (2010) point out that the allocation of responsibility is obscured by the accounting methodology currently used to measure emissions. Greenhouse gas emissions are currently measured at the point of production, not at the point of consumption. Helm et al (2007) argue that point of consumption more accurately reflects the real state of national emissions. For example, rapidly developing countries such as China manufacture large amounts of products for export to wealthy developed economies: currently 45 per cent of production is for exports and does not therefore represent domestic consumption. However, the emissions from export production are currently counted as domestic emissions.

Conversely, many developed countries have de-industrialised as manufacturing shifted to low-wage developing economies. Wealthy countries import large amounts of emissions-intensive manufactured goods, but the emissions embedded in the consumption of these goods do not figure in their greenhouse gas accounts. In other words, the accounting methodology effectively shifts a significant proportion of developed country emissions offshore to the point of production in developing countries. Helm et al (2007) and Pan et al (2009) argue that if these accounting anomalies are actually incorporated into national greenhouse gas accounts, the picture changes markedly, as do current assumptions about the most effective policies for emissions reductions. Helm et al (2007) point out that the UK currently promotes the claim that it has reduced emissions by 15 per cent on 1990 levels, a seemingly positive achievement. However, when emissions are measured at point of consumption, emissions in the UK have in fact risen by 19 per cent since 1990. This is a huge difference and begins to explain why some countries can claim to be reducing emissions and yet global emissions are increasing so rapidly. In effect, wealthy consumers in OECD countries are partly responsible for about half of the increase in emissions in countries such as China.

Measuring emissions in terms of consumption puts the problem in a radically different perspective. It provides yet another reason for arguing that the overwhelming responsibility for dealing with climate change lies with the wealthy developed nations.[48] As Helm (2009a, p. 8) points out, the 1 billion consumers in the US, EU and Japan are responsible for half of global emissions. That alone, he suggests, means that western consumers should pay half the bill before even historical responsibility and per capita emissions are included. This is a vastly higher cost burden than anything contemplated in current international treaties and negotiations.

Unfortunately, a clearer conception of the issue does not solve the problem. One of the key problems is how to address the massive growth in coal consumption in the developing world. Given wealthy nations are overwhelmingly responsible for both causing and perpetuating the problem, Helm (2009a, p. 9) argues that two changes need to occur rapidly. Firstly, wealthy nations must reduce their own greenhouse gas-causing consumption substantially to address

[48] Or as Harris (2010) argues, with wealthy individual consumers irrespective of nationality.

what is happening in their domestic economies. This runs quite counter to any political logic in developed countries where politicians who have espoused climate change as a serious problem have aimed to reassure voters that climate change can be tackled without significant impacts on living standards or lifestyles. Secondly, wealthy nations must transfer substantial amounts of financial capital to developing countries to develop low emissions energy technologies. Helm acknowledges that this raises substantial, if not insurmountable, political difficulties. It may be that, contrary to the claims in the Stern review (addressed in a later section), tackling climate change will have a significant adverse impact on living standards in wealthy countries (Helm 2009a, p. 10). This is a hard message that no western government is willing to consider as part of a climate change response. In fact, it has been those governments that have been upfront about their unwillingness to address climate change that have employed the argument about adverse impacts on economic growth and living standards as a reason not to tackle the problem. Furthermore, transferring money to China, an autocratic communist country and a large creditor nation,[49] would be virtually impossible to sell politically in the US or even the EU (Helm 2009a, pp. 9-10). The political obstacles to a reduction in global greenhouse gas emissions, at least along the lines already tried, appear intractable at present.[50]

Finally, climate change is just one of several serious issues confronting humanity at present – others include peak oil, biodiversity loss, water shortages, loss of soil fertility and food security. The issues and the drivers that underpin them (economic model, population growth, and technology choice) are linked, and it is unlikely that they can be resolved in isolation. Climate change also intersects with other geopolitical issues, primarily the conflict over resource and energy security, in particular the struggle to obtain oil and gas supplies. These

[49] There is a substantial trade imbalance between China and the US: China is a global creditor nation whereas the US is a large debtor nation.

[50] The failure of the Kyoto process has led some analysts to argue that a different approach is required (e.g. Prins and Rayner 2007; Hulme 2009; Prins et al 2010; Pielke 2010). These authors point out that climate change has the attributes of a 'wicked' issue. A wicked issue was first defined by Horst Rittel and Melvin Webber (1973) to characterise an issue that combined uncertainty, complexity, and interdependency with conflict over problem definition, values, participation, and resolution. In *The Hartwell Paper*, Gwyn Prins et al (2010) argue that climate change cannot be solved, and indeed attempts to solve an aspect of the problem reveal further previously hidden difficulties. Instead a 'wicked' problem must be managed by governments with a series of 'clumsy' interventions as opposed to an elegant but unworkable solution such as a targets-based international agreement. These authors argue that the primary goal should be to combine energy access for all with accelerated decarbonisation and suggest a technology-centred approach whose central aim is to make non-carbon sources of energy cheaper than the conventional fossil fuel sources.

strategic conflicts over resources influence the degree to which leverage can be exerted over various states to engage in meaningful discussion over a coordinated approach to climate change (Giddens 2009, pp. 203-207). This is important. Sovereign governments can use elements of coercion to impose laws and regulations within their own boundaries. The element of coercion is missing to some extent at the international level in the conduct of international negotiations on environmental treaties (Boehmer-Christiansen and Kellow 2002). Even though some weaker states may be pressured to accept outcomes against their best interests, larger more powerful nations are unlikely to accept outcomes that run manifestly counter to their national interests. Nevertheless, it is possible that in future, an agreement with a sufficiently large number of powerful nations or blocs such as the EU may enforce compliance or retaliate against non-compliance by enforcing trade sanctions (Joshi and Patel 2009, p. 192).

Sonja Boehmer-Christiansen and Aynsley Kellow (2002, pp. 2-3) identify several potential outcomes from the international negotiations over the Kyoto protocol including a treaty that is not particularly effective because it concedes to too many interests and is therefore diluted, and a treaty that is concluded, but which is later undermined by nations such as the US and Australia that refused to ratify it. However, some countries that did ratify the protocol at the outset such as Canada have subsequently failed to adhere to the treaty because the domestic costs are seen as too high and there is no credible and enforceable compliance mechanism. Furthermore, as chapter 4 details, countries such as Australia (under the Rudd government) that did eventually ratify the protocol were intent on allowing unlimited use of symbolic mechanisms such as carbon offsets that would have obviated the need to pursue emissions reductions within Australia. Finally, there is the possibility that no effective treaty will be concluded because the competing national interests are incommensurable, an outcome that was manifest at Copenhagen in 2009.

Potentially, a treaty could be concluded in the future as the costs and damages of climate change become more apparent. However, there are two concerns here: firstly, concerted international action down the track may be overwhelmed by natural positive feedbacks in the climate system: in effect, it could be too late to mitigate climate change and governments would be reduced to dealing with consequences. Secondly, other factors may work against

international cooperation down the track. Despite seemingly incommensurable national interests at present, global tensions are lower than at many periods in the post World War Two period, and most of the world's major powers can currently sit down and negotiate an international treaty (Dyer 2008). This may not always be the case: indeed, conflict between two or more major powers over scarce resources, or conflicts arising from climate change or other impacts may preclude international negotiations in the future (Dyer 2008). Despite the grim prospects at present, this may be the best chance for securing international cooperation.

Australia's Greenhouse Gas Emissions Profile

Australia has the highest annual greenhouse gas emissions per person of any industrialised country, almost twice the average for the OECD and four times the world average. Only a handful of small oil states rank higher (Turton 2004, p. 12; Baumert et al 2005, pp. 21-22; Garnaut 2008b, pp. 153-154). In 2006, Australia's per capita emissions were 28.1 tonnes and total emissions were 576Mt CO_2e, about 1.5 per cent of the world total (Australian Government 2008b, pp. 1, 5).

Decisions about energy made by Australian governments in the 1980s and 1990s have had long-term implications for energy and climate change policy. In 1971, Australia had a similar emissions intensity of energy to the OECD average (Garnaut 2008b, pp. 158-159). But in the early 1990s, according to senior industry and energy bureaucrats interviewed by Pearse (2007, p. 168), Australia decided to focus on its cheap and abundant coal resources, and used the lure of cheap coal-fired electricity to attract energy-intensive industries such as aluminium smelting. By contrast, most other OECD countries increased their reliance on renewable or nuclear energy (Garnaut 2008b, p. 159). The emissions intensity of Australian energy increased as coal contributed a growing proportion of Australia's energy needs. Despite this, the overall emissions intensity of Australian industry is still roughly comparable with the OECD average: although Australia has a large aluminium smelting industry, it has smaller than average iron and steel and chemical and petrochemical industries (Turton and Hamilton 1999, p. 17). Australia is not therefore a uniquely emissions intensive economy. Rather, Australia's high per capita emissions derive from the decision to use emissions intensive coal as the principal energy source (Garnaut 2008b, pp. 158-160; Hamilton 2001, p. 19).

Australia currently generates about 80 per cent of its electricity from coal. As a result, the emissions intensity of Australia's electricity supply is almost double the OECD average and 74 per cent higher than the world average (Garnaut 2008, pp. 159-160). The stationary energy sector, primarily coal-fired electricity generators, is the biggest contributor to Australia's greenhouse gas emissions. Stationary energy is responsible for half of Australia's total emissions: 287.4Mt CO_2e in 2006 (Australian Government 2008b, pp. 1, 7). Emissions from this sector increased 47.3 per cent between 1990 and 2006, up from 195.1Mt CO_2e to 287.4Mt CO_2e. This substantial increase in emissions is well above the 8 per cent increase in overall emissions granted to Australia at the conclusion of the Kyoto negotiations. The heavy reliance on coal therefore has a marked impact on Australia's surging energy emissions.

Nevertheless, a complete understanding of Australia's emissions profile is only possible with an explanation of land-use, land-use change and forestry (LULUCF). Land clearing causes greenhouse gas emissions. Conversely, a reduction in land clearing and/or the revegetation of previously cleared land sequesters carbon and reduces overall emissions from the land sector. The issue of LULUCF featured prominently in Australia's Kyoto negotiations.[51] Fortuitously for Australia, land clearing peaked in 1990 and declined substantially in 1991 independently of any government climate change policy. Figure 6 (next page) shows the increase in Australia's energy emissions and the decrease in emissions from land clearing between 1990 and 2004. Energy emissions have continued to rise since 2004.

[51] During the Kyoto negotiation in 1997, this category was originally referred to as land-use change and forestry (LUCF).

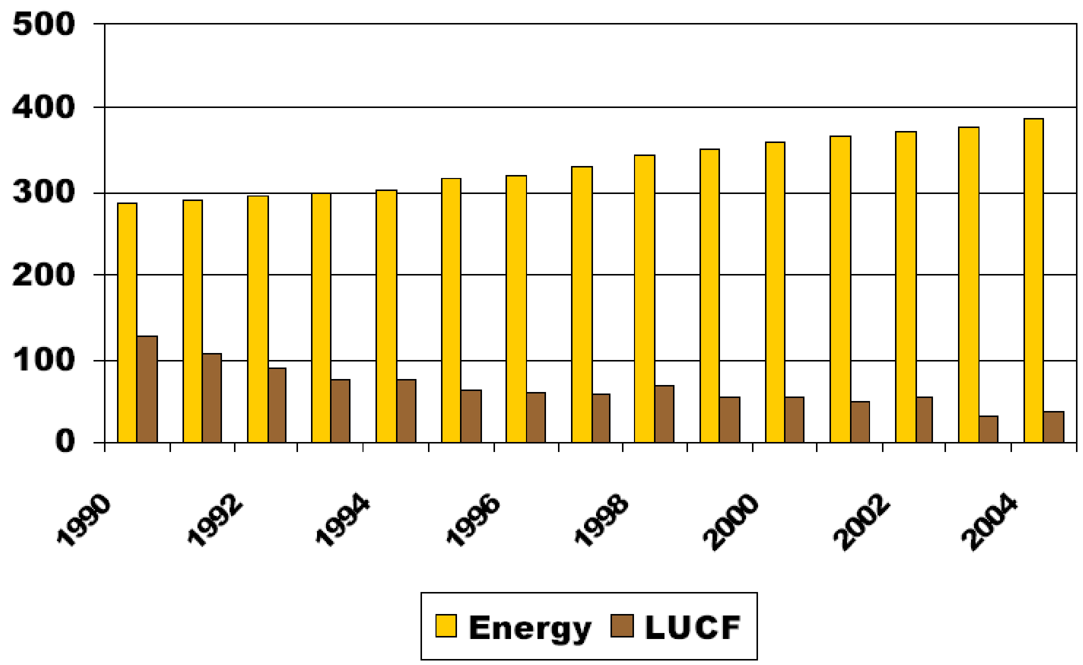

Figure 6: Changes in GHG emissions from energy and LUCF, Mt CO_2e. Source: Hamilton 2006, p.6.

At the Kyoto negotiations, Australia's insistence on the inclusion of land clearing figures in the 1990 baseline effectively inflated Australia's overall baseline emissions by 6 per cent (Hamilton 2001, p. 106). This provided Australia with considerable extra leeway on its overall emissions target. In effect, Australia has remained on track to meet its Kyoto target without the need for any policy action by government to reduce energy emissions. Indeed, the decline in land clearing and the resultant decrease in emissions from that sector have masked the 47.3 per cent increase in energy emissions since 1990. In 2006, Australia's overall emissions were up 4.2 per cent on 1990 levels (Australian Government 2008b, p. 1), in line with the target of an 8 per cent increase on 1990 levels during the Kyoto commitment period of 2008-2012.

Australian historical and political context

Hawke and Keating Labor Governments

Australian governments have been aware of the potential economic, political and environmental dimensions of climate change since at least 1981 when the Office of National Assessments prepared a confidential report for the Fraser federal government (Hamilton

2007a, p. 44). Following scientific conferences at Villach in 1985 and Toronto in 1988,[52] the Hawke government adopted, in principle, ambitious greenhouse gas reduction targets.[53] However, the greenhouse debate within government polarised between the department of environment who developed policy, and the department of primary industry and energy who advocated on behalf of industry and were primarily responsible for implementing the policies (Hamilton 2001, p. 32). A crucial decision was taken by Hawke's 4th cabinet in October 1990: it declared that '"the Government will not proceed with measures which have net adverse economic impacts nationally or on Australia's trade competitiveness in the absence of similar action by major greenhouse gas producing countries"' (in Hamilton 2001, p. 33). Moreover, the Government would not interpret 'harm' to the Australian economy in absolute terms such as an absolute fall in GDP growth, but rather in terms relative to business as usual: that is, even a potential reduction in GDP growth by 2050 to 260 per cent instead of 270 per cent would be construed as harming the economy (Pearse 2007, p. 71). This decision and this particular interpretation have been a critical caveat in all Australian policy decisions since. They have ensured the primacy of short-term economic factors over long-term economic, social, and environmental welfare.

After Paul Keating became Prime Minister in 1991, Australia attended the United Nations (UN) Conference on Environment and Development – the 'Earth Summit' – in Rio in June 1992. The main political response to the first IPCC report in 1990 was the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) at the 'Earth Summit'. Relying on advice from the IPCC, the UNFCCC was a voluntary convention that acknowledged the reality of anthropogenic climate change. Along with 155 other nations, Australia signed the UNFCCC which came into force in 1994. Article 2 of the Convention pledged to take measures to 'prevent dangerous anthropogenic interference with the climate system' (UNFCCC 1992, p. 3). Although the objectives and principles were ambitious, the Convention was designed as a preliminary framework with few specific measures (Dessler and Parson 2006, p. 13).

[52] See chapter 1, p. 38.
[53] Climate change also became prominent on the political agenda in the US during this period. In the hot, dry North American summer of 1988 a US Senate enquiry received testimony from NASA climate scientist James Hansen stating that the hot temperatures were related to human-induced climate change.

Hamilton (2001, p.1) argues that a realistic government strategy to tackle climate change would involve restructuring the economy: it would need to focus on the energy supply system and the vested corporate interests involved in it. Keating considered a carbon tax, but met with an industry sector that successfully organised itself to oppose a carbon price (Christoff 2005a, p. 32). Keating elected instead to avoid antagonising industry by seeking voluntary greenhouse gas reductions.

Voluntary programs

According to Hamilton (2001, pp. 39-40), voluntary programs serve a crucial function for governments and industry. Successfully promoted, they give the appearance of action and blunt demands for more effective policies that lead to structural change in the economy. Both government and industry benefit by conveying the impression that they are working together to tackle a problem.

The Keating government introduced *Greenhouse 21C* in 1995 as a voluntary scheme to address climate change. It was based on the 'no-regrets' principle: measures that industry agrees to undertake because they have no net cost and are commercially beneficial. *Greenhouse 21C* was aimed at the production or supply side of the economy and involved voluntary agreements with most major industrial and energy corporations. *Greenhouse 21C* was inherited by the Howard Coalition government in 1996 and rebadged as the Greenhouse Challenge Program (GCP). Following the Kyoto protocol negotiations, Howard established the Australian Greenhouse Office (AGO) in 1998 to develop and implement greenhouse policy in Australia. Based on commissioned evaluations, the AGO claimed the GCP had achieved significant greenhouse gas reductions compared to a business as usual scenario.

Hamilton (2001, pp. 40-52) provides a detailed analysis of the voluntary measures used by the Keating and Howard Governments to address climate change. Hamilton draws in particular on two evaluations of the GCP, one an independent report by George Wilkenfeld and Associates and Economic and Energy Analysis (GWA and EEA) in 1996, and one by the Government itself in 1999, the Greenhouse Challenge Evaluation Report. Hamilton notes that in numerous reviews the GCP was not subjected to a rigorous audit. Hamilton (2001, p. 47) points out that the Greenhouse Challenge Evaluation Report was made up entirely of people

with an interest in defending the Government's flagship program for greenhouse gas abatement. Hamilton (2001, pp. 43, 47-48) argues that the AGO became predominantly concerned with promoting the credibility of the GCP rather than achieving actual emissions reductions.

One early report that did attempt a thorough audit of the GCP was undertaken by GWA and EEA in 1996. It was critical of the 'frozen-efficiency' assumptions and 'baseline inflation' in the GCP. Frozen efficiency occurs when an industry claims the procedures it currently employs will be used over the next period of production. Baseline inflation is an inflated estimate of a corporations' emissions profile. Both assumptions allow corporations to project higher emissions scenarios than would actually occur. These unrealistic scenarios then allow industry to claim it has reduced emissions. In reality, Hamilton (2001, p. 42) notes that the GWA and EEA report concluded that the vast majority of emissions reductions would have occurred as a result of improved efficiency regardless of the GCP.

A failure to rigorously audit the industry assumptions embedded in voluntary schemes has benefits for both government and industry (Hamilton 2001, pp. 41-50). Firstly, concealing the ineffectiveness of voluntary schemes blunts demands for more effective mandatory policies. Voluntary schemes allow government to avoid (or postpone) tackling issues of structural change in the economy. Secondly, positive evaluations are excellent public relations for industry who can promote official figures as proof that voluntary schemes are effective. Thirdly, an ineffective audit allows recalcitrant corporations to avoid cutting emissions thereby leaving themselves room to manoeuvre should mandatory reductions be introduced at a later stage. Fourthly, voluntary reporting places substantial power in the hands of major emitters by allowing them to build up credibility and expertise in accounting how emissions are calculated. These years of practice give them an advantage over governments or environmental bureaucrats.

In contrast to the GCP which targeted the production side of the economy, Australian state governments have addressed the demand side of the equation. Green Power is a joint initiative of the ACT, NSW, SA, QLD, VIC and WA government agencies to accredit sources of renewable energy. Green Power is a voluntary scheme that provides consumers with an option to purchase renewable energy at extra cost. However, as Hamilton (2001, pp.

50-52) points out, there are significant problems with this approach. Firstly, Green Power inverts the polluter pays principle because consumers are forced to pay more for clean electricity instead of the big polluters being forced to pay for their pollution. Secondly, a large-scale collective problem is left to individual choice.

Much of the controversy over these voluntary programs (and the implementation of some market-based schemes) arises from different views on the role of the public – as politically involved citizens, or as consumers making choices in the marketplace. Free market advocates (e.g. Robson 2009) support schemes that provide consumers with a choice in the marketplace. Free market advocates argue that if consumers really cared about the environment, they would be willing to pay more to protect it. Conversely, if schemes such as Green Power attract little patronage, free market advocates allege that people do not think the problem is particularly serious. This allows free market advocates to claim that environmental activists do not represent the feelings of the broader public on climate change, and that government regulation of industry is merely pandering to a vocal minority whilst imposing a financial burden on the majority. The advantage for government and business of a voluntary scheme such as Green Power is that it shifts the burden of responsibility onto consumers whilst relieving government of the need to take effective policy action and protecting industry from regulation.

The Kyoto Protocol

The Kyoto protocol was negotiated as an amendment to the UNFCCC after it became clear that a voluntary arrangement was insufficient to stabilise greenhouse gas emissions. The Kyoto protocol was the first step in a global attempt to secure multilateral cooperation on binding emissions reductions. Based primarily on historical responsibility, the protocol divided countries into two categories: developed countries in Annex 1 accepted binding greenhouse gas emission reductions, but non-Annex 1 developing countries had no obligations to reduce greenhouse gas emissions (UNFCCC 2011). Compliance with greenhouse gas targets requires reducing fossil fuel emissions by changing the energy supply mix, improving energy efficiency, and changes to land use. However, the Kyoto protocol also included ‘flexible mechanisms’ which allowed Annex 1 countries to meet their reduction obligations through emissions trading or projects in non-Annex 1 countries.

Howard Federal Government

The conservative Howard Liberal National Coalition government was first elected to office in March 1996. The government was opposed to the idea of mandatory greenhouse gas targets. In the lead-up to the Kyoto negotiations in December 1997, the government engaged in a period of intense international diplomacy designed to convince other nations of the merits of Australia's claim for a lenient target. The government framed Australia as a special case deserving special treatment (Hamilton 2001, pp. 53-54; Christoff 2005a, p. 33). This approach met with hostility in other nations as a strategy that could undermine the international cooperation required to conclude a comprehensive binding international agreement. There was a fear that concessions granted to one nation would undermine trust amongst other nations (Hamilton 2001, p. 54-55).

Still, the Australian government persisted with its strategy and extracted significant concessions during the Kyoto negotiations. Environment Minister, Senator Robert Hill, played a game of brinkmanship by threatening to withdraw from the agreement if Australia was not granted the extra concessions that it demanded. This tactic was employed at the very end of proceedings ensuring that a failure to reach agreement on Australian demands would mean the failure of the negotiations. UN negotiators made it clear that Australia was granted concessions to preserve an agreement, not because other nations thought they were justified (Hamilton 2001, pp. 87-89; Lowe 2005, p. 187).[54]

The Kyoto protocol mandated average reductions in greenhouse gas emissions from developed nations of 5.2 per cent from the baseline year of 1990 over the commitment period of 2008-2012. Australia gained, firstly, a target of an 8 per cent increase in its emissions, and secondly, the right to count land use, land-use change and forestry in its greenhouse gas accounts. Given that land clearing in Australia had already peaked in 1990 (the internationally-agreed benchmark year against which emissions were to be measured) and fallen substantially by 1997, this gave Australia an inflation of its baseline emissions (Hamilton 2001, pp. 98-108; Lowe 2005, p. 187). Taken together, Australia had secured

[54] Christoff (2005a, pp. 33-34) also questions whether Australia gained the concessions as a result of exhaustion and inattention on the part of conference delegates, or in recognition that concessions to Australia were of minor consequence so long as the US, EU and Japan accepted binding emission reduction targets.

concessions that would allow it to increase its energy emissions by between 20 and 33 per cent and still meet its emissions target (Hamilton 2001, p. 103).

Hill (1997) declared the Kyoto protocol was ‘a win-win result that … protects Australia’s export competitiveness and employment prospects’. Despite these gains, the Howard Government did not ratify the protocol. According to leaked documents obtained by The Australia Institute, the Howard cabinet decided in 1998 that Australia would not ratify Kyoto until the US did (Hamilton 2001, p. 134). By World Environment Day in 2002, Howard (2002, p. 3163) used a different rationale and confirmed publicly that:

> It is not in Australia’s interest to ratify the Kyoto protocol … for us to ratify would cost us jobs and damage our industry.[55]

The protocol finally came into effect on 16 February 2005, following Russian ratification in 2004 (UNFCCC 2011).

The Energy White Paper: Securing Australia’s Energy Future (2004)

The Australian Government Energy White Paper, *Securing Australia’s Energy Future* (2004) was very clear about future energy policy for Australia. In particular, it affirmed the central position of fossil fuels in Australia’s energy future and asserted that coal ‘will remain the main energy source for electricity generation’ (Australian Government 2004, p. 37). In the Prime Minister’s ‘Foreword’, John Howard stated that Australia’s prosperity was due in large measure to the low-cost energy delivered by coal that ‘supports the competitiveness of significant parts of our industrial base’. Australia’s national interest was therefore dependent on coal.

The Energy White Paper was explicit on climate change policy. It specifically dismissed the idea of an ETS in advance of similar schemes globally because to do so would involve ‘the premature imposition of significant economy-wide costs’ that ‘would harm Australia’s competitiveness and growth’ (Australian Government 2004, pp. 25, 140). *Securing*

[55] Crowley (2007, p. 136) points out that by 2002, the value of the one-off land use concessions ‘had become abundantly clear’ to the Howard government and that ‘had Australia ratified, it would have been faced with a second commitment period with no concessions, in which cuts to energy emissions, and therefore confrontation with business interests, trade unions and coal rich state governments, would have been unavoidable’. I cover the manner in which the Rudd government approached this dilemma later in this chapter.

Australia's Energy Future (2004, p. 136) concluded that emissions trading would lead to the loss of Australian industries and jobs overseas. In addition, it (2004, pp. 135, 147) rejected the recommendations of the Tambling Review (2003, p. xxvii, no. 8) to extend and expand the mandatory renewable energy target (MRET).

Securing Australia's Energy Future endorsed the position of the fossil fuel industry. At the same time, it clearly stated that measures to address climate change and proposals to expand the renewable energy sector would not be considered on the policy agenda. This position was vigorously reaffirmed on several occasions by Howard (2007b, p. 70) in Parliament, in major policy speeches (Howard 2006a), and in media releases (Howard 2006b). This standpoint was also embedded in the terms of reference for the Prime Ministerial Task Group on Emissions Trading and the findings of the Task Group *Report* (2007).

The Stern review

The *Stern Review on the Economics of Climate Change* (Stern 2007)[56] was commissioned by the Chancellor of the Exchequer (UK Treasury) during the Blair Labour Government to examine the evidence on the potential economic, social and environmental impacts of climate change, and to assess the economics of moving to a low-carbon global economy. The Stern Review has been influential because it framed climate change in economic terms and attempted to quantify the economic impacts of climate change on GDP growth. This approach was readily understood by business people, economists, bureaucrats, government policy makers and media editors, giving climate change greater credibility amongst these groups.

The *Stern Review* (2007, p. xv) began by stating that 'the scientific evidence is now overwhelming: climate change is a serious global threat, and it demands an urgent global response'. The *Stern Review* (2007, p. xviii) labelled climate change as 'the greatest market failure the world has ever seen', but found that the problem was amenable to market solutions that established a carbon price such as a tax or ETS. Furthermore, the *Stern Review* (2007, p. xv) found that the costs of inaction that would result from doing nothing about climate change far outweighed the costs of action to mitigate climate change. These findings gave

[56] The Stern Review was initially released online on 31st October 2006.

weight to those voices in politics, business, the media, and environmental groups calling for effective and immediate government action to address climate change.

The *Stern Review* has been criticised by a range of commentators and groups from all sides. Sceptics denounced the *Stern Review* as worthless because it was based on what they alleged to be the fundamentally flawed science of the IPCC (Byatt et al 2006; Carter et al 2006; Lavoisier Group 2006). By contrast, climate change economists and modellers that accept the need for an economic response to climate change, such as William Nordhaus (2007a, 2007b) and Richard Tol (2006; Tol and Yohe 2007a, 2007b; Yohe and Tol 2008), have criticised the assumptions adopted by Stern. They critique Stern's approach to discounting and note that the rate of pure time preference is very low and argue that other rates should have been modelled.

The choice of discount rate determines the estimation of the future costs of climate change. In this way it influences priorities and decisions about how much money should be spent now to mitigate future costs. This has political ramifications. The critiques of Nordhaus and Tol both allege that the very low discount rate adopted in the *Stern Review* inflates the future costs of climate change, leading to a distorted policy response biased towards expensive short-term responses. Simon Dietz et al (2007) and Nicholas Stern and Chris Taylor (2007) have answered these criticisms by pointing out that the analysis in the *Stern Review* is based on a serious assessment of both risk and ethics. Furthermore, the Garnaut Review (2008, p. 19) judged that Stern's choice for the rate of pure time preference was appropriate and it adopted a very similar value.

The estimated costs of mitigation contained in the *Stern Review* have also been questioned. The *Stern Review* (2007, p. xvi) claimed that 'the annual costs of achieving stabilisation between 500 and 550ppm CO_2e are around 1 per cent of global GDP'. However, energy economist, Dieter Helm (2008, 2009a), argues that a rapid upscaling of renewable technology will be far more expensive than Stern estimated. This is a critique not only of the Review, but also the message that some OECD governments have employed to try and persuade their citizens that the costs of mitigating climate change will be minimal. If greenhouse gas emissions are measured in terms of consumption as opposed to production, then current claims about emissions reductions in the UK are illusory. Helm's (2008, 2009a; Helm et al

2007) analysis calls for significant reductions in consumption in developed countries – a dramatically different conclusion to that reached in the *Stern Review*. This has profound implications for the current economic model because it questions the assumption that economic growth can continue in developed nations whilst global emissions are reduced.[57]

The *Stern Review* has been criticised on two other counts. Firstly, the *Stern Review* (2007, p. xvii) found the costs of stabilising at 450ppm CO_2e 'would already be very difficult and costly'. Many scientific advocates and climate activists (e.g. Hansen et al 2008; Spratt and Sutton 2008; McKibben 2010; Hamilton 2010a) argue that a target of 450ppm let alone 500 or 550ppm is incapable of preventing dangerous climate change from occurring, and that policy should be directed to far more vigorous emissions reductions. A second criticism of the *Stern Review* (and subsequent publications e.g. Stern 2009) is that Stern fails to address the politics of climate change (Hamilton 2007b, p. 100; Giddens 2009, p. 201). These critics argue that Stern ignores the reality of vested interests, the power of various sectors of the capitalist class, and the fact that many governments have, to varying degrees (but particularly Australia and the US), been captured by the fossil fuel lobby. Critics point out that Stern assumes that a logical appraisal of the reality of climate change will induce key actors to participate in global cooperation to tackle climate change, without identifying who will force this to happen and how it may come about.[58]

Despite the criticisms, the *Stern Review* did change the terms of the debate in Australia, and was a factor that contributed strongly in climate change gaining prominence and credibility on the public agenda, and ultimately, making the governmental agenda.

The Prime Ministerial Task Group on emissions trading: The Shergold Report

After the release of the Al Gore documentary *An Inconvenient Truth* (Guggenheim 2006) followed by the *Stern Review*, public opinion in Australia shifted decisively on climate change in late 2006.[59] By 10th December 2006, Howard (2006e) announced 'the

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57 Anderson and Bows (2011) reach a similar conclusion.

58 An earlier criticism of the wider attempt to construct international environmental treaties without addressing the missing element of coercion inherent in international (as opposed to national) frameworks is given by climate sceptics Sonja Boehmer-Christiansen and Aynsley Kellow (2002).

59 Much of eastern Australia had also been subject to a prolonged drought at this time that became linked in the public mind to climate change.

establishment of a joint government business Prime Ministerial Task Group on emissions trading'.

The Government set the policy agenda for the Prime Ministerial Task Group (PMTG) with the terms of reference and the selection of members for the inquiry panel. The terms of reference stated that:

> Australia enjoys major competitive advantages through the possession of large reserves of fossil fuels and uranium. In assessing Australia's further contribution to reducing greenhouse gas emissions, these advantages must be preserved (Prime Ministerial Task Group on Emissions Trading 2007, p. 1)

Ian Dunlop[60] (2007, p. 3) points out the contradiction embedded in the terms of reference: maintaining Australia's competitive advantage in fossil fuels is 'impossible' in a carbon constrained future. Dunlop (2007, p. 3) notes that there is no reference to targets or the 'scale of emission reductions required'. Dunlop concludes that the preservation of Australia's competitive advantage in fossil fuels has been set as the primary policy focus ahead of any reduction in greenhouse gas emissions.

The PMTG was filled with representatives of the fossil fuel, mining and resource, electricity generating, and metals manufacturing industries, all of whose interests are directly affected by emissions restrictions. Prominent business representatives included:

> Peter Coates CEO Xstrata (transnational mining corporation)
> Chris Lynch CEO BHP Billiton (transnational mining corporation)
> John Marlay CEO Alumina Limited (bauxite and aluminium)
> Margaret Jackson Chair Qantas (national airline)
> Tony Concannon Managing Director International Power (Australia's largest private electricity generator)
> John Stewart Managing Director National Australia Bank
> Russell Higgins Australian Pipeline Trust (gas pipeline infrastructure)

Higgins was also secretary and CEO of the Industry department from 1997-2002 and chair of the Australian Government Energy taskforce in 2003-4 that produced *Securing Australia's*

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[60] Dunlop is a former senior international oil, gas and coal industry executive. He chaired the Australian Coal Association in 1987-1988, chaired the Australian Greenhouse Office Experts Group on Emissions Trading from 1998-2000, and was CEO of the Australian Institute of Company Directors from 1997-2001.

Energy Future. The remainder of the panel were senior Government bureaucrats. The Task Group was chaired by Peter Shergold, Secretary of the Department of Prime Minister and Cabinet (Prime Ministerial Task Group on Emissions Trading 2007, pp. 145-48). There were no representatives from the renewable energy industry, tourism, agriculture, or insurance. The environment movement and citizens groups were not represented either.

The PMTG (Final Report 2007, pp. 10-13) recognised the importance of cheap fossil fuels to Australia that had been specified in the terms of reference, identified the need for emissions-intensive trade-exposed industry and other business deemed to have suffered loss of value to be compensated, proposed an ETS begin by 2012, but did not recommend any emissions targets. Furthermore, the PMTG (2007, p. 7) argued that new technologies were ‘the key to achieving an enduring decoupling of economic growth and greenhouse gas emissions’ and identified carbon capture and storage as a priority (2007, p. 128).

The Garnaut Climate Change Review

The *Garnaut Climate Change Review* was initiated in April 2007 by Kevin Rudd, Leader of the federal opposition, the Premiers of the six states and the Chief Ministers of the two territories of Australia. Garnaut (2008, p xvi) was asked to report on the likely impacts on Australia of unmitigated climate change, the potential contribution of international climate policy and the costs and benefits of domestic and international climate policy on the Australian economy, Australia’s role in international climate policy, and medium to long-term policy options.

The *Garnaut Review* lasted eighteen months and comprised numerous papers, public forums and lectures, opportunities for submissions, and reports. Four reports are covered briefly here: the *Interim Report*, *Draft Report*, *Supplementary Report* and *Final Report*. Although much of the material is addressed in the *Final Report*, looking at the Interim Report in particular reveals some important developments and shifts in approach as the *Garnaut Review* progressed.

Interim Report February 2008

From the beginning, the *Garnaut Review* (Garnaut Climate Change Review 2008a; Garnaut 2008b, p. xvii) accepted that the mainstream science of the IPCC is correct in pointing to high risks from unmitigated climate change. However, the *Interim Report* (Garnaut Climate Change Review 2008a) specifically warns that the world may be moving towards higher risks of climate change more rapidly than was previously anticipated by the IPCC. This is because emissions in the 21st century are well above the now-outdated IPCC worst-case scenarios due to strong economic growth in Asia, the high energy intensity of that growth, and the high reliance on fossil fuels as an energy source (*Interim Report* 2008a, pp. 15-16, 19). The *Review* noted that high global economic growth driven by China and India is expected to continue until the late 2020s and takes this continued economic growth as a given, mainly due to the 'undeniable' aspirations of the developing world for improved material standards of living (*Interim Report* 2008a, p. 4).

The *Interim Report* (2008a, pp. 19-20) argues that the implications of these trends demand an 'urgent, large, and effective global policy' response to prevent humanity passing tipping points for irreversible climate change. The *Interim Report* (2008a, pp. 19-20, 24) sees stabilisation at 450ppm – the EU threshold for dangerous climate change – as ambitious and highly improbable, and yet acknowledges that 550ppm carries far greater risks of dangerous climate change. Like the *Stern Review*, the *Interim Report* (2008a, p. 20) finds that keeping to 450ppm would require a peaking of global emissions in 2010 followed by ongoing annual reductions of seven per cent.[61] Furthermore, the *Interim Report* (2008a, p. 36) points out that the post-Kyoto framework agreed in Bali in December 2007 for the UNFCCC conference in Copenhagen 2009 will not keep risks of dangerous climate change at moderate levels because it does not envisage emissions budgets for developing nations.

The *Interim Report* (2008a, p. 36) considers rapid, broad and deep emissions reduction is imperative to avoid dangerous climate change, but this is only possible with concerted and 'strong action by both developed and major developing countries alike between now and 2020'. Part of the strategy of the Garnaut Review therefore becomes finding the best model

[61] Assuming these timeframes and the analysis that goes with them are correct, the unspoken conclusion in both the Stern and Garnaut reviews is that avoiding dangerous climate change on these terms is now virtually impossible.

for achieving international cooperation that would allow both developed and developing countries to participate in emissions reductions. The *Interim Report* (2008a, p. 30-31) argues that a global emissions budget must be both fair and practical: it must embrace equal per capita emissions rights and yet allow a sufficiently lengthy adjustment period towards such a position. The *Garnaut Review* argues that this approach is the best method for securing the cooperation of developing nations because it is equitable.

Like the *Stern Review*, the *Interim Report* (2008a, p. 4) regards decoupling economic growth from greenhouse gas emissions as the key to tackling climate change. This is likely to either require a transition to much cleaner sources of energy, and/or a means of removing or sequestering the carbon released in burning fossil fuels. A technological solution to climate change assumes that technological advances will allow humanity to satisfy greater material needs at a higher level of population without imposing critical strains on ecological systems. Both the *Stern Review* and the *Garnaut Review* fit within the broader framework of sustainable economic development in the sense that they do not question global economic growth per se, but rather the type of economic growth: that is economic growth that is compatible with ecological sustainability.

Although the *Interim Report* (2008a, p. 44) endorsed 'many of the design features proposed by the Task Group', the *Garnaut Review* appeared to be a marked shift from the stance of the Howard Government and the recommendations of the Shergold report. Both Howard and Shergold avoided any mention of targets, but Garnaut declared that Australia should make a firm commitment in 2008 to emission targets for 2020 and 2050 (*Interim Report* 2008a, p. 4). Australia could play a constructive role in helping achieve global cooperation by implementing its own abatement policies. Furthermore, when global cooperation is reached with major developing nations, then Australia would need to go further and it should formulate that position in advance (*Interim Report* 2008a, p. 5). In contrast to the Task Group, the approach adopted by the *Interim Report* signalled serious intent towards emissions reductions by Australia as part of a global response.

Draft Report July 2008

The *Draft Report* (Garnaut Climate Change Review 2008b) was released just two weeks prior to the federal Government's Carbon Pollution Reduction Scheme (CPRS) Green Paper. It made recommendations on the implementation of an ETS. It stated that a carbon price must be as broad as possible including petrol and transport, that permits should be fully auctioned to force polluters to reduce levels of pollution and pay for the pollution they cause, and that there should be no compensation for electricity generators because they can pass on the costs of the permits in higher prices to customers. The *Draft Report* also stated that Australia would be highly vulnerable to climate change. These points are dealt with below in the section on the Final Report.

Targets and Trajectories: Supplementary Draft Report September 2008

The *Supplementary Draft Report: Targets and Trajectories* (Garnaut Climate Change Review 2008c) contained a significant shift in recommendations, based on a pessimistic appraisal of future international climate change negotiations. The paper laid out several emissions scenarios. It stated (Garnaut Climate Change Review 2008c, p. 18) that for a 450ppm scenario, Australia should cut emissions by 25 per cent from 2000 levels by 2020 and 90 per cent by 2050; and for 550ppm, reductions would be 10 per cent by 2020 and 80 per cent by 2050. However, the *Supplementary Draft Report* (2008c, p. 3) had already concluded that global agreement on a target of 450ppm was 'not possible at this time'. The *Supplementary Draft Report* (2008c, p. 4) recommended that in the absence of a comprehensive global agreement on greenhouse gas emissions, Australia should commit to an unconditional reduction in emissions from 2000 levels by 5 per cent by 2020.

The *Supplementary Draft Report* (2008c, p. 4) argued this would still be consistent with the Government target of a 60 per cent reduction by 2050, and that pursuit of such a target on a global scale would still allow stabilisation at 550ppm, the target suggested by Stern in 2006. Garnaut did not attempt to cover up the magnitude of the problem, nor did he question the credibility of the science. By his own admission, his recommendations fall well short of what is needed to avert the coming crisis. In his address to the National Press Club, Garnaut (2008a, p. 10) argued that 550ppm is a necessary but insufficient first step, and that harder

targets can be accommodated once agreement is reached on easier targets. In other words, Garnaut believed that 550ppm is politically feasible and should be the aim of governments because it would be better to secure robust agreement and action on a weaker target and strengthen the action later when success has been achieved rather than founder on trying to achieve a much more difficult objective such as aiming for 450ppm.

Not surprisingly, the 5 per cent target proposed by Ross Garnaut was denounced by environmental groups and commentators as inadequate (Hamilton 2008; Jasudason 2008). Nevertheless, a 5 per cent reduction would still represent a significant shift from business as usual. Australia's energy emissions have increased hugely over the last two decades and overall emissions are up on 2000 levels. According to Gittins (2010), a 5 per cent reduction on 2000 levels by 2020 would equate to about a 22 per cent reduction on business-as-usual scenarios. The fact that this significant shift in direction and momentum is still far short of what is required to achieve even a half chance of relative climate stability indicates the magnitude of the problem and the increasing difficulty of the task inherent in further delay.

Still, the conflict was about more than the target. There was a fundamental disagreement about Garnaut's strategy and the perception that he was doing the political legwork for Rudd by recommending a softer and more politically feasible target rather than forming his recommendations on the basis of scientific reality (Hamilton 2008). Furthermore, Hamilton (2008) points out that Garnaut's own modelling predicted that the costs of a more aggressive approach to mitigation that aimed at a lower target would still be manageable, and would be negligible compared to the costs of failing to respond adequately to climate change.

Final Report

The *Final Report* (Garnaut 2008b) states that an ETS is the most efficient way of reducing emissions in Australia subject to certain conditions being met. The key danger arises from special interests capturing and subverting the policy process. Garnaut warns that indulging special interests would critically undermine the effectiveness of the scheme. Firstly, it would protect major polluters and therefore act as a barrier to change within those sectors. Secondly, it would penalise cleaner sectors and therefore distort investment decisions in a harmful way by rewarding dirty sectors and punishing cleaner sectors. Moreover, carbon pollution needs to

be paid for and if corporations are exempted from paying for their pollution, then the burden of payment must fall on consumers and/or taxpayers.

Garnaut specifically warns against compensation for coal-fired electricity generators. The *Final Report* points out that the coal-fired generators are likely to pass the permit price on to their customers in the form of increased electricity prices. Moreover, the permit price is likely to have negligible effect on asset values. Garnaut also makes the point that talking about compensation is an incorrect way of viewing the problem because industries should not be compensated for changes in government policy. Garnaut (2008b, p. 397) observes that 'compensation was not provided to the asbestos or tobacco industries' and that the case presented by the coal-fired generators is simply unjustified special-interest pleading.

Garnaut (2008b, p. 332) argues that are no justifiable grounds for the free allocation of permits. Indeed, the review notes that a free permit is a misnomer. A permit may be allocated freely, but it incurs a cost within the economy that would most likely be borne by households. Garnaut (2008b, p. 315) points out that any scheme that promotes rent seeking from government, particularly by permit allocation that rewards special interest pressure, 'must be viewed as an abject failure'. Getting the scheme wrong at the outset by free allocation of permits could compromise the ETS to such a degree that it would be impossible to rectify at a later stage (Garnaut 2008b, p. 331).

Garnaut (2008b, p. 316) acknowledges that until an international arrangement between major trade competitors imposes relatively uniform carbon constraints, trade-exposed emissions-intensive industries are 'a special case' and represent a 'dreadful' problem. Nevertheless, Garnaut (2008b, p. 342) states that free permit allocation to trade-exposed emissions-intensive industries could 'pervert' an ETS and render it unviable. Instead Garnaut (2008b, p. 345) argues for a 'transitional arrangement' that provides assistance to eligible trade-exposed emissions-intensive industries in the form of 'a credit against their permit obligations equivalent to the expected uplift in world product prices that would eventuate if our trading partners had policies similar to our own'. According to Garnaut, his formula avoids distorted price signals and will automatically decline as competitors adopt carbon pricing and cease when a global arrangement is completed.

Garnaut (2008b, pp. xix) points out that Australia has a strong interest in helping secure an effective negotiated agreement because it is the OECD country most exposed to the dangerous consequences of unmitigated climate change. The *Final Report* also points out that implementation of an ETS is occurring in a dynamic international context where policy action is monitored closely by other countries to assess its effectiveness. The actions of the Australian Government will impact on the approach taken by other countries and the concessions they are willing to make to progress a negotiated global solution. Excessive compensation given to industry by the government could undermine international action by indicating to other nations that Australia is not serious about reducing emissions from the largest emitters (Garnaut 2008b, p. 344). This scenario could leave the world with little chance of avoiding dangerous climate change.

Although Garnaut was upfront in acknowledging that powerful vested interests will try to distort an ETS to their own advantage, there appears to be an assumption that if Governments adopt a principled approach to the issue, they should be able to resist this pressure. A dilemma arises when the concessions to vested interests are sufficiently large to render the policy ineffective. The *Final Report* provided no remedies for overcoming this dilemma.

The agenda management techniques of government

Harding (1985) observes that governments manage their agenda to reduce opposition to their policies (or lack of policy). By shaping the way a problem is defined, or preventing certain aspects from emerging, governments can manipulate public perceptions and evade negative attention (Harding 1985, pp. 224-5). Governments face a very difficult challenge with climate change. Scientific and economic reviews point to grave consequences in the future from a lack of effective policy action. Powerful industry groups have an immediate vested interest in business-as-usual. Public opinion has expressed a desire for action on climate change. Yet, arguably, there is little public understanding of the enormity of the change needed and the potential costs, burdens and sacrifices that may be required. The following sections classify the techniques that Howard and Rudd used to manage climate change on their agenda.

The Howard Government

Cover-up and access to information

It is impractical for governments to control the flow of information about climate change itself because scientists have communicated the evidence to a range of audiences including governments, media, and the public. However, one aspect of cover-up available to governments is conducting some of their business in secret in order to conceal underlying motivations or deals from the public. For example, leaked notes that came to light in 2005 (Hamilton 2007a, pp. 10-12) reveal that in 2004, Howard and industry minister Ian Macfarlane convened a meeting with the heads of major fossil fuel corporations to discuss the MRET. Apparently, the government was keen to frustrate the expansion of the renewable energy industry and discussed methods for outflanking the renewable energy industry and protecting the fossil fuel industry. According to Hamilton (2007a, pp. 10-12) such political manoeuvring might cause uproar if it became public knowledge and would contradict the government's claim that it was dealing even-handedly with all sectors of the energy industry. Secrecy therefore concealed this aspect of the government's agenda to prevent a backlash against its approach.

Devaluation

The Howard government devalued the Kyoto protocol after it had made the decision not to proceed with ratification. Despite its initial judgement that the Kyoto protocol was a 'win-win result' for the environment that 'protects Australia's export competitiveness and employment' (Hill 1997), the government subsequently criticised Kyoto for imposing a disproportionate burden on Australia whilst failing to place limitations on rapid emissions growth in developing countries (Kemp 2003a, p.6, 2003b; Australian Government 2004, p. 24; Howard 2006a; Campbell 2006b, 2006c; Downer 2007). Kyoto was belittled by Environment Minister Campbell (2005) as a 'dud' and denigrated by Foreign Minister Downer (2007) as 'fatally flawed', a 'vanity pose' and a barrier in the 'quest for a truly global and therefore effective solution'. Yet, at different times, Hill, Downer, Kemp and Campbell had, either publicly or in cabinet, all recommended that Australia ratify the Kyoto protocol (Christoff 2005b, p. 40; Hartcher 2009a, pp. 70-73). This suggests that publicly reducing the status of the Kyoto

protocol was used to allay concern over the government's refusal to ratify the protocol. Nevertheless, devaluation was ineffective in changing public opinion on the issue, possibly because demonising Kyoto appeared incongruous: the government consistently claimed Australia was one of the few countries 'on track' to meet its emissions target (Kemp 2003a, p. 6; Australian Government 2004, p. 138), and thanks to the land clearing concession, it managed this objective without affecting economic activity or jobs and without any deviation from a business-as-usual approach to economic affairs.

Reinterpretation

Reinterpretation has been central in the climate change debate, particularly disputes about the evidence and different ways of framing of the problem. The various forms of reinterpretation are a crucial aspect of the struggles over problem definition and agenda management that were identified in chapter 3 in the work of Cobb and Elder (1983), Rochefort and Cobb (1994), Kingdon (2003) and Stone (2002).

Denial

The Howard government used denial to reinterpret climate change as an issue of ongoing scientific uncertainty and debate. Howard and various ministers denied the evidence on the cause of climate change and the seriousness of the problem. Energy Minister Warwick Parer, Forestry and Fisheries Minister Eric Abetz, and Agriculture Minister Peter McGauran all dismissed climate change (Pearse 2007, pp. 144-146). Industry Minister Ian Macfarlane (2006a, 2006b, 2007) declared himself 'a sceptic of the connection between emissions and climate change', and dismissed *An Inconvenient Truth* as 'just entertainment'. Finance Minister Nick Minchin (in Frew 2007) claimed 'a number of eminent scientists remain in the sceptical camp' and Environment Minister Ian Campbell (2005, p. 2) maintained that 'there's a lot of very serious scientists who still doubt' the science. Coalition MPs such as Russell Broadbent (in Evans 2006b), Dennis Jensen (2007) and Senator Cory Bernardi (2009) have also launched sceptical booklets at Lavoisier Group functions and former Liberal Party

President Tony Staley[62] (2000) delivered a paper at the inaugural Lavoisier Group conference.

Raising doubts about the scientific evidence helped the government to manage its agenda by allowing it to project itself as rational and prudent in delaying action such as an ETS until the science was more conclusive. Nevertheless, denial and implicit devaluation can be counter-productive when evidence, particularly from reputable authorities, is widely communicated to a receptive public. On 2 February 2007, the IPCC *AR4* concluded that:

> most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations (IPCC 2007a, 10, emphasis original).

Yet on 6 February, Howard (2007a, pp. 14-15) stated in Parliament 'that the jury is still out on the degree of connection' between emissions and climate change. Howard retracted this statement the next day (ABC [Australian Broadcasting Corporation] 2007a). This perhaps indicates he now believed denial was no longer useful as a tool to downplay the government's inaction, and had instead become a liability that could ignite opposition by exposing the user of this tactic as out of touch with mainstream opinion.

Deception

In Parliament, Howard (2006c, p. 66) claimed that:

> According to ABARE [Australian Bureau of Agriculture and Resource Economics], a 50 per cent cut in Australian emissions by 2050 would lead to a 10 per cent fall in GDP, a 20 per cent fall in real wages, a carbon price equivalent to a doubling of petrol prices, and a staggering 600 per cent rise in electricity and gas prices.

Howard gives the impression that with a cut in emissions the Australian economy would be smaller and real wages lower than today. Yet, according to Pearse (2007, pp. 377-378) and Gittins (2007b), the figures used by Howard need to be interpreted relative to the reference case of business-as-usual in 2050. Pearse (2007, p. 460 no's. 26, 27) points out that ABARE

[62] Pearse (2007, p. 146) notes that Staley was a Howard loyalist and remained on the Liberal Party federal executive until 2005.

predicted in its worst-case scenario that GDP would increase by 246 per cent as opposed to 281 per cent and real wages would increase by 81 per cent as opposed to 129 per cent by 2050 . As Gittins (2007b) notes, this is the equivalent, in the worst case, of the economy growing at 2.2 per cent as opposed to 2.3 per cent per annum. Moreover, by 2050, according to ABARE figures, Australians would be paying proportionately less for electricity despite reducing emissions by 50 per cent (Pearse 2007, p. 272). Pearse notes that ABARE (Ahammad et al 2006) made no claims for the doubling of fuel prices or the 600 per cent increase in electricity prices.[63] These figures came from the Department of Industry, Tourism and Resources (Pearse 2007, p. 378, p. 460, no.28). Howard relied on both omission and misrepresentation to mislead the Australian people about the impacts of policy action.

Framing

Neo-liberal market ideology has been a dominant global frame for the last thirty years (Herman and Chomsky 2002, pp. xvii-iii). This perspective has impinged on media treatment of environmental issues (Beder 2000, pp. 195-202). The Howard government framed Australia's national interest and prosperity as based on a comparative advantage in cheap fossil fuels. Within this frame, coal was positioned as both a source of wealth and the only realistic energy source for the foreseeable future (Australian Government 2004; Kemp 2003b; Howard 2006a).

Conversely, action on climate change, such as a carbon price, was framed by the government as a recipe for economic disaster. The government routinely observed in policy documents, speeches, media releases and in Parliament that the economic gains from the resource sector were too important to be undermined by an emissions reduction program (Australian Government 2004; Howard 2006a, 2006b, 2007b, pp. 68, 70). The government emphasised the job losses that a carbon price would cause. The government argued that 'premature' action would lead to carbon leakage as heavy emitting industries moved to locations with weaker environmental standards than Australia (Australian Government 2004, 25, p. 140). A climate change response was therefore framed as both economically irresponsible and environmentally ineffective.

[63] ABARE estimated an 80 per cent rise in electricity costs by 2050. This was confirmed in an email to Pearse (2007, p. 460, no. 28) on 6 September 2006 by Shane Bush, a senior official at the Department of Industry, Tourism and Resources.

Minimisation

The government minimised Australia's contribution to the problem by pointing out that Australia only contributes 1.4 per cent of total global greenhouse gas emissions (as opposed to recognising Australia's very high per capita emissions). The government argued it would make little difference what Australia did on climate policy because even if Australia cut emissions drastically, these efforts would be negated within six to twelve months by burgeoning emissions in Asia (Howard 2006a; Costello 2007b; Chapman 2007, p. 138; Turnbull 2007). Minimisation reinforced the government position that there really was no point in acting prematurely. However, the Garnaut Review (2008b, p. 291) points out that the government's efforts to minimise Australia's responsibilities had international repercussions that included lending support to the Bush Administration's rejection of the Kyoto protocol.

Official channels

The main official channel on climate change has been the Kyoto protocol. Yet the Howard government refused to ratify the protocol. By rejecting the main instrument for official action, the government denied itself the opportunity to use the Kyoto protocol to proclaim its commitment to reducing emissions.[64] Of all the decisions made on climate change, this may have been the most damaging for the government in terms of public opinion because it was highly symbolic (see Campbell in Hartcher 2009a, pp. 72-73). Aware that its refusal to ratify Kyoto was unpopular, the government devalued the protocol and promoted a range of other official programs in an effort to reframe Australia as a practical leader on climate change and reassure the public that the government was serious about climate change (e.g. Downer 2007; see also Crowley 2007).

The Howard government promoted the Greenhouse Challenge Program (GCP) as an example of practical progress on climate change. It appears, however, that the GCP realised little actual emissions reductions (Hamilton 2001, pp. 40-50).[65] The government also established the Australian Greenhouse Office (AGO) to develop greenhouse policy. The AGO commissioned four reports into emissions trading, but did not have the power to implement

[64] Nonetheless, the government frequently claimed that Australia was one of the very few countries 'on track' to meet its target (e.g. Australian Government 2004, p. 138).
[65] See above section on voluntary programs, pp. 110-112.

policy and was subject to a ministerial council with the balance of power residing in the energy and industry departments (Hamilton 2007a, pp. 97-98). By 2001 Howard revoked its executive agency, and then removed its independence and placed it under his personal control (Pearse 2007, p. 85). Still, the government promoted the setting up of the AGO as a world first and a leading example of its commitment to 'taking action' on climate change (e.g. Downer 2007).

Shortly after the Kyoto protocol came into effect in 2005 the Howard government launched the Asia-Pacific Partnership on Clean Development and Climate (AP6) on 12 January 2006 in Sydney. The AP6 included the major Asia Pacific countries: Australia, China, India, Japan, Korea, and the US (Canada subsequently joined in October 2007). China, India, Japan and Korea had all ratified Kyoto: only the US and Australia had not. The AP6 was a voluntary agreement about cooperation on the development and sharing of technology that enabled greenhouse gas emissions reductions. It has been criticised in the US by Senator John McCain (in Goodell 2007, p. 231) as inadequate and ineffective. The GCP, AGO and AP6 can all be seen as symbolic or token policies designed to provide public reassurance, offer limited action, and deflect criticism over the decision not to ratify the Kyoto protocol.

The MRET introduced in 2000 mandated 9500GWh (approximately 2 per cent) of energy be procured from renewable sources. The scheme stimulated growth in macro renewable energy projects, particularly wind energy. It was likely the target would be surpassed several years ahead of projections and a government-commissioned review recommended extending and expanding the scheme (Tambling 2005, pp. xvi-ii, xxvii, no. 8). Initially, the government (Australian Government 2004, pp. 135, 147) rejected this proposal. However, midway through the 2007 election year, the government raised the renewable energy target to 15 per cent by 2020.

On 10 December 2006, Howard established a joint government business Prime Ministerial Task Group (PMTG) on emissions trading. Having previously stated that Australia would not institute an ETS in advance of other nations, Howard overturned his existing position and on 4th July 2007, committed himself, if re-elected, to introducing an ETS by 2012 irrespective of international developments. Two aspects of official channels are revealed here. Firstly, the proposed timetable for the ETS still delayed implementation for a further five years.

Secondly, the PMTG can be seen as an emergent strategy designed to try and defuse a political backlash by giving the impression that Howard was now serious on climate change. Despite the policy commitment, the shift in position contrasted with Howard's refusal to ratify Kyoto and his previous claims that a carbon price would not be introduced in advance of a comprehensive global agreement because it would devastate the economy.

Pressure

Interviews with prominent CSIRO scientists on a *Four Corners* television program in 2006 reveal a managerial ethos at the CSIRO that prevented scientists from commenting on the public policy implications that flowed from their work (ABC 2006). It appears these directives came from government. Graeme Pearman, a world-renowned climate scientist with 30 years experience at the CSIRO was repeatedly censored before being made redundant (ABC 2006). Another senior climate scientist, Barrie Pittock, was advised not to talk about reducing emissions and that sections of a report to government, containing references to potential environmental refugees in the Asia Pacific region as a result of rising sea levels, were unacceptable and should be removed (ABC 2006). These examples send a chilling signal to other scientists in the field.

According to *Four Corners*, several other scientists spoke off camera about censorship, but were afraid to go public. It benefits government if scientists and their organisations can be quietly persuaded to adopt a degree of self-censorship. This reduces the likelihood that pressure will be exposed and cause outrage. Preventing certain pieces of information from leading Australian climate scientists reaching the public sphere also gives the impression the governmental perspective is unchallenged. Nevertheless, these methods were not entirely successful because television coverage did expose, to a receptive audience, the pressure placed on scientists working in a government institution.

The Rudd Government

Validation

There is no evidence that federal Labor has used devaluation as a tactic to reduce concern about climate change, at least in the public arena.[66] In contrast to the Howard government, Labor validated climate science and acknowledged the seriousness of the problem. Labor also validated the Kyoto protocol and legitimised domestic action within existing frameworks of international cooperation.

Reinterpretation

Official rhetoric promoting the importance of climate change and the need for a serious policy response was prominent after the Rudd government came to power. Although the government used aspects of deception, framing was generally sufficient to convey the government message. More recently, the government made some use of blaming and aspects of minimisation.

Framing

Labor defined itself and its policy responses as markedly different from Howard. The Rudd opposition characterised itself as part of the solution to climate change and the Coalition as part of the problem. Labor promised policy action after ten years of denial and delay under Howard (Garrett 2007; Australian Labor Party 2007). Rudd (2007a) declared climate change to be 'the great moral challenge of our generation'. Nevertheless, Rudd has framed himself as a pragmatist on fossil fuels. Like Howard, Rudd (2009a) urges acceptance of 'the cold hard reality that coal will be the major source of power generation for many years to come'. This reliance on coal into the foreseeable future keeps Labor aligned with the major corporations and unions in the resource sector, and is complemented by the government's promotion of clean coal technologies (see Rudd 2009a). In an attempt to reconcile these divergent visions of great moral challenge and coal as an economic reality, the government has framed its response to climate change as a balancing act between reducing carbon pollution and

[66] By contrast, Michael Costa, Labor Treasurer in the NSW state government between 2006 and 2008 was a prominent climate sceptic.

supporting economic growth. According to then federal climate change Minister Penny Wong (2009) 'the Government's primary objective has been to get the balance right'. The government portrays itself as taking a responsible middle path between the alleged fundamentalism of the Greens and climate scepticism of the Coalition.

Deception

The CPRS (Australian Government 2008d) has been promoted as transformative and the first scheme to ever limit carbon emissions from industry in Australia (Rudd 2008; Wong 2008). The government emphasised that business would now need to hold permits to pollute. Yet the CPRS contains major concessions to industry[67] that significantly compromise the effectiveness of the scheme. Treasury modelling (Australian Government 2008e, p. 33, chart 3.9) does not envisage any emissions reduction from coal-fired electricity generation until 2033. This indicates that far from reducing emissions in the energy sector, the CPRS may 'lock in' emissions from the largest emitters. Emissions trading schemes such as the CPRS are the preserve of experts because they are complicated and technical. Complex and tedious details make it difficult for the public to grasp the implications. Even if the complexity is inadvertent, the lack of transparency makes it easier for government to reassure the public that effective action is being taken even though the policy will do little to restrain emissions or induce major structural change in the economy. The claims of transformation by the government amount to a deceptive reinterpretation of the evidence.

Blaming

As it prepared the CPRS legislation for Parliament, the government conceded to extra industry demands on compensation and Coalition demands to postpone the scheme until 2011 (Rudd 2009b). In November 2009, Rudd (2009c) tried to blame sceptics in the opposition for preventing the passage of his legislation. Had the government decided to campaign consistently on its legislation, one may have expected blaming to feature prominently.

[67] Covered in the section on inducements, pp. 136-138.

Minimisation

By May 2010, the government had dropped climate change from its agenda and shifted attention to other issues (Taylor 2010; Hartcher 2010b). It could be argued that this was an attempt to minimise the issue by failing to give it the attention that Rudd previously accorded it.

Displacement

Displacement refers to the attempt to ‘shift [the] focus of controversy to a different issue’ (Harding 1985, p. 225). During the period of bi-partisan agreement on an ETS (under Malcolm Turnbull’s leadership of the Liberal National opposition between September 2008 and November 2009) divisions were apparent in the opposition over whether to support passage of the CPRS in the Senate. Hartcher (2009b) argues that Rudd avoided campaigning on his climate change policy between May and October 2009 to ensure that the media focussed on the bitter struggle within the opposition in the hope that the opposition would tear itself apart. The ploy to divert attention backfired against the government because prominent climate sceptics went unchallenged in public debate and support for the CPRS fell significantly (Hartcher 2010a). As sceptics were emboldened, Tony Abbott gained leadership of the opposition on a platform to oppose the CPRS, effectively ending the government’s hopes of passing its policy.

Official channels

At least until early 2009, Rudd made sophisticated use of official channels both as leader of the opposition and as Prime Minister. During 2007, Howard attacked federal Labor’s proposed 2050 emissions targets as disastrous for jobs and the economy and demanded to know Labor’s interim 2020 targets (House of Representatives, *Debates* 2007b, p. 68; ABC 2007b). The *Garnaut Review*, commissioned in April 2007, fulfilled important aspects of official channels for Labor. Garnaut had been a key advisor to the Hawke government advocating the removal of trade barriers and the experience of its author gave the Review authority and provided the impression the issue was being taken seriously by Labor. Furthermore, Rudd was able to avoid specific debates with Howard prior to the election about

economic impacts by stating, plausibly, that Labor policy on a 2020 target would be informed by the findings of the Garnaut Review (ABC 2007b).

Once elected, Rudd (2007b) made immediate use of official channels by ratifying the Kyoto protocol as the first official act of his government. Kyoto ratification signalled to the Australian public and to the world that Australia was committed to current international processes as an active and responsible participant. Ratification gave Rudd a global stage on which to proclaim Australia's new position and differentiate his government from the previous Australian government.

Coinciding with the *Garnaut Review Final Report* (2008b), the government developed its key policy, the CPRS. The government initially gave the impression it would be guided by the Garnaut Review and has used the Review to provide an imprimatur of authority to government policy even though the CPRS[68] does not adhere to crucial Review recommendations.

Besides the impression of serious and authoritative action, official channels also provide plausible reasons for delay. The *Garnaut Review* delivered its *Final Report* on 30 September 2008. The government developed a consultation Green Paper released on 16 June 2008, commissioned Treasury modelling, released a White Paper on 15 December 2008, prepared draft legislation for Parliament in March 2009, and negotiated with the Turnbull Coalition to try and ensure the legislation would pass through the Senate. The government decided to introduce the legislation but postpone implementation until after the next election, ostensibly to secure the support of the Coalition in the Senate. Even if it had been passed, the CPRS would not have come into effect during the first term of the Rudd government. Nevertheless, the delay can be justified as a legitimate aspect of the democratic political process.

Inducements

Martin describes bribery as a payment or other incentive to induce cooperation, suppress opposition, or silence debate. Bribery is particularly difficult to detect because it is hidden and because the boundaries between bribery and other forms of financial inducement are

[68] As discussed in the next section, pp. 136-138.

indistinct (Martin 2007a, 5). There is no suggestion the Rudd or Howard governments engaged in bribery in the literal sense.

Policies that promise fundamental change and the imposition of burdens on powerful players may employ mechanisms that provide incentives and inducements to attract the support or cooperation of these players (Schneider and Ingram 1993, pp. 337-340). There are several inducements to industry in the CPRS. Firstly, major polluting industries will receive freely allocated permits rather than being required to purchase them (Australian Government 2008d, sec. 12-2).[69] Yet for an ETS to function effectively and provide an incentive to reduce pollution, pollution permits should be allocated by auction (Garnaut 2008b, pp. 331-332). Auctioning of permits conforms to the polluter pays principle insofar as polluters pay for their permits and the money raised goes to the public purse[70]. Conversely, free allocation of permits to the largest polluters inverts the polluter pays principle: in effect, it involves a transfer of wealth from the public to the polluters (Gittins 2007a, 2009).

Furthermore, the free allocation of permits distorts the market because rewarding the worst performers entrenches their position and discriminates against cleaner alternatives. This undermines the incentive to reduce pollution and invest in cleaner alternatives and erodes the economic and environmental integrity of an ETS (Macgill and Betz 2008, p. 2; Garnaut 2008b, pp. 314-315, 343). Finally, European experience with free permit allocation shows that major polluters still pass on their permit price in the form of higher prices to the consumer (Lohmann 2006, p. 91; Macgill and Betz 2008, p. 1). This delivers windfall profits to big corporations. Meanwhile, the consumer ends up paying twice in the form of higher prices and because the permit revenue does not flow into the public purse.[71]

Secondly, the Australian government (2008d, sec.13-21) proposed $7.4 billion in compensation to the coal-fired electricity generators (Verrender 2010). The *Garnaut Review* (2008b, p. 397) states clearly that there is no economic justification for compensating coal-fired electricity generators. In a recent speech, Ross Garnaut (2010) referred to compensation

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[69] The PMTG (2007, pp. 11-12) upon which Howard was basing his proposed ETS also recommended the free allocation of permits.
[70] Economic instruments assume that pollution can be compensated for. For a critique of the assumptions underpinning economic instruments and the polluter-pays principle, see Beder (2006, pp. 192-98)
[71] Gittins (2009) points out that although this is grossly unfair, the price signal still works for the consumer.

as ‘excessive and unprincipled payments’. Similarly, a review by the Grattan Institute found that the CPRS compensation proposed by the Rudd government was either ‘unnecessary or poorly targeted’ (Daley and Edis 2010, p. 4).

Thirdly, the CPRS places no limits on the purchase of international carbon credits (Australian Government 2008d, sec. 11-9). This concession allows major polluters to offset any increase above their permit cap by purchasing international credits. Guy Pearse (2009, pp. 65-66) has warned that Australia could be awash in cheap carbon offsets from avoided deforestation in PNG and Indonesia.[72] Designed to allow access to the cheapest source of greenhouse gas mitigation, cheap international offsets may negate any incentive for Australia to reduce domestic emissions and provide industry with a cheap alternative to finance an ongoing increase in emissions.

Conclusion

This chapter has shown that the strategy and tactics used by Howard and Rudd to manage climate change were influenced by a complex range of shifting factors including the structure of the Australian economy, historical decisions on energy sources, international developments (scientific, political, socio-cultural, economic and policy), shifts in public opinion, the domestic balance of political fortunes and the strategy of opponents, and more prosaic factors such as weather and climate patterns.

The framework for analysing tactical choices is a particularly useful way to clarify the similarities and differences between the approaches of the respective governments. Table 2 (next page) indicates that between them, the two governments used the full range of tactics available to powerful players including rhetorical, financial, coercive and official measures, as well as some elements of cover-up. However, neither government used all the tactics, but instead tended to rely on particular methods to suit their overall agenda. Yet, with its proposed adoption of an ETS with industry inducements, it could be argued that the Howard government intended to make use of all the methods available to government. Still, table 2 is a simplification of the methods used by Howard and Rudd and I use it to illustrate the main

[72] For a critique of offset mechanisms in developing countries, see the earlier section on market mechanisms, p. 52.

patterns, rather than to serve as a detailed analysis. For example, I have not ticked official channels for Howard because he refused to ratify the Kyoto protocol even though he did use other official channels.

Table 2: Tactics used by the Howard and Rudd governments

Backfire framework	Howard government	Rudd government
Cover-up	✓	
Devaluation	✓	
Validation		✓
Denial	✓	
Deception	✓	✓
Minimising	✓	
Blaming		✓
Framing	✓	✓
Displacement		✓
Official Channels	*	✓
Pressure	✓	
Financial Inducements	**	✓

Key: ✓ indicates use of the method
* indicates partial use
** indicates this method would have been used if Howard had been re-elected in 2007
Indented tactics indicate the various forms of reinterpretation

The difference in approach between the Howard and Rudd governments mirrors the positions the two leaders took on the Kyoto protocol. Howard's refusal to ratify the Kyoto protocol was a decisive move. Howard lost credibility on climate change by denying himself the opportunity to use the primary official channel on climate change to proclaim his government's commitment to addressing the problem. Certainly the Howard government used other official channels such as voluntary programs and government-industry and inter-government partnerships. Indeed, Howard's abrupt policy shift on emissions trading could be seen as a final effort to use the potential of official channels to persuade the public that he was serious about climate change. But there were contradictions between the government's new-found position and its rhetorical history of climate scepticism, as well as the exposure of secret meetings with industry and revelations about alleged attempts to silence mainstream scientists whose views it disagreed with.

By contrast, Rudd relied almost exclusively on official channels to give the impression his government was taking action on climate change. Furthermore, his use of official channels

was consistent with his rhetorical tactics such as his validation of climate science and the Kyoto protocol. Nevertheless, the Rudd government's reinterpretation of its key climate policy as transformative was deceptive because the substantial concessions granted to industry would have significantly undermined its effectiveness. The financial inducements granted to industry can be seen as measures designed to reduce vocal objections to the CPRS from powerful industry players and convert them from political opponents into potential allies. Although some concessions are a necessary part of political compromise to achieve policy progress, the opaque nature of the Rudd government's intended policy supports the claims of Edelman (1985), Schneider and Ingram (1993), and Stone (2002) that governments use a degree of deception in contentious cases involving powerful players: the public receives symbolic rhetorical assurance, but industry gets the key decisions.

Rudd also used his policy for political purposes. Rudd had significant advantages upon assuming power in government including a public mandate to implement climate policy and, during Turnbull's leadership of the opposition, a political opponent genuinely committed to policy action on climate change. Yet Rudd squandered these opportunities by tactical failures: firstly, he acquiesced completely to industry demands for compensation rather than risking a fight over differentiated levels of compensation, and secondly, he failed to campaign vigorously for a genuine bipartisan agreement on climate change policy, preferring instead to subject the opposition to short term political pain. Rudd's tactic of displacing attention onto his opponents backfired, and contributed to a significant strategic loss in public support for his own policy agenda. Furthermore, Rudd's failure to secure his climate change legislation demonstrates that impetus on policy can be lost due to political misjudgement, and not just denial within government or opposition from vested interests.

Governments are not necessarily neutral arbiters in a policy conflict and they have their own specific agendas and interests. Both Howard and Rudd were concerned to protect Australia's major fossil fuel producers and consumers into the future. Neither envisaged any major structural change to the economy, and both strongly emphasised the importance of 'clean coal' technology. In fact, the climate change policy implemented by a re-elected Howard government would have been very similar to that proposed by the Rudd government. However, the two governments reached that point using markedly different agenda

management techniques. Governments manage the policy agenda to achieve certain outcomes, including electoral gain and alleviating public concern over their actions. The fact that the strategic and tactical choices made by two Prime Ministers in managing their climate change agendas contributed in varying degrees to their own political demise indicates the importance of studying agency in the political realm.

Chapter 5: The Industry campaign

Introduction

This chapter looks at industry, one of the key protagonists in the climate change debate. One way of seeing the conflict over climate change (and fossil fuels) is to treat it as a strategic engagement between the professional power of scientific institutions and the financial power of the fossil fuel industries. Most scientists and their professional organisations and institutions have formed a position on one side of the debate, along with a range of environmental organisations. On the other side of the debate, a fossil fuel industry alliance has funded a global network of think tanks and front groups to dispute the science and stress the economic upheaval involved in reducing emissions (Pearse 2007; Jacques, Dunlap & Freeman 2008; Oreskes and Conway 2010). Media critics, many of whom are associated with corporate-funded free-market think tanks, can be seen as an integral part of this industry alliance (Pearse 2007; see also Beder 2000, pp. 195-231).

Given its significant financial power, industry has the ability to mobilise resources and pursue strategies across multiple arenas. Industry has successfully shaped public and political debate and stymied policy progress on climate change over several decades. It is important, therefore, to understand how industry operates. To do this, I look at industry from the perspective of both its own vested interests and its ideological commitments. This involves an investigation of three distinct but complementary facets of the industry campaign: a cross-industry greenhouse lobby group, an industry front group, and certain allies in the media.

I begin by situating the fossil fuel and resource sector within the wider business community. I then look at the coal and aluminium industries and the role of resource and energy exports in the Australian economy. I give some background on the Australian Industry Greenhouse Network (AIGN), followed by the role of the mining industry in establishing elements of the radical neoliberal network and the Lavoisier Group in particular. I then cover the importance of credibility in a dispute before using the tactical framework to examine the tactics of the AIGN, the Lavoisier Group, and the media critics.

The fossil fuel sector

Fossil fuels occupy a paradoxical position in modern society. Although fossil fuels have enabled industrial advances and social development, they now constitute one of the greatest risks to human civilization. As such, the fossil fuel, resource and metals processing sector of industry has a direct and vested interest in the outcome of the climate change debate. If governments introduce legislation that aims to rapidly and substantially decarbonise energy supply, this would pose a threat to the core business of some of the world's major corporations. For example, the Australian coal industry faces the prospect of having to leave many years worth of easily accessible coal in the ground. Energy intensive industries such as the aluminium industry in Australia rely on large amounts of cheap coal-fired electricity and would face rising electricity prices under a scheme to reduce greenhouse gas emissions, threatening the viability of Australian aluminium exports.

The industries that produce and consume fossil fuels are one of the key players in the climate change debate. Corporate influence in the climate change debate is underpinned by two key factors: the central importance of fossil fuels in modern economies and the fact that the fossil fuel industry is dominated by major corporations, many with transnational activities. The economic power of the corporations coupled with the organization of the fossil fuel sector has enabled the fossil fuel industry to exert considerable leverage over government and to some degree over other industry sectors and the public agenda (Hamilton 2007a; Pearse 2007).

Nevertheless, industry is not monolithic. There are mixed interests within the energy sector between corporations that have interests in coal, gas, oil and uranium, as well as a nascent renewable energy industry. Gas, uranium and renewables may gain market share at the expense of coal in a carbon constrained economy. There are divisions between the major greenhouse gas polluters and other industry sectors such as insurance, tourism, forestry and agriculture which will be adversely affected by climate change. Yet these sectors, for various reasons (some of which are covered later in the section on pressure), have had little input into the debate (Pearse 2007). There are also splits between the fossil fuel sector and the wider business community. Major corporations in the finance sector have an interest in the development of large carbon trading markets. Furthermore, finance corporations may begin to price a carbon risk into their investment decisions. Investment and lending decisions by the

business sector could have a crucial influence on the outcome of the debate and the speed and timing of a transition to a low-carbon economy.

Competing interests within the business community raise the possibility that at some stage of the struggle, fractures will appear as some business sectors visibly shift position and demand substantial policy measures from government. This raises questions about the role of citizen organisations and their interaction with certain sectors of industry and government. Social movement activists such as Bill Moyer (1987, 2001) and political scientists such as Frank Baumgartner and Bryan Jones (1991, pp. 1050-51) have noted that strategic alliances shift during a struggle as some elite stakeholders either join with broad-based social movements or lead reform on particular issues. Paul Gilding and Phil Preston (2010) note the potential for this scenario (e.g. a shift in the investment decisions made by large financial corporations) in the climate change debate. Yet, there is little indication at present that large investment banks and fund managers are even beginning to consider the risks of investing in new coal (Leggett 2010).

Although I recognise various competing interests within the business sector and the potential for shifting alliances, I focus on the strategies and tactics of the fossil fuel, resource and metals processing sector because it has been the most active and influential industry participant in the debate. To get a more complete understanding of these industries, I examine their role in energy and industry, their economic contribution, and their political power.

Resource exports and the Australian economy

Since the early period of colonisation, the Australian economy has been geared towards exporting resources and importing manufactured goods. Up until the 1960s, Australia was particularly dependent on wool exports for its prosperity (Fenna 2004, p. 211). More recently, exports of minerals such as iron ore, energy such as coal and liquid natural gas (LNG), and non-ferrous metals such as aluminium have dominated Australian exports (Macfarlane 2002, p. 9; Fenna 2004, p. 211; ACA 2010). Total resource exports in 2008-09 were over $160 billion compared to manufactured exports of less than $40 billion. In 2008-09 energy exports totalled $78 billion (ABARE 2010, p. 2).

Energy underpins economic growth and abundant supplies of cheap fossil-fuel energy have been crucial in facilitating rapid economic growth over the last century. Global energy demand, driven by rapid industrialisation in China and India, is expected to increase by 60 per cent between 2003 and 2030 and the IEA (2004, p. 31, 2006, pp. 1-2) expects 85 per cent of this increase in global energy demand to be met by fossil fuels. Australia is now the world's largest coal exporter with a value of over $50 billion in 2008-09 (ACA 2009b, 2010). Australia also has considerable reserves of LNG and is poised to become the second largest LNG exporter by 2015 (Australian Government 2006, p. 1). LNG exports were valued at $10.1 billion in 2007-08, with the major market being Japan followed by China (Roarty 2010; Priestley 2010; Australian Government 2011).

Conventional economic wisdom held that development and prosperity required a country to pass through the phase of resource exploitation and into value-added manufacturing. By contrast, former Governor of the Reserve Bank of Australia (RBA) Ian Macfarlane argues that Australia has a comparative advantage in energy and resource production. He suggests that, contrary to conventional wisdom concerning the long-term vulnerability of commodity prices, Australia's resource exports will continue to be its future economic strength because changes in world mineral resource and energy demand have boosted the price of energy resources on world markets. By comparison manufactured goods will experience increasing cost and price pressures because the volumes produced, particularly in low-wage developing countries, can be expanded easily (Macfarlane 2002, pp. 9-10). This implies that a continued focus on resource production will provide a unique source of material prosperity for Australia.

The exploitation of resources such as coal impacts the Australian economy in several ways. Firstly, resource corporations currently contribute large sums of tax to federal Treasury. This makes a significant difference to the federal budget and allows governments more discretion in politically sensitive areas such as spending and taxation. For example, Treasury (2008, p. 42) estimated that between 2004 and 2007, a robust economy and a mining boom had added an additional $334 billion dollars to the federal budget surplus, of which the Howard government used $314 billion in new spending and tax cuts. Secondly, the resource sector is largely responsible for the big improvement in Australia's terms of trade because of the high

prices received for coal and iron ore (ABS 2010b, 2010c; Murdoch 2010). The terms of trade refer to a price comparison between a sample of key exports and imports. An increase in the terms of trade results in a rise in average per capita income. Historically, Australia has faced a long-term decline and volatility in its terms of trade (Treasury 2003, p. 47). However, this trend has been reversed by the current mining boom.

Thirdly, resource exports improve the balance of payments, the difference between the value of exports and imports. Australia has historically had a balance of payments deficit (Gruen 2005, p. 2), but high prices for commodities such as coal and iron ore have recently reduced the size of the deficit substantially from a seasonally adjusted $16.46 billion in the first quarter of 2010 to $5.6 billion in the second quarter (ABS 2010a; Martin P 2010). Although the ramifications of the global financial crisis are far from clear at present and may yet plunge the world into a deep and sustained recession, a business-as-usual scenario would see continued economic growth in many Asian countries sustaining strong demand for Australian resources such as coal and iron ore. These circumstances place large transnational multi-mineral resource corporations in a powerful negotiating position with regard to federal government.

The standing of the coal industry has also improved compared to other industry sectors. The relatively high Australian dollar up to mid-2010 is not hurting coal exports because world demand for coal is strong and there is a supply deficit. There is a lag between the price stimulus given by increasing demand and the investment in supply such as approval for new coal mines and increases in infrastructure such as coal handling facilities at ports. Australian coal exporters are not facing competition from other countries that could erode Australia’s market share, nor is there currently enough capacity in Australia for Australia to satisfy current world demand. Prices are therefore likely to remain high in the medium term.

Coal and the coal industry

The fossil fuels coal, oil and gas took millions of years to form and are non-renewable. The heat and pressure involved in their formation means they are highly concentrated forms of energy. Fossil fuels are hydrocarbons (combinations of hydrogen and carbon). Methane gas contains large proportions of hydrogen, whereas anthracite coal is predominantly carbon.

Burning fossil fuels releases large amounts of chemical energy which can be used in electricity generation, transportation, and various industrial processes such as smelting. CO_2 is one of the waste products released as a by-product of the combustion process. Of the three fossil fuels, coal releases the most CO_2 per unit of energy, then oil and then gas.

Coal is a combustible, sedimentary, organic rock formed from ancient peat vegetation transformed by heat and pressure over millions of years. This process, known as 'coalification', affects the physical and chemical properties of the coal and determines its rank in a classification system (ACA 2008a). Brown coal (also known as lignite) is classified as a 'low rank' coal. Lignite or brown coal is the youngest of all the coals and formed at lower temperatures and shallower depths. It is brown, soft, has a high moisture and oxygen content, but is lower in carbon than other coals, and therefore lower in energy and heating value. Lignite veins are generally located close to the surface in thick beds and are therefore easily accessible by strip surface mining. This makes lignite production cheap. The high moisture content of brown coal makes it unsuitable for transport and it is therefore used on-site for electricity generation.[73]

Bituminous (also known as black coal) coals are hard, black and have a high carbon and energy content and low moisture content. Bituminous coals are storable and transportable and can therefore be exported. Good quality bituminous coal is suitable for use as coking or metallurgical coal in steel production and the remainder is thermal or steaming coal used in electricity generation. Figure 7 (next page) shows the different ranks of coal, their amounts on a global scale, and their typical uses.

[73] However, there are plans to export dried Victorian brown coal to India (ABC 2010a).

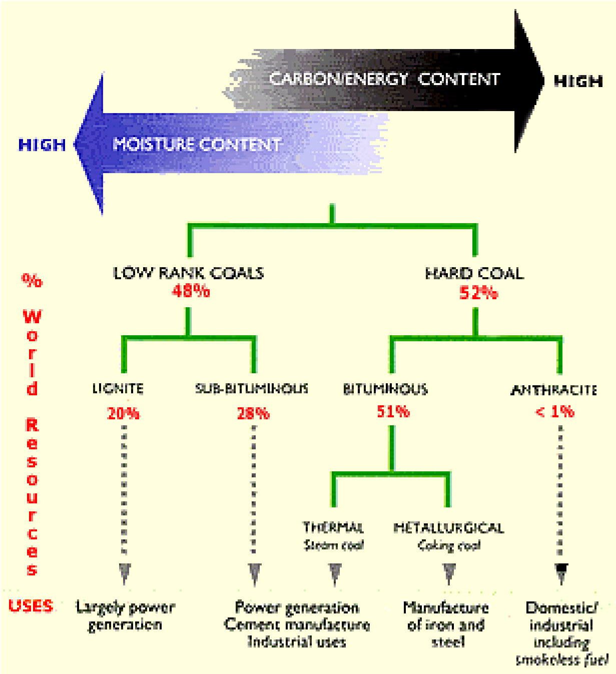

Figure 7: The ranking of Coal. Source: ACA 2008b

Australia has roughly equal quantities of high rank and low rank coal with black coal reserves of 36,800 million tonnes and sub-bituminous and lignite coal reserves of 39,400 million tonnes (BP 2010, p. 32). Coal produces over 80 per cent of total electricity generation in Australia with black coal accounting for about 57 per cent and brown coal about 24 per cent (ACA 2008c). This is double the world average where coal contributes about 42 per cent of total electricity generation (ACA 2008d).

Large lignite deposits in seams up to 330 metres thick exist in the Latrobe valley in Victoria. There are currently four brown coal-fired power stations in the Latrobe valley: Hazelwood power station and mine owned by International Power; Yallourn power station and mine owned by TRUenergy; Loy Yang power station and mine owned by a consortium, Great Energy Alliance Corporation; and Loy Yang B power station jointly owned by International Power and Mitsui.[74] The Latrobe valley brown coal generators produce about 90 per cent of Victoria's electricity. Advocates from free market think tanks advocates such as Alan Moran (2010) tout Victorian brown coal as the world's cheapest electricity. However, brown coal is the most polluting fuel in terms of greenhouse gas emissions, releasing on average 37 per

[74] Electricity generation in Victoria was privatised by the Kennett state government in the 1990s.

cent more CO_2 per unit of electricity than black coal (Tarlo 2002, p. 5). As Diesendorf (2007, p. 228) points out, the low price placed on coal only occurs because ‘the considerable environmental and health costs of using coal are not included in the price of coal-fired electricity’. Large deposits of black coal exist in NSW and Queensland and these states generate most of their electricity from black coal. NSW and Queensland also supply all of Australia’s black coal exports.

Aluminium and the aluminium industry

The aluminium industry in Australia comprises five bauxite mines, seven alumina refineries and six aluminium smelters. Australia is the world’s largest bauxite producer, second largest producer of alumina, and the fourth largest aluminium producer (Australian Aluminium Council [AAC] 2010a). Alumina exports totalled over $6 billion in 2007, but are forecast to fall to $4.6 billion in 2009-10 due to lower export prices (ABARE 2009, p. 685). Australia produces about 2 million tonnes of aluminium, 80 per cent of which is exported. Australia’s aluminium exports were worth $A 5.6 billion in 2007, but are also forecast to decline to $3.5 billion in 2009-10 as a result of falling global aluminium prices (ABARE 2009, p. 684).

Alcoa, one of the world’s leading producers of alumina and aluminium, has bauxite mines and three alumina refineries in Western Australia and smelting operations at Portland and Point Henry in Victoria. There are also smelters at Gladstone in Queensland owned by Rio Tinto Alcan, Tomago in NSW owned by Rio Tinto Alcan, CSR and Hydro Aluminium, Kurri Kurri in NSW owned by Hydro Aluminium and Bell Bay in Tasmania owned by Rio Tinto Alcan (AAC 2010b). The Australian aluminium smelting industry is almost entirely foreign-owned and 100 per cent foreign-controlled (Turton 2002, pp. 5-6).

Aluminium smelting requires large amounts of electricity and the industry uses ‘almost 15 per cent of all the electricity consumed in Australia’ (Turton 2002, p. vii). Electricity therefore forms a significant part of the overall business costs of the aluminium industry. The aluminium industry in Australia has negotiated very cheap prices for its electricity on long-term contracts and pays far less for its electricity than other large industrial users (Turton 2002, p. vii). Even accounting for its expected ability to secure cheaper electricity than many other businesses, Hal Turton (2002, p. vii) estimates that ‘the Victorian smelters have been

paying below-market prices equivalent to at least $110 million per year'. This amounts to at least $2.5 billion over the two and half decade lifetime of a contract that began in the 1980s. It is a significant subsidy for the aluminium industry.

Apart from the Tasmanian smelter, all the mainland smelters rely on either brown or black coal-fired electricity. Aluminium smelting accounts for 6.5 per cent of total Australian greenhouse gas emissions and 13 per cent of emissions from electricity (Hamilton 2001, p. 64). The aluminium industry in Australia claims to be operating smelters that meet world's best practice. Indeed, direct emissions of greenhouse gases such as perfluorocarbons per tonne of aluminium production have been reduced dramatically since 1990 (AAC 2010c, 2010d). However, embedded greenhouse gas emissions resulting from a reliance on coal-fired electricity are very high compared to many overseas locations where smelters run mainly on hydro electricity. Australian aluminium is the most polluting globally in terms of embedded greenhouse gas emissions (Turton 2002, p. viii-ix). The Australian aluminium industry is therefore highly exposed to a potential price on carbon.

Globally, the aluminium industry understands that measures to deal with climate change such as a carbon price are inevitable (Pearse 2007). Major aluminium producers such as Alcoa are proactively locating new smelters in countries with substantial sources of clean energy such as Iceland, thereby insulating itself from a carbon price. Alcoa has operations in both Iceland and Australia. Yet, as part of the Australian Aluminium Council, Alcoa in Australia is demanding large subsidies and compensation from Australian taxpayers.

There are some important differences between the coal and aluminium industries and the impacts that a domestic carbon price would have on the respective industries. Eighty per cent of Australian aluminium production is exported. Likewise, 80 per cent of Australian black coal production is destined for export. Unlike aluminium, however, Australian coal exports are not subject to an Australian carbon price. This is because a carbon price is applied when a fossil fuel is burnt, not when it is extracted.[75] By definition, Australian coal exports are not burnt in Australia and therefore would only attract a carbon price in their country of import. The only Australian coal subject to an Australian carbon price would be that coal burnt in Australia as a fuel to produce electricity.

[75] The exception may be some charge for methane leakage during the coal mining process.

Perhaps the major point of contention and confusion in the debate about the Australian aluminium industry is the issue of loss of international competitiveness and the potential for what industry terms ‘carbon leakage’. Carbon leakage is said to occur when a corporation decides to relocate from a developed nation such as Australia to a developing nation that is not subject to carbon constraints. The introduction of a carbon price in Australia would raise the price of coal-fired electricity as electricity generators passed the cost onto their customers. Industries such as the aluminium industry would be faced with increased energy costs, but may be unable to pass the cost on to their export customers. The aluminium sector in Australia would therefore have to absorb the carbon costs which would reduce its profitability potentially causing downward pressure on its share price and asset values. If the carbon price was high enough, it could have an impact on the viability of the industry. Garnaut (2008, p. 341) referred to this as a ‘dreadful’ problem. Industry and its allies (including governments) argue that this would result in substantial job losses in regional Australia for no environmental gain because production would be relocated in regions with lower environmental standards.

However, Hamilton, Turton and Pearse point out several flaws in the industry argument. Firstly, because it relies on coal-fired electricity, Australian aluminium production is the most greenhouse-emissions intensive globally, two-and-a-half times higher than the global average. Relocation would in fact reduce global emissions, directly contradicting industry claims about carbon leakage (Turton 2002, p. ix). Secondly, Australian aluminium is competing, at least in part, against subsidiaries of the same transnational corporation already producing aluminium in clean or cleaner energy locations (Pearse 2009, pp. 27-28). Thirdly, electricity price is only one determinant of investment (Shipper in Hamilton 2001, p. 27). Other advantages for aluminium smelting in Australia include ‘low transport costs, political stability, excellent infrastructure, expertise, high-quality alumina, access to technology and a high tolerance of foreign investment’ (Turton 2002, p. ix). Fourthly, smelters are a long-term investment and involve sunk capital that would not be abandoned lightly (Hamilton 2001, p. 27; Pearse 2007, p. 312). Fifthly, the relocation argument assumes that developing nations will not be subject to a carbon price in 20-30 years (the production lifespan for a smelter). This appears unlikely because once developed countries have demonstrated a commitment to emissions reduction (e.g. by imposing a carbon price), the major developing countries will

likely be drawn into the process within a decade. The likelihood of a global carbon price (or the imposition of a border tax on non-compliant countries) undermines the incentive for greenhouse polluting industries to relocate to countries with lax standards, and in fact is further motivation for emissions intensive industries to locate new investment in clean energy countries (Pearse 2009, pp. 27-28).

The AAC which represents the aluminium industry and the ACA which represents the black coal producers and exporters are two of the key players in the Australian Industry Greenhouse Network (AIGN).[76] The role of the AIGN in the Australian climate change debate is considered next.

The Australian Industry Greenhouse Network

Much of the research on the AIGN and its methods of operation has been done by Guy Pearse. Pearse, a former Liberal Party member and industry lobbyist, was speechwriter and advisor to federal Environment Minister Robert Hill who conducted the Kyoto protocol negotiations on behalf of the Australian Government. When Pearse embarked on a PhD into the business response to climate change, he was curious about why large sections of business and industry had remained 'silent' during the climate change debate when climate change would have significant detrimental impacts on their business. During the course of his PhD, Pearse conducted over sixty taped interviews with senior AIGN executives. Referring to themselves as the 'greenhouse mafia' these executives revealed the previously hidden operation of a powerful, well-organised and well-connected lobby group (Pearse 2007). Pearse discovered not only why major sections of business had remained silent on climate change, but also how the federal bureaucracy and government had been 'captured' by the carbon lobby.

The AIGN is a cross-industry lobby group representing the coal, oil, aluminium, chemicals, iron and steel, cars and trucking, and farming and forestry sectors.[77] It comprises industry

[76] The Minerals Council of Australia (MCA), particularly under CEO Mitch Hooke, is also a key member of the AIGN and has also been a vocal and important player in its own right as part of the industry campaign over climate policy.

[77] AIGN Chief Executive John Daley (2007, p. 48) says the 'AIGN is not an industry lobby', but is a network for information exchange, initiatives and policy co-ordination. Yet in anonymous interview transcripts, senior

associations such as the Minerals Council of Australia (MCA), the ACA and the AAC, and corporations such as ExxonMobil, Alcoa, and Xstrata.[78] Beginning in the 1980s, the corporate and industry interests that later formed the AIGN identified the sources of political, economic and scientific advice on greenhouse policy within government and concentrated on influencing them (Pearse 2007, pp. 193-94). Important sources of advice to government within the bureaucracy included the Industry Department,[79] the Department of Foreign Affairs and Trade, ABARE, and CSIRO. ABARE which used to be located in the Department of Primary Industries and Energy has been an almost exclusive source of economic policy advice on greenhouse to government. Senior bureaucrats working in the areas of energy, industry, and trade had a strong tradition, going back to the late 1980s, of identifying with, and promoting the interests of, the fossil fuel intensive export industries. This included preventing greenhouse considerations from impinging on energy policy (Pearse 2007, pp. 167-169).

A key aspect of the AIGN strategy involved hiring several of these senior Canberra bureaucrats to lead AIGN industry associations. Many, particularly from the Industry Department, had twenty years experience drafting and shaping policy on both energy and greenhouse (Pearse 2007, pp. 229-31). When they returned to lobby the bureaucracy in their new roles as AIGN executives, they had the advantage of extensive policy experience, inside knowledge and connections, and seniority over many of the junior bureaucrats that had replaced them (Pearse 2007, pp. 231-232).

Executive power in Australia is concentrated in the Prime Minister and Cabinet. To influence government at the top level, the AIGN transformed itself from an industry network into a focused lobby group. Divisions within the AIGN based on competing industry interests were overcome by bonding together around a common goal and a common enemy (Pearse 2007). Pearse (2007, p. 230) argues that the common goal is, in order of priority, the prevention of

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AIGN executives refer to themselves as the ‘carbon lobby’ and the ‘greenhouse mafia’ (Pearse 2007 pp. 228-38).

[78] A current membership list is available from Australian Industry Greenhouse Network (2011).

[79] The ‘Industry Department’ refers to the department with primary responsibility for minerals and energy. From 1987 to 1998 it was the Department of Primary Industries and Energy; from 1998 to 2002 it was the Department of Industry, Science and Resources; and from 2003 to 2007 it was the Department of Industry, Technology and Resources. In 2007 it became the Department of Resources, Energy and Tourism.

any constraints on greenhouse gas emissions, the delay of any constraints for as long as possible, and lastly, exemption and/or compensation should any scheme be introduced. The common enemy that also helps bind the alliance together is a loathing of environmentalism (Hamilton 2007). These twin motivations of common goal and common enemy ensure that greenhouse lobbying remains the core AIGN activity.

The overall strategy of the AIGN has been to influence government at the national level to prevent or indefinitely postpone the introduction of any effective government response to climate change. However, the strategies of the AIGN have shifted over time in response to new developments and changes in the political landscape. In the federal election year of 2007, Prime Minister Howard commissioned a Task Group to report on the possible framework for an ETS. Recognising that it may not be able to prevent the introduction of an ETS for much longer, the AIGN adopted a new strategy to protect its interests within the confines of an ETS. The key aim of this emergent strategy was to insert AIGN preferences into a proposed ETS. This included various demands for special dispensation and compensation. Previously the AIGN opposed cuts to Australian greenhouse gas emissions per se, but now it focuses on preventing emissions reductions in the particular sectors that it represents and extracting concessions for actions taken. This displays a practical and self-interested approach to the issue.

The mining sector and the radical neo-liberal movement

Climate change policy clearly threatens vested interests in the fossil fuel, resources and metals processing sector. However, climate change policy also poses a wider challenge to neoliberalism. The neo-liberal shift in the 1970s and 1980s has been epitomised by a belief that the ‘free’ or unregulated market is the best mechanism for solving issues. Notions of market failure are anathema in neo-liberal philosophy (Pearse 2007; p. 131). Yet the *Stern Review* (2007, p. xviii) asserted that climate change represented the greatest case of market failure in history and required international collective action to address it. This challenges neoliberal beliefs regarding the efficacy of a *laissez-faire* market, and the minimal role of government in society.[80] Much of the opposition to climate change in the Anglo-American

[80] Neo-liberalism is not monolithic across countries. The specific interests and different political realities of various neo-liberal governments also help determine responses to climate change policy in different countries.

world has been channelled through a range of free market think tanks and radical neoliberal organisations. This includes the Competitive Enterprise Institute, the Heartland Institute, and the Frontiers of Freedom in the US, the Institute of Economic Affairs in the UK, the Fraser Institute in Canada, and the Institute of Public Affairs (IPA) in Australia.

The radical neo-liberal movement in Australia is organised around a variety of think tanks and groups linked by a common ideology and overlapping memberships (Cahill 2004). The mining industry, in particular Western Mining Corporation, took the leadership role within the radical neo-liberal movement in Australia (Cahill 2004, p. 218). Damien Cahill (2004, p. 5) argues that the radical neo-liberal movement acted as the vanguard for neo-liberalism in Australia and describes the radical neo-liberal movement as an elite social force with ‘a small social base’. Despite its small numbers, the movement has acquired considerable influence because of its links to powerful sections of the capitalist class such as the mining sector.

In Australia several neo-liberal think tanks and organisations have taken an openly sceptical position on climate change. This includes the IPA in Melbourne, the APEC Study Centre at Monash headed by Alan Oxley, and the Lavoisier Group. There are numerous links between the various organisations and their memberships. According to SourceWatch (2008b) the IPA established its own environmental front group, the Australian Environment Foundation (AEF) in 2005. Documents lodged at the Australian Securities and Investment Commission (ASIC) obtained by SourceWatch note that the registered office for the AEF is the IPA in Melbourne (Australian Securities and Investment Commission [ASIC] 2005). Climate sceptic Jennifer Marohasy was listed as a director of the AEF (ASIC 2005) and was also Director of the Food and Environment Unit at the IPA (Marohasy 2006). Mike Nahan, the former executive director of the IPA (IPA 2008) is also a director of the AEF (ASIC 2005).

The AEF also shares several links to the Lavoisier Group. For example, corporate lawyer Tom Bostock is a director of both the Lavoisier Group and the AEF (AEF 2011b). Bob Carter, a prominent Australian contrarian scientist is associated with the Lavoisier Group, is Emeritus Fellow and Science Policy Advisor at the IPA (IPA 2011), is a founding member of the AEF (Carter 2006), and is scientific advisor to the Australian Climate Science Coalition (ACSC) (ACSC 2011). The ACSC is a contrarian organisation that denies the scientific evidence for climate change. The ACSC describes itself as ‘an apolitical, not-for-profit

affiliate of the AEF' (ACSC 2008). The AEF (2011a) also describes itself as 'a not-for-profit, membership-based environmental organisation having no political affiliation'. Yet the AEF was established by the IPA which is both corporate-funded and highly ideological. Indeed Pearse (2007, p. 282) points out that Alan Moran has acknowledged that the Energy Forum at the IPA 'is funded by a secret group of a dozen energy firms'.

The role of the radical neo-liberal movement in the climate change debate is important. Because it shares the same individualist and market-based ideology as many government officials and bureaucrats, most of the people that leaders such as John Howard trusted and listened to on a range of issues, including climate change, are within the movement (Pearse 2007, p. 147-150). The radical neoliberal movement provides an influential avenue for the dissemination of critical opinions on climate change.

Front groups

In the 1960s, corporations learned some important lessons from the successful campaigns waged against them by environmentalists. During the 1940s and 1950s, corporations in the US were generally viewed in a favourable light as providing beneficial goods and services that improved modern life. This public perception of corporations altered with the publication of *Silent Spring* by Rachel Carson in 1962 which linked large chemical corporations with environmental damage that threatened the life of many species. Moreover, when the chemical companies tried to defend their interests, they based their arguments on scientific research that they had commissioned and funded. Environmentalists were able to exploit this link by claiming that the research itself was tainted because the chemical companies had a vested interest in the findings. Direct attempts by corporations to improve their image proved ineffective because the perception remained that corporations had a vested interest in what they were trying to convey (Rampton and Stauber 2001).

The inability of corporations to regain public trust with their own direct propaganda led to the development of a new tactic. Many corporations engaged public relations (PR) firms with promotional expertise. One of the key innovations was the funding of seemingly independent third parties to campaign publicly on issues that would benefit corporations. Campaigns waged by 'independent' organizations appear to be separate from the corporation. Because

the ‘message’ is not readily identified as coming from a corporation, it appears independent and therefore has greater credibility than if the same message was promoted by a corporation (Rampton and Stauber 2001).

One of the most effective third party interventions developed by PR firms and major corporations is the industry front group. Front groups typically present themselves as a group of concerned citizens and usually adopt non-partisan names that convey a sense of moderation, concern and choice. However, the front group (such as the Lavoisier Group or the AEF) is not actually independent: it is in fact fronting for industry and is funded by a particular corporation or group of corporations to campaign on a particular issue. The key advantage of a front group is the credibility that it can generate for a particular position because the front group is not obviously promoting narrow corporate interests. A front group can campaign vigorously on a particular issue without risking a consumer backlash because it is not selling a product: instead it is selling a position, an idea or a value (Beder 2000, pp. 27-45). This is typically a position that would suit the corporation but which it could not credibly promote itself in public.

Front groups achieve a further degree of separation from a corporation by promoting the work of supposedly independent scientists. Much allegedly ‘independent’ scientific opinion in the climate change debate is funded by fossil fuel interests (Dunlap et al 2008). But because the links are concealed from public view, front groups promote the work as a highly credible challenge to the majority scientific consensus. The counter claims and arguments advanced by third parties become more effective when they are picked up in the media, not only because they reach a wider audience, but because the ideas are further separated from corporate interests. Credibility increases when evidence appears to be unbiased. Front groups are effective precisely because they can promote information that benefits a corporation’s interest, whilst having no visible connection to that corporation. This gives the impression that the material is independent. In reality, front groups deceive the public into attributing greater credibility to certain sources of information because they are not visibly tied to a corporation or industry (Beder 2000; Rampton and Stauber 2001). The front group can be seen, therefore, as a tactic of industry.

The Lavoisier Group

Founders and members

The Lavoisier Group was founded in 2000 by Hugh Morgan, Ray Evans and Ian Webber who were executives at Western Mining Corporation (WMC)[81] at that time (Pearse 2007, p. 202).[82] According to an AIGN executive that confided in Pearse (2007, p. 202), most of the funding for the Lavoisier Group came from WMC until its acquisition by BHP Billiton in 2005. Morgan is the current President, Webber Vice-President and Evans Secretary of the Lavoisier Group (Lavoisier Group 2009). WMC was a large Australian mining and metals corporation with interests in gold and nickel mining in Western Australia, and the multi-mineral Olympic Dam mine at Roxby Downs in South Australia. Olympic Dam is the world's largest uranium deposit containing 33 per cent of known global reserves. It is also the world's fourth largest remaining copper deposit and fifth largest gold deposit (BHP Billiton 2011). WMC also had a phosphate fertilizer business and a major (39.25 per cent) share in Alcoa World Alumina Australia which operated the Portland and Port Henry aluminium smelters in Victoria and three alumina refineries in Western Australia (Green 2002). WMC therefore had significant emissions-intensive activities in mining, refining, and smelting.

As a corporation, WMC was politically active and took a hard line on labour relations, Indigenous land rights, and environmentalism (Garnaut and Counsel 2002; Green 2002; Sustainable Energy and Anti-Uranium Service 2001). WMC campaigned against climate change legislation and was actively involved in attempts to undermine the Kyoto protocol, both in the US and in Australia. In 1997, WMC collaborated with the Competitive Enterprise Institute (CEI), a US free-market think tank, to organise a climate sceptic conference in Washington DC in July. The following month, WMC, CEI and another US free-market think tank, the Frontiers of Freedom, helped sponsor and organise the 'Countdown to Kyoto' conference in Canberra in August 1997. The conferences were designed to discredit climate

[81] WMC Resources was later bought out by transnational mining conglomerate BHP (now BHP Billiton) in 2005.
[82] Cahill (2004, p. 218) notes that WMC had a long history of corporate activism and several WMC figures such as Sir Arvi Parbo, Hugh Morgan, Ray Evans, Dame Leonie Kramer and David J. Brydon played a leadership role within the radical neo-liberal movement.

change science and according to a fundraising letter from the Frontiers of Freedom, ‘to offer world leaders the tools to break with the Kyoto treaty’ (in Hamilton 2001, p. 79).

Hugh Morgan, President of the Lavoisier Group, was Chief Executive Officer of WMC between 1986 and 2003. Morgan had been a director of WMC since 1976, a director of Alcoa of Australia between 1977 and 1998 and a director of Alcoa Inc from 1998 to 2001 (Deakin Graduate School of Business 2010). Morgan has been described as the ‘moving force’ behind the AAC which has been the most ‘vociferous and intransigent’ of all the industry lobby groups on climate change (Hamilton 2007a, p. 116). Morgan was president of the MCA between 1981 and 1983, and President of the Business Council of Australia (BCA) between 2003 and 2005. He is also past President of the Australia Japan Business Co-operation Committee and a member of the Lafarge International Advisory Board.[83]

Morgan was instrumental behind the scenes in founding and/or brokering funding for many of the neo-liberal think tanks in Australia (Cahill 2004, p. 199). He has been a board member of the Centre for Independent Studies, the IPA, and the Tasman Institute, as well as the Australian Lecture Foundation (Cahill 2004, pp. 204-05). As a key backer of the Lavoisier Group, Morgan (2000a) assured the Group’s inaugural conference that it could count on him for support. Morgan is a long-term Liberal Party member and has been the Director of the Cormack Foundation, one of the major fund-raising vehicles for the Liberal Party (Garnaut and Counsel 2002; Pearse 2007, p. 266). Morgan has served on the Board of the RBA for fourteen years. He was first appointed by federal Treasurer John Howard in 1981, and more recently between 1996 and 2007 during the period of the Howard government (RBA 2011). Morgan was also appointed to the Foreign Affairs Council, a peak body established by Foreign Minister Downer. As a close personal friend of Howard, Morgan was one of the very few people who could pick up the telephone and get an immediate audience with the Prime Minister (Pearse 2007, pp. 267-268; see also Garnaut and Counsel 2002).

The Lavoisier group has good connections on both sides of politics. Peter Walsh, former federal Labor Finance Minister in the Hawke Government, was inaugural President of the Lavoisier Group and served between 2000 and 2009. According to people interviewed by Pearse (2007, p. 246), ‘Walsh inspired hatred for the environmentalists among many of the

[83] Lafarge produces building materials, primarily cement, aggregate, concrete and gypsum.

Department of Primary Industry and Energy bureaucrats'. In Parliament as Coalition Prime Minister, Howard (2006, p. 67) quoted Walsh's views on the Kyoto protocol with relish.[84] Walsh also gave the Lavoisier Group credibility and access in the current Labor party including the ability to talk to the Prime Minister Rudd (Pearse 2009, p. 49).

Ray Evans is Secretary of the Lavoisier Group and was a WMC executive between 1982 and 2001. According to Paul Kelly (1994, p. 46; see also Morgan 2010), Evans was Morgan's 'speechwriter, sounding board and intellectual activist'. Evans is symptomatic of the overlapping memberships and common ideology that the Lavoisier Group shares with several other radical neo-liberal organisations in Australia (Cahill 2004). Evans co-founded the HR Nicholls Society in 1986 with Peter Costello who later became a long-standing Coalition federal Treasurer (HR Nicholls Society 2011). The HR Nicholls Society is focused on labour market deregulation and workplace reform. Evans was the inaugural Secretary and then between 1989 and 17 April 2010 (Bisits 2010). Evans is co-founder and Secretary (until 2008) of the Bennelong Society which takes a conservative position on Indigenous policy. Evans is also Treasurer of the Samuel Griffith Society which was founded in 1992 to deal with Constitutional matters, and in particular campaigns for greater federalism as opposed to centralisation of government in Australia (Samuel Griffith Society 1992).

Harold Clough, Lavoisier Group Treasurer, is the former Managing Director and Chairman of Clough Limited, a mining resource and service company. Clough is also a board member of the IPA, a member of the HR Nicholls Society and was very close to Howard's office (Pearse 2007, p. 246). Des Moore is another sceptic associated with the Lavoisier Group. Moore, a former Deputy Secretary in the Commonwealth Treasury, later worked for the IPA for nine years before founding the Institute for Private Enterprise (2011) in 1996. A founding member of the Bennelong Society (SourceWatch 2008a) and its current Secretary/Treasurer (Bennelong Society 2011), Moore is also a Board member of the HR Nicholls Society (2011).

Sir Arvi Parbo is closely associated with the Lavoisier Group and launched a Lavoiser Group booklet at Parliament House (Parbo 2007). Parbo is a former Chairman of Alcoa and BHP and former Managing Director of WMC, a position he inherited from Hugh's father, Bill

[84] The similarity between Walsh and Howard on climate change and the Kyoto protocol are evident in an open letter Walsh (2003) penned to Howard on behalf of the Lavoisier Group.

Morgan. Parbo trained Hugh Morgan for the position of CEO and has been a strong supporter of Morgan (Garnaut and Counsel 2002; Morgan 2010).

Alan Oxley, a former Australian trade ambassador, is another prominent associate of the Lavoisier Group. Oxley was a member of the Foreign Affairs Council[85], has connections to the Department of Foreign Affairs and Trade, and was involved in securing the US Australia Free Trade Agreement (FTA). This reinforces his credibility within Government which increases his influence over Australian climate change policy (Pearse 2007, pp. 268-270). Oxley also edits the Asia Pacific section of the Tech Central Station (TCS) website,[86] one of the world's most sophisticated climate denial websites. Oxley is Chairman of the Australian Asia-Pacific Economic Cooperation Study Centre (APEC SC) at Monash University. Alongside the Lavoisier Group and the IPA, the APEC SC is the most prominent of the sceptical organisations in Australia. The APEC SC focuses on trade and climate change issues. It produces research for government in support of free trade, plays a lead role in business lobby groups campaigning for free trade agreements, hosts sceptical conferences designed to undermine policy action on climate change, and publishes papers that argue policy to address climate change is unwarranted and unaffordable (Pearse 2007, pp. 148, 200, 269). Along with Ray Evans, Oxley is a key link between the Australian and American carbon lobbies (Pearse 2007, pp. 269-271).

The media sceptics

The media are an important strategic arena in the contest for power because they occupy a central role in political communication in modern democracies (Tiffen 1989). Media scholars such as Tiffen (2010) observe that between 2006 and 2010, segments of the Australian quality broadsheet press have run a consistently critical line on climate change. The position taken by the media in the climate change debate has a bearing on the outcomes of the conflict because media treatment is a factor in both public understanding of climate change and elite decision-making on the issue (Carvalho 2007, p. 223; Gavin 2009, pp. 765-768; Antilla 2010,

[85] Oxley, Morgan, and columnists from *The Australian*, Pearson, Albrechtsen and Kelly were all members of the Foreign Affairs Council chaired by Minister Downer in the Howard era (Pearse 2007, pp. 248, 266, 269-270; Pearson 2007).
[86] TCS is a sceptic front group run by PR firm DCI, and funded by ExxonMobil (Hamilton 2007a, p. 131; Pearse 2007). DCI sold TCS in 2006 to the editor of the site, Nick Schultz, who was also political editor of FOXNews.com (Hamilton 2007a, p. 239, note 7).

p. 240). The media therefore not only help influence public opinion and set the public agenda, but it also has an indirect influence on the governmental and policy agenda.

Strategy and credibility

Credibility is a critical attribute in any strategic interaction. Jasper (2006, p. 11) argues that improving one's own credibility and damaging the credibility of an opponent is a central goal of strategy and has a bearing on the outcome of the struggle. Struggles over scientific credibility are a key part of the climate change debate.

In complex scientific or technical controversies such as climate change, the technical details are beyond the understanding of most governments and citizens. Furthermore, climate change is intangible to most citizens in developed nations, and therefore the predictions of science must be taken on trust. In these circumstances, credibility is important in deciding who to trust for an explanation of the problem. There are several layers of credibility here. First, there is the question of science in general and its legitimacy as an authoritative explanation of the natural world. Then, in the case of climate change, there is the specific issue of whether to trust the majority of climate scientists and their respective scientific institutions, or the dissenting minority of critics. Linked to this is the question of who to trust to provide an authoritative interpretation of this dilemma.

Scientists normally have an advantage in a debate because there is a perception that they are objective and just deal in facts, even when they make comments on policy issues. In the modern era, science often stands for credible and legitimate knowledge about the natural world with scientists creating their own image as objective and disinterested investigators (Gieryn 1999). Nevertheless, Thomas Gieryn (1999, p. 27) argues that science is not universal and essential, but rather local, contingent, episodic, constructed, practical and strategic. Credibility contests in science are therefore a constant feature of the terrain. Scientists create and defend the boundaries of science against 'external' non-scientific explanations of the natural world. However, scientists also work within the scientific community to have their own claims accepted as valid, their credibility as spokespeople vindicated, and other claims excluded (Gieryn 1999).

Yet scientists are not the only actors performing boundary work. As science moves into public, corporate, judicial and legislative arenas, assumptions about scientific credibility are contested (Gieryn 1999). As science moves into the public arena, it may come into conflict with different values held by other players (Cullen 2006). These values may include economic self-interest, a belief in the efficacy of unregulated markets, and a distrust of government intervention.

Trust is a reflection of the degree to which values are shared or are in conflict. Trust is more likely to be engendered if the messenger espouses values similar to those already held by the audience. Conversely, an audience is likely to ignore the 'facts' if there is a perception of conflicting values (Lakoff 2004). Because trust does not arise solely, or even mainly, from a rational assessment of the facts (such as scientific evidence), it is very susceptible to influence by rhetorical tactics that embody emotional appeals to certain values.

Yet, climate scientists and environmentalists are not defenceless. They have access to resources and the ability to state their case in different arenas (see chapter 6). Nonetheless, differing standards of evidence and behaviour between the scientific and public arenas have been exploited by front groups and media columnists, exposing climate scientists to public attacks that are difficult to defend against (Dessler and Parson 2006, pp. 34-9). In the scientific arena, credibility is built through published work that relies on a high degree of evidence to support its conclusions. Moreover, personal attacks are not tolerated within the scientific arena. By contrast, lower standards or even unsubstantiated evidence is prevalent in political and public arenas: indeed, misrepresentation, lies, and personal attacks on opponents are 'frequently effective' and 'rarely punished' (Dessler and Parson 2006, pp. 37-38). The choice of arena for a smear campaign is important, and explains why media critics and front groups use devaluation in the political and public arenas, but do not contest the science in the scientific arena.

Tactics in the industry campaign

The following sections examine the tactics of the AIGN, the Lavoisier Group, and the media critics in the climate change debate.

Cover-up and access to information

The AIGN lobbying is unpublicised and some has occurred without the public, major environmental organisations, other industry groupings, or even federal environmental bureaucrats being aware of its full extent. Much of the lobbying has employed conventional political methods such as direct access to bureaucrats and decision-makers that are available to powerful elites in liberal democracies. Although legal, these activities are generally hidden because broad exposure would reveal the disproportionate access and influence that certain powerful actors within the system enjoy. However, allegations based on tape-recorded interviews with senior AIGN figures suggest that on a few occasions, some of the methods may have crossed the boundaries of legitimacy. This includes access to Cabinet in-confidence materials, and the occasional writing of Cabinet submissions and ministerial briefs by senior AIGN executives on behalf of bureaucrats (Pearse 2007, pp. 234-237). Secrecy regarding these actions would be of the utmost importance, both to conceal the activity from opponents and the public and therefore minimise outrage, and also to retain the confidence of trusted contacts within the bureaucracy.

When the ABC (2006) *4 Corners* program aired the alleged extent of covert activities, the AIGN responded with outright denial (see also Pearse 2007, pp. 236-237). Denial was aided in this instance by the fact that members of the AIGN were aware that in challenging Pearse to validate his allegations, he would be unable to identify sources to whom he had promised anonymity (Pearse 2007, p. 236). Denying allegations about the true extent of their influence was designed to keep the activities of the AIGN concealed from the wider public.[87]

A different facet of cover-up occurs in the way that the Lavoisier Group hides the source of its funding and its ties to industry. Bob Carter (2008a), a prominent Australian contrarian scientist associated with the Lavoisier Group states that he himself receives no research funding from industry. However, industry money channelled to think tanks and front groups can be used to fund fellowships, advisory positions, conferences, travel and publications

[87] The federal government, another powerful player in the climate change debate, also moved rapidly to deny the allegations. Within twenty-four hours of the *4 Corners* program, Environment Minister Campbell (2006a, p. 175) quoted in federal Parliament a statement by Industry Minister Macfarlane that the allegations made by Pearse were false.

(Pearse 2007, pp. 200-203).[88] Industry is reluctant to disclose the funding it provides to organisations such as the Lavoisier Group because the money may be used to promote contrarian science by groups that present themselves as genuinely independent.

Analysing cover-up reveals that industry adopts different approaches to hiding its actions depending on the nature of the organisation through which it operates and the type of activities conducted. The AIGN openly presents itself to government as the voice of industry. Nevertheless, it conceals its activities from the public to preserve its influence and minimise the outrage that would occur if the extent of its influence became public knowledge. In contrast, the Lavoisier Group publicly promotes its activities. In order to preserve its credibility, the Lavoisier Group conceals the true nature of its identity from the public by portraying itself as a group of concerned and disinterested citizens (Evans 2007c, p. 4; Parbo 2007, p. 2). Cover-up conceals the extent of active industry engagement in the climate change debate by hiding the actions that industry is taking to avoid sanctions over its greenhouse gas emissions. These actions involve alleged covert intervention in the political process and sponsoring a campaign of climate change denial. Remaining hidden therefore helps industry avoid blame for orchestrating self-serving campaigns that protect its interests.

Devaluation: discrediting opponents

In their efforts to reduce credibility, the Lavoisier Group and media critics have targeted climate science, the peer-review system, the IPCC, climate advocates, economic reviews of climate change, and various policy measures. Many of their methods resonate with Gieryn's descriptions of credibility contests as critics attempt to position climate science outside the scientific realm and portray climate scientists and their advocates as the voices of unreason.

Media critics belittle climate change science by claiming it is not real science. Climate science is depicted as a subset of environmental science that eschews empirical observations in favour of simplistic and unvalidated computer models. Duffy (2007d; see also M. Devine 2009b; Wood 2007c) states that this alleged preference for modelling produces wildly over-

[88] David Michaels (2008, pp. 143-144) discusses the impact of the 'funding effect' on science with regard to tobacco and pharmaceutical drugs, but much of his book documents a parallel trend in several case studies where different industries have channelled money to third parties to cast doubt on the science.

pessimistic virtual scenarios for future warming. There is a crucial distinction here. Media commentators are not attacking the cultural integrity of science. Instead, they are depicting climate science as an aberration that does not fit within the constraints of 'real' science. The implication that flows from critics placing climate science outside the boundaries of true science is that climate science does not have the scientific authority to legitimate its claims, and therefore cannot be trusted as a source of scientific information.

The peer-review process by experts in the relevant field is used extensively in science to determine the rigor of new work and its conformity with scientific standards. Critical commentators assert the peer-review process used by the climate science community has degenerated into a self-reinforcing process controlled by an incestuous clique for the purpose of defending its position. Wood (2006a, 2007c), Albrechtsen (2007) and Frank Devine (2007) argue that climate scientists have refused to disclose data in an effort to prevent independent scrutiny of their methods and results. Critics allege that as a result, methodological flaws have been perpetuated. Critical commentators imply that the peer-review process is fatally compromised and that unsound climate science ends up being used in the policy domain.

These claims about methodological flaws were developed by former economics editor of *The Australian*, Alan Wood. Wood (2006a) reported the findings of the Wegman committee in the US that investigated the statistical aspects of the 'hockey-stick' climate reconstructions.[89] The 'hockey-stick' portrayed late 20th century warming as anomalous in the context of the previous millennium and the graph and its conclusions appeared in the IPCC *TAR* (2001, p. 3). Wood reports that Wegman found the social network connections within the paleoclimate community were sufficiently close to negate the claimed independence of the peer-review process, that data disclosure by Mann was poor and incomplete, that the 'hockey stick' was an artefact of statistical error, and that the analysis could not support the claims for anomalous warming in the late 20th century. Wood also points out a conflict of interest between Mann's position as lead author of ground-breaking research and his position as lead author for related sections of the IPCC report. There are three key claims advanced by Wood: firstly, the peer-review process within sections of the climate science community is insufficiently rigorous and wide-ranging to detect flaws in scientific procedures; secondly, a

[89] I cover this in chapter 6, pp. 210-212, and chapter 7, pp. 257-259.

key piece of evidence used by the IPCC to support the case for alleged dangerous global warming has been destroyed; and thirdly, the reputation of the IPCC has been severely damaged because it promoted faulty science. All these allegations serve to undermine trust in climate science.

In recent years, editorials in *The Australian* have cautiously welcomed some of the findings of powerful mainstream climate advocates such as Nicholas Stern and Ross Garnaut. However, *The Australian* (Editorial 2007b, 2007e, 2007g, 2008b, 2008d, 2009d) has consistently discredited more marginal voices such as Greens leader, Bob Brown, scientist and author Tim Flannery, and economist and climate campaigner Clive Hamilton, portraying them as alarmist and irrational fringe-dwellers. The message conveyed by Stern and Garnaut on the one hand, and Brown, Flannery and Hamilton on the other, is similar in some respects, particularly with regard to the urgent and serious nature of the problem indicated by the science, and in the case of Stern, Garnaut and Hamilton, the primacy of market-oriented solutions to the problem. There are however important differences on, for example, the politics of achieving rapid cuts, as well as the merits of continued economic growth and the best form of economic development. Nevertheless, the treatment of different voices by *The Australian* may be influenced by the relative standing, power and influence of the various players, including the strength of their potential allies.

In contrast to editorials in *The Australian*, opinion columnists make no distinctions and label all climate advocates as ‘alarmist’ and consistently disparage them as emotionally charged religious zealots incapable of rational thought. Miranda Devine (2007) and Duffy (2007a) denounce high-profile public figures like Al Gore and Tony Blair as hypocrites because they lecture on the need for emissions reductions whilst enjoying high-emission personal lifestyles. Albrechtsen (2007) and McCrann (2007a) depict Stern as a crusading evangelist preaching the gospel of climate apocalypse and redemption. By using religious metaphors to equate climate change with dogmatic belief, critical commentators again try to place climate-change advocates outside the scientific realm and the arena of reasoned debate.

The *Stern Review* was a particular target for critical opinion columnists. Duffy (2007a), Albrechtsen (2007), Pearson (2006), Wood (2006b, 2007c, 2007d), McCrann (2007a, 2007b, 2008b) and Frank Devine (2007) variously dismiss the *Stern Review* as biased, alarmist,

selective, self-indulgent, overbearing, speculative, and misleading. They argue that it uncritically adopts the consensus position on the science, glosses over significant limitations in the IPCC peer-review process, overstates the costs of global warming, and understates the costs of reducing emissions. The implication is that the scientific and economic flaws in the *Stern Review* render it unsuitable as a rational basis for decision-making.

According to *The Australian*'s finance commentator, Terry McCrann (2008a), Australian economist Ross Garnaut suffers from the same faults as Stern. McCrann (2008c, 2009b) also lambasts the Australian Treasury and accuses it of succumbing to the same flawed gospel and as collapsing as a bastion of reason on economic affairs. Proposed policies such as the Rudd government's Carbon Pollution Reduction Scheme are denounced as a 'national suicide note' (McCrann 2009a, 2009c). By denigrating economists, Treasury officials and senior government leaders, these emotive comparisons seek to place even the most moderate attempts at emissions reductions far outside the bounds of a rational approach to governance.

Damaging scientific credibility is also a key tactic of the Lavoisier Group and there are many similarities between the methods of the Lavoisier Group and the media critics. The Lavoisier Group has produced and publicised scathing critiques of the science, scientists, scientific processes such as the peer-review system, and scientific organisations such as the IPCC (Archibald 2007a, 2007b; Carter 2007, 2008a, 2008b; Evans D 2008b; Evans 2006a, 2006b, 2006c; Gray 2008; Kininmonth 2002, 2008; Lavoisier Group 2002, 2008). The critiques systematically undermine the credibility of climate science by labelling it as implausible, biased, alarmist, fraudulent, deceitful, and a scam.

Similarly, Ray Evans (Evans 2006a, p. 1; see also Archibald 2007b; Evans 2007b), Secretary of the Lavoisier Group denigrates environmentalism as a corrupted form of religious belief 'which places no importance on telling the truth'. By consistently referring to environmentalism as green religion, the Lavoisier Group implies climate change relies on faith and has no basis in science. Environmental campaigners such as Al Gore are ridiculed as hypocritical evangelists (Evans 2007b, p. 2), and the documentary *An Inconvenient Truth* is described as 'bullshit from beginning to end' (Evans in Murphy and Nicholson 2007, p. 4). In an interview with Pearse (2007, p. 150), a senior Lavoisier Group insider confided that the desired outcome of contrarian arguments is to ensure there 'is an understanding within

cabinet that all the science is crap'. This suggests that much of the public denigration of climate science, climate scientists, and environmentalists by the Lavoisier Group is designed to influence the attitudes, and most importantly, the actions of government.

By contrast, there is little evidence that the AIGN has devalued climate science, at least in public. However, one instance occurred at the Australian APEC Study Centre's Conference, 'Kyoto – The Impact on Australia'. The APEC Study Centre is a neoliberal think tank with a focus on trade and the environment chaired by climate contrarian and former Australian trade ambassador Alan Oxley. In a speech to the conference, John Daley (1998, pp. 2-3), a future CEO of the AIGN, stated he was sympathetic to the idea that 'the science is shonky and self-serving' and that 'the science is global warming's Achilles heel'. These remarks came three years after the *SAR* of the IPCC (1996, p. 2) concluded that the scientific evidence suggested a 'discernible human impact' on climate change, and one year after governments, including Australia, had accepted the scientific evidence and negotiated a binding agreement to reduce emissions with the Kyoto protocol in 1997. Daley's unsubstantiated comments appear designed to appeal to the values and prejudices of a specific audience, namely representatives of government, business, and free market think tanks. A sympathetic audience is important because devaluation is more successful if it confirms something the audience would like to believe is true, for example that climate change is not really a problem and therefore difficult policy decisions to reduce greenhouse gas emissions are not required. As Pearse (2007, pp. 150-52) observes, an outcome of inserting these ideas into elite forums was that they might be picked up by decision-makers in government.

The AIGN has consistently devalued one weaker group within the climate change struggle, the renewable energy industry. The AIGN and industry members such as the AAC have claimed renewable energy is too expensive and would force up industry costs by raising the overall price of electricity, rendering industry internationally uncompetitive and leading to job losses (AAC 2003, 2008a, 2008b).[90] The AIGN maintained a concerted attack on the Howard Government's MRET, and the AIGN (2009) and AAC (2008a, 2008b) lobbied to be exempted from the Rudd Government RET. AIGN concerns have focussed on the comparative advantage derived from cheap fossil fuels, and the flow-on in terms of lost jobs

[90] See also the AAC (2010d) position on climate change policy on its website.

and export earnings that could arise from the imposed cost burden of being required to purchase more expensive renewable energy. The AIGN attacks on renewable energy as impractical for industry are designed to support its campaign to be excluded from the renewable energy provisions.

Whereas the AIGN critique of renewable energy focussed on the cost burden to industry, a legitimate concern of business, the Lavoisier Group has attacked the renewable energy industry on numerous grounds by presenting itself as a 'disinterested' observer. It has consistently derided renewable energy as primitive and pagan, and a rent-seeking distortion of the electricity industry that will cause de-industrialisation and economic collapse (Evans 2004, 2006a, 2006b, 2006c, 2007a, 2008a, 2008b; Lavoisier Group 2000a, pp. 2-3, 2008, pp. 8, 10; Evans, Quirk and Moran 2009). If the renewable energy industry is discredited as a return to the pre-industrial era, a continued reliance on fossil fuels appears less inappropriate.

Editorials and opinion columns in *The Australian* are antagonistic towards renewable energy technologies and policies designed to foster them. *The Australian* (Editorial 2006b, 2007a) and its finance commentator McCrann (2007c, 2009c) deride renewable energy technologies as expensive feel-good vanities unable to make any serious contribution to power generation in Australia. *The Australian* (Editorial 2007i) and Wood (2007a, 2007d) stigmatise the MRET as extra taxation that merely encourages inefficient, expensive and uncompetitive technologies.

Whereas public devaluation of climate science conducted by the AIGN might be regarded as self-interested and outrageous, denigration by the Lavoisier Group or media commentators may be seen as part of the normal process of vigorous public debate and dispute because the Lavoisier Group and media columnists are not seen to have a vested interest in the outcome. Establishing a front group to participate in public devaluation is a powerful tool. This is because a front group is able to sow doubt by attacking opponents and saying things on behalf of industry that industry could not safely say itself. Likewise, having a steady flow of media commentary that undermines climate science also serves to defend the status quo. Moreover, the activities of front groups and media columnists occur in arenas where climate scientists can experience difficulties defending themselves and their research against unconstrained devaluation and misinformation.

Allegations against the scientific 'orthodoxy'

Jasper (2006, p. 25) claims that being labelled an aggressor in modern society carries the risk of condemnation and is likely to draw a sense of sympathy for the victims. This is analogous to the outrage that is generated by public awareness of the use of unjustified force by a powerful aggressor in the typical dynamic of the backfire model. Climate critics use this tactic consistently. Critical commentators typically condemn the IPCC as an intolerant and authoritarian bully, brutally suppressing the lonely and defenceless voices of dissent and crushing legitimate debate on climate change. Editorials in *The Australian* (e.g. 2007h) are less strident in their condemnation, but still express comparable sentiments. Wood (2006b; see also M. Devine 2008b; *Australian* Editorial 2009a) asserts that 'the high priests of climate change are trampling dissent'. Similarly, Miranda Devine (2008a; see also F. Devine 2007; Duffy 2007b; *Australian* Editorial 2007c, 2007h, 2009c) states that a 'ferocious amount of energy [is] expended suppressing any dissent from orthodoxy on climate change'. Furthermore, Miranda Devine (2008c) claims that scientists can only speak out with safety once they are free of alarmist scientific institutions. Likewise, Pearson (2009b) cites sceptical Australian climate scientist, Garth Paltridge, who claims the CSIRO threatened to remove his research funding after he voiced doubts about the extent of climate change. These accusations are designed to create a sense of outrage against the IPCC and engender sympathy for dissident scientists portrayed as independent voices of reason.

Media critics also claim that scientific organisations have abused the principles of challenge and dissent that underpin the integrity of the scientific method. In 2006, the world's oldest scientific academy, the UK Royal Society, wrote to ExxonMobil 'challenging its views on climate change and its funding of some scientific institutions' (in Hulme 2009, p. 93). Pearson (2006, 2009b) and Wood (2006b) accuse the Royal Society of outrageous behaviour and trying to stifle debate in the manner of church or state. Similarly, Miranda Devine (2009d) accuses Will Steffen, head of the Climate Change Institute at the Australian National University, of betraying the scientific method by belittling Senator Stephen Fielding and refusing to answer supposedly pertinent questions about climate uncertainties.

Critical columnists extend these arguments by claiming that environmentalists use smear tactics against dissenters in a deliberate attempt to close down debate. In particular, critical

commentators take issue with the phrase ‘climate change denial’. Frank Devine (2008), Miranda Devine (2008a), Albrechtsen (2007) and Wood (2006b, 2007c) all argue that the label ‘climate change deniers’ is a cynical and repugnant attempt to equate climate scepticism with Holocaust denial. The implication is that environmentalists resort to underhand tactics because the scientific evidence for climate change is insufficient to withstand careful scrutiny.

The Lavoisier Group accuses the climate science community of extensive lies, deceit and fabrication. The IPCC and climate scientists such as Michael Mann are accused of falsifying the evidence on global warming (Evans 2006a; Lavoisier Group 2008; Evans D 2010), and the IPCC is accused of fabricating the data for its Special Report on Emissions Scenarios (Walsh 2002). Accusing others of lies and deception not only devalues an opponent, but may also deflect criticism of one’s own position. It can therefore also serve as a smokescreen, for example to distract attention from deliberate deception practiced in public arenas by industry front groups such as the Lavoisier Group.

Self-validation

Presenting oneself as an independent observer in a debate builds trust by avoiding suggestions of bias towards a particular position. Industry front groups and critical opinion columnists become much more effective if they are seen to be disinterested, objective and concerned with the public interest. Sceptical commentators have no scientific training and few credentialed allies in the scientific community. On the other hand, Albrechtsen, Frank Devine, Miranda Devine, Duffy, McCrann, Pearson, and Wood were variously associated with a network of corporate-funded neoliberal think tanks such as the IPA and front groups such as the AEF and the Lavoiser Group that promote a critical line on climate change (Pearse 2007, pp. 211, 243-250). This indicates a degree of self-validation (and cover-up) on behalf of media columnists because the sceptics are not up-front about their partisan links to a shared network of interests.

Validation of contrarian voices

At the same time as they attack the credibility of climate science, critical commentators in the media validate dissident scientists as reputable and well-credentialed, laud disbelieving

politicians as heroes, and praise disparaging reviews of the science and economics of climate change as rational critiques of overblown alarmist dogma. When critics validate dissenting voices, they play on long-standing liberal democratic notions about the importance of dissent and debate in maintaining a healthy and robust democracy. This may accord dissenting voices with a degree of credibility to which they are not necessarily entitled, particularly if validation by a critical commentator promotes a dissenting position as genuinely sceptical when in fact it may be just contrarian, ill-informed or wrong.

Australian geologist Ian Plimer has attacked the entire basis of climate science. Miranda Devine (2009b) applauds him as an independent and free-thinking scientist and favourably contrasts his empirical fieldwork with climate modellers who supposedly inhabit a virtual world. Plimer's book, *Heaven and Earth* (2009) is welcomed by Devine (2009b; see also Pearson 2009a; *Australian* Editorial 2009b) as a 'comprehensive scientific refutation' of the authoritarian dogma underpinning human-caused climate change. Similarly, *The Great Global Warming Swindle* (Durkin 2007), a documentary featuring contrarian scientists that screened on the ABC in 2007, was endorsed by *The Australian* (Editorial 2007c) and by Miranda Devine (2008a) as an important contribution to open debate and understanding of climate change. It is significant that despite several editorials that accept the science of climate change, contrarians receive institutional endorsement from *The Australian* as bona fide critics with a credible viewpoint. For *The Australian*, at least in this instance, the debate on the causes of climate change is far from decided. This is an implicit rebuke to the scientific authority of the IPCC.

Australian Family First Senator Steven Fielding visited the Heartland Institute in the US in June 2009 to attend a conference critical of climate change. He has since questioned the scientific evidence on climate change. Miranda Devine (2009c) commends Fielding as 'one of the few politicians who is actually trying to understand the facts in the debate'. According to Devine (2009d), Fielding 'embodies the classic story of David versus Goliath' and is praised as being tough enough to stand up to the bigoted bullying meted out by environmentalists and climate scientists. Devine's representation of Fielding as a courageous individual is crucial because the fossil-fuel industry and industry-funded think tanks such as the Heartland Institute hardly fit the image of 'David'.

Critical commentators consistently paint positive pictures of climate 'sceptics' and contrast this with negative images of climate scientists. Frank Devine (2007) compares the incisive but measured analysis of the 'lucid and urbane climate sceptic', David Henderson, with the 'ill-mannered hectoring' of climate scientists and 'authoritarian ranting by puffed-up bureaucrats' in the IPCC. Devine (2007), Wood (2006a) and McCrann (2007a) all praise Ian Castles and David Henderson for exposing the allegedly misleading income comparisons underpinning the IPCC Special Report on Emissions Scenarios. Duffy (2007a, 2007b), Albrechtsen (2007) and McCrann (2007a) laud the critics of the *Stern Review* as eminent and rational, and portray them as part of an emerging consensus that the dangers of climate change have been overblown. In a similar vein, Wood (2007a) and editorials in *The Australian* (2007a, 2007d, 2007f, 2007g) regularly approved of the critical position taken on climate change by former Australian Prime Minister John Howard, describing it as carefully considered, pragmatic and adaptable.

Reinterpretation

Scientists face a difficult task in conveying warnings about a looming threat such as climate change because the human-induced component of climate change is difficult to detect against the background of natural climate change and weather patterns (Rahmstorf 2005). Additionally, greenhouse gas emissions are not a visible form of pollution and the sources of human impact are diffuse in time and space and underpin most of modern civilisation. This makes it difficult to arouse indignation and allocate blame against specific targets.

Nevertheless, once scientific evidence revealed that industry was causing potentially irreparable harm, the continuation of damaging industrial practices would be likely to trigger outrage. Reinterpretation then becomes a central task as industry organisations and their allies seek to insert their interpretation of the situation into the public discourse. Methods of reinterpretation include denial and raising doubts, blame-shifting and minimisation, and reframing.

Denial

Denial of the problem, or at least its seriousness, is of paramount importance because it enables industry to avoid blame for their activities. Denial is aided by the fact that few of the

consequences of climate change have had an immediate impact on most people's lives in wealthy industrialised countries. Nevertheless, denial by industry becomes more risky as the scientific consensus on cause and effect is communicated to the public through various media. In recent years, the AIGN has been careful not to publicly associate itself with climate science denial because as an industry association it could be viewed as having a direct interest in denial of the problem and the tactic could cause outrage and backfire against industry.[91]

By contrast, denial of the problem is a principal tactic of the Lavoisier Group. Because it has no apparent links to industry, denial is less likely to generate a backlash against industry. Several arguments are raised to deny greenhouse science, including attributing warming to natural variability (Kininmonth 2002; Foster 2000a, 2000b, 2001; Evans 2006c, 2007a; Carter 2007). Allocating and avoiding blame is a crucial strategic activity (Jasper 2006, p. 51; see also Stone 2002, pp. 188-209). Unlike human activity or inactivity, either deliberate or unintentional, natural occurrences do not generally attract blame or outrage (Jasper 2006, p. 48-49).[92] Therefore, interpreting climate change as a natural phenomenon is a valuable tactic that serves industry. Not only does it negate greenhouse science if climate change can be explained as entirely natural in origin, it also deflects any blame from industrial activity. Moreover, emissions reductions can be portrayed as misguided and pointless because they can have no beneficial environmental impact.

A similar approach has been taken by media critics who have consistently disputed the evidence for continued global warming. Critical columnists contend that global temperature data contradicts climate model predictions about a warming world. Duffy (2008a) and Pearson (2008) claim that global warming stopped in 1998. Duffy (2007c; see also *Australian* Editorial 2008a) notes that in the US at least, the 1990s were no warmer than the 1930s. Furthermore, Duffy (2008b) accuses leading climate scientists of deliberately misleading the public about the rate of warming and covering-up contrary evidence. Duffy (2007c) charges

[91] Industry generally recognises that the weight of evidence behind the science of climate change is sufficiently solid that it cannot be credibly refuted by industry itself. Documents that surfaced in a lawsuit in 2009 reveal that a formerly pre-eminent industry lobby group in America got this advice from its own in-house scientific and technical experts back in 1995 (Revkin 2009).

[92] Although natural disasters may not cause outrage, inadequate preparations or a delayed relief effort may generate widespread condemnation.

climate science organisations such as the Goddard Institute of Space Studies (GISS) at NASA (National Aeronautics and Space Administration) with subterfuge surrounding its treatment of temperature records and claims that GISS is reluctant to release data in sufficient detail for the results to be verified by independent researchers. In theory, conflict over temperature records should be resolvable by looking at the evidence. However, maintaining controversy over temperature data allows critics to portray the science as inconclusive, depict temperature variations as purely natural fluctuations, and cast doubt about the credibility of future temperature projections. These arguments serve to reduce the apparent seriousness and urgency of climate change.

Several editorials in *The Australian* (2007c, 2009b, 2009c) as well as opinion columns by Albrechtsen (2007), Pearson (2006) and Wood (2006b, 2007c) assert that climate science is not settled and strongly dispute the notion of a scientific consensus on the causes of climate change. Albrechtsen (2007), Pearson (2008) and Miranda Devine (2008b) all state that the scientific evidence shows no correlation between CO_2 emissions and temperature increases. Instead, *The Australian* (Editorial 2007c) and Albrechtsen (2007) offer alternative explanations for recent warming. Once again, the assertion that the empirical evidence contradicts the theory of global warming serves to further discredit the scientific basis of climate change and implies that not enough is known about the science to justify policy action on climate change. This is an important tactic because it plays on a general assumption that more conclusive scientific evidence in the future would resolve the problem. In reality, more evidence rarely solves scientific controversies because the disputes are generally about far more than the science (Pielke 2009a, pp. 42-44). The crucial importance of conflicting values in controversies (for example, over the 'proper' role of the state in society) is revealed in the following sections on blame-shifting and reframing.

Deception

Exposure of deceit within the scientific arena carries grave consequences and can result in the loss of credibility, loss of funding and the end of a career. By contrast, similar sanctions rarely apply to deception used by participants in the public arena (Dessler and Parsons 2006, pp. 37-38). Deception may be difficult to detect and expose in public debate. One form of deception involves promoting science in the public arena that has already been rejected in the

scientific arena. For example, the Lavoisier Group presents Henrik Svensmark's solar-cloud hypothesis as destroying the case for human-caused global warming (Evans 2007d). However, Svensmark's work has been decisively rebutted in the peer-reviewed scientific literature (Damon and Laut 2004; Lockwood and Fröhlich 2007) and yet the Lavoisier Group makes no mention of this and misrepresents the solar-cloud hypothesis as though it is fact. The Lavoisier Group has also promoted work that makes selective use of data to mislead its audience about the state of the climate, for example, by claiming that global warming has stopped (Carter 2007, 2008a, 2010).

By failing to disclose its backers, the Lavoisier Group is misleading its audience about its own identity. This deception is critical because the apparent lack of connection to industry and corporations allows the Lavoisier group to appear as an independent 'third party' in the debate. Independence is a crucial element in building credibility for a particular point of view. The Lavoisier Group is therefore deceiving the public into attributing greater credibility to a perspective that serves industry precisely because the viewpoint appears to be advanced independently.

Minimisation

Governments may prioritise issues for consideration on the formal agenda according to their prominence on the public agenda. If the seriousness of a problem can be minimised, it is less likely that it will be considered formally, particularly if policy action requires contentious decisions (Kingdon 1995, pp. 197-202). Successful minimisation of a problem reduces the pressure on governments to act and increases the likelihood that governments will defer significant action, or take only symbolic action.

The Lavoisier Group minimises the problem of human CO_2 emissions in the following ways. Firstly, the Lavoisier Group minimises the extent of the warming that has already occurred (Foster 2000a, 2000b; Evans 2006a, 2008b; Carter 2007). Secondly, it minimises CO_2 as the cause of the warming that has already occurred (Evans 2006c, 2007b, 2008a; Foster 2000a, 2000b; Carter 2007, 2008a, 2008b; Morgan 2000a, 2000b; Archibald 2007a, 2007b; Moore 2007, 2008; Lavoisier Group 2008). Thirdly, it minimises the size of human emissions of CO_2 in comparison to the total natural flux of CO_2 (Evans 2006a, 2008a). Fourthly, it

minimises the possibility of any future warming, even suggesting that that we are entering a period of global cooling (Evans 2007b, 2007c, 2008b, 2008c; Archibald 2007a; Lavoisier Group 2008). And fifthly, the Lavoisier Group minimises the negative aspects of any potential warming by arguing that previous warming has been associated with flourishing civilisations (Evans 2007d; Archibald 2007a; Moore 2007, 2008).

By contrast, the AIGN avoids minimising the scale of the problem because it could readily be interpreted as industry trying to deny the science. Instead, AIGN members minimise their role in the problem by pointing out that Australian emissions are only a fraction of total global emissions and argue that if Australia were to decarbonise its economy, it would have negligible impact on global emissions (ACA 2007).

Likewise, even when media commentators admit the possibility that climate change is happening and may be caused by CO_2 emissions, they minimise Australia's contribution to the problem by pointing out that Australia is only responsible for 1.4 per cent of global emissions. One editorial in *The Australian* (2007a) and columns by Miranda Devine (2008a, 2008c, 2009b) assert that cutting emissions in Australia will have negligible global impact, and that promises to lead the world on climate change reek of futile economic martyrdom for no environmental gain.

Minimisation by industry and its media allies plays into complex normative disputes about who should bear responsibility for doing something about climate change. Because normative claims involve value judgements, they are very difficult to resolve (Dessler and Parson 2006, p. 20). The argument that there is little to be gained by premature Australian action helps reduce outrage over policy delays. Normative disputes including blame-shifting may prolong a controversy long after positive claims about the science have been resolved. This makes them a useful tactic for a side that stands to gain from delayed policy action resulting from seemingly irreconcilable conflicts.

Framing

The AIGN has framed climate change primarily as an economic issue, particularly in terms of wealth generation derived from a comparative advantage in cheap coal-fired electricity

serving an emissions-intensive export-oriented industry (Daley 2006).[93] Economic arguments about the importance of cheap fossil fuels are easily expressed within the dominant neo-liberal paradigm. Moreover, the economy is typically considered separately from the environment and economic decisions are prioritised. A similar framing of the issue dominated *Securing Australia's Energy Future* (Australian Government 2004), indicating that official government policy reflected the AIGN perspective. This congruent perspective supports the notion advanced by Jasper (2006, p. 11) that persuasive arguments are most effective when they appeal to shared values.

Reframing climate change as an economic issue also lends greater saliency to the immediate impacts of economic restructuring that would occur with reducing emissions, whereas the impacts of climate change are more intangible and long-term. Critical commentators argue that emissions reductions would destroy jobs and wreck the economy for no environmental gain. Several editorials in *The Australian* (2006, 2007f, 2008d) as well as opinion columns by Miranda Devine (2009b, 2009c, 2009d), Albrechtsen (2008), Pearson (2006, 2007), Wood (2007b) and McCrann (2008a, 2008b, 2009b, 2009c) variously castigate emission reduction policies as disastrous, irrational, premature and futile.

Interests associated with the AIGN challenged recommendations in the *Garnaut Review* by framing industry as the victim of climate change, not the perpetrator. Industry claims it will be subjected to disproportionately unfair cost burdens under an ETS, and is the victim of unforseen and unilateral carbon pricing decisions by government that will destroy asset values (Page[94] in Taylor and Ferguson 2008). This claim relies on concealing the fact that industry has had considerable notice about a carbon price: indeed it has spent most of the last decade-and-a-half lobbying vigorously to prevent the introduction of any carbon scheme (see Christoff 2005a, pp. 31-32). Reframing industry as victim therefore requires both deception and cover-up.

The ACA is a key player in the AIGN. The ACA (2011) and its Executive Director, Ralph Hillman (2011), and *The Australian* (Editorial 2006b, 2007a, 2007e, 2008b) reframe 'clean

[93] John Daley was CEO of the AIGN. This speech is no longer publicly available on the AIGN website.
[94] Brad Page was CEO of the Energy Supply Association.

coal' as the solution to climate change.[95] This inverts the environmental frame that depicts dirty coal as the cause of the problem. 'Clean coal' is a classic instance of reinterpretation because there is no functioning clean coal power station globally. Carbon capture and storage technology remains unproven and is not expected to be commercially available for at least 10 years (if ever) under the most optimistic scenarios, and even then is forecast to have minimal impact on emissions by 2030 (Saddler et al 2004b, p. xii; see also Wilkenfeld et al 2007, pp. 3-4). Moreover, the coal industry has relied on government subsidies for research and so far appears to have invested little of its own money into so-called 'clean coal' technology.[96] This indicates that reframing 'clean coal' as the solution to climate change is a marketing coup and an industry exercise in practical politics designed solely to preserve the social mandate for coal mining and use, rather than a serious commitment to rapidly develop cleaner technology.

Nonetheless, clean coal is the site of a fierce tactical disagreement between the practical industry politics of the AIGN and the Lavoisier Group. The Lavoisier Group argues that clean coal is a 'suicide note' for the coal industry because the additional cost will price coal out of the market (Evans 2008b, p. 8). The coal industry is scorned for pursuing a 'fantasy' which the Lavoisier Group regards as a complete waste of public and private resources (Evans 2008b, p. 8). This stance is consistent with the Lavoisier Group position that CO_2 emissions are not a problem, but also displays an ideological opposition to public funding for clean coal research.

The precautionary principle is intended specifically for instances of scientific uncertainty over the probability and potential extent of harm. The precautionary principle requires decision-makers to act prudently, particularly in cases with the potential for serious and irreversible harm such as human-induced climate change, and requires proponents to establish that their activity will not result in significant harm (Beder 2006, pp. 47-51). Sheldon Rampton and John Stauber (2001, pp. 148-50) argue that preventing the implementation of the precautionary principle is a key corporate strategy.

[95] A similar message has also been promoted by government, for example Howard (2006a) and Rudd (2009a).
[96] The Rudd government (Australian Government 2008a) contributed $500 million to a National Clean Coal Fund. This supplemented the $300 million the Howard government (Australian Government 2004) made available through the Low Emission Technology Demonstration Fund. By contrast, the ACA (2008) is raising $1 billion in its COAL21 fund, but this is spread over the next ten years.

The Lavoisier Group has tried to shift the burden of proof in the climate change debate by reframing the precautionary principle as an unjustifiable tool used by environmentalists to advance an ideological opposition to legitimate business practices (Morgan 2000b). Hugh Morgan (2000b) and David Evans (2008a) argue that the catastrophic economic and social consequences of decarbonisation might reasonably require proving beyond reasonable doubt that human greenhouse gas emissions are causing climate change. Since its inception, attempts by the Lavoisier Group to reframe climate change in terms of requiring proof beyond reasonable doubt have been used in tandem with arguments that there is no evidence for greenhouse warming and that climate science is inherently uncertain and riven by scientific controversy. Lack of evidence and scientific uncertainty preclude decisions beyond reasonable doubt. Doubt is therefore a critical tool for delaying a policy response such as an ETS. It also allows decision-makers to approve new coal-fired power stations on the basis that it cannot be proved that they will cause irreparable harm. The Lavoisier Group has targeted the precautionary principle because the principle undercuts the industry campaign to prevent or delay policy action.

There is a global campaign by industry-funded think tanks and front groups and sympathetic media commentators to reframe environmentalism as a far greater threat to humanity than climate change ever would be. Critics align scepticism with rational, liberal, democratic values of governance and reframe environmentalism as an eco-fundamental crusade against democratic freedoms and capitalism. Religious metaphors abound as the Lavoisier Group and media critics label climate change a religious quest overrun with zealots, fundamentalists, prophets, holy books, dogma, doctrine, guilt, apocalyptic visions, superstition, divine retribution, penance and salvation (Evans 2006a, 2006c, 2007b, 2008d; M. Devine 2008b; Albrechtsen 2007; *Australian* Editorial 2007j).

Ray Evans (2000, 2001, 2007b, 2008b, 2009, p.1; Lavoisier Group 2000b) has long held that environmentalism poses a threat to human sovereignty and freedom. Similar views have appeared in the media. Miranda Devine (2009a) quotes participants at a Heartland Institute conference on climate change who argue that environmentalism has superseded socialism as

the principal threat to freedom in the 21st century.[97] Nigel Lawson is a former newspaper editor in the UK and was later Chancellor of the Exchequer under Margaret Thatcher. In 2009 he founded the Global Warming Policy Foundation (2009), a think tank that disputes climate science and climate change policies. His views on environmentalism have been aired in the Australian media. Pearson (2006; see also M. Devine 2006; Evans 2007b; *The Australian* Editorial 2007b, 2007e, 2007j, 2008c) quotes Lawson's view that the 'global salvationist movement is anti-development and profoundly hostile to capitalism and the market economy' and that:

> it could not be a worse time to abandon our own traditions of reason and tolerance, and to embrace instead the irrationality and intolerance of eco-fundamentalism, where reasoned questioning of its mantras is regarded as a form of blasphemy. There is no greater threat to the people of this planet than the retreat from reason we see all around us today (in Pearson 2006).

Demonising environmentalism and framing it as the real threat fits in with the methods of devaluation described earlier. Equating environmentalism with fundamentalism and totalitarianism impedes the ability of scientists and environmentalists to appeal to a wider audience. By evoking fears, critical commentary aims to inoculate decision-makers against the message of climate scientists and environmentalists. The visceral hostility to government intervention in the economy and the value-laden framing of environmentalism reveal some of the obstacles that make climate change such an intractable problem. Although the issue at hand may appear to be a scientific disagreement, the underlying conflict is intensely ideological based on deeply-held and conflicting values around priorities for economic development and the governance of society.

Official channels

Official channels include reviews, commissions, and court action (Martin 2007a, p. 5). Apart form court action, official channels are not normally a method available to other players.

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[97] The Heartland Institute (2011) is a US corporate-funded free-market think tank that proudly denies climate change science. Contrarian scientists associated with the Lavoisier Group such as Bob Carter spoke at the Second International Conference on Climate Change in New York, the Third International Conference on Climate Change in Washington DC (Heartland Institute 2011), and the Fifth International Conference on Climate Change sponsored by the Heartland Institute in Sydney on 1st October 2010 (Heartland Institute 2010).

Nevertheless, there are instances where industry in the form of the AIGN has participated in official channels instigated by the federal government. One instance is the Greenhouse Challenge, a voluntary non-binding agreement between government and industry. This helped the government and the AIGN to blunt demands for tougher regulatory action and provided both government and industry with a platform to promote their activities (Hamilton 2001, pp. 40-43). In this sense, the Greenhouse Challenge could be seen as a tool to reduce outrage by promoting a vision of government and industry acting together on climate change.

The AIGN has also participated in other government-instigated official channels to further its interests. It was a key player in Howard's Task Group on emissions trading where it had a strong presence on the review panel.[98] And at international negotiations, AIGN executives have secured a unique position as official members of the Australian negotiating team (Pearse 2007, p. 231).[99] As a powerful cross-industry lobby group, the AIGN has therefore used official channels both to reduce outrage and to further its own interests. By contrast, as a non-powerful player, the Lavoisier Group does not appear to have had inside access to official channels.

Pressure

The boundaries between verbal intimidation and legitimate persuasion vary between cases and are often difficult for an outsider to discern. I have designated this category as pressure because this seems a more appropriate description of the AIGN methods. The AIGN has used persuasion, threats, and an ability to out-manoeuvre opponents to convince major Australian industry and business associations such as the BCA and the Australian Chamber of Commerce and Industry to either stay out of the greenhouse debate or to adopt the AIGN line on the issue (Pearse 2007, pp. 177, 239-243).[100] Likewise, the mining and metals interests

[98] The business representatives were Peter Coates, Xstrata; Chris Lynch, BHP Billiton; John Marlay, Alumina Limited; Margaret Jackson, Qantas; Tony Concannon, International Power; John Stewart, National Australia Bank, and Russell Higgins, Australian Pipeline Trust. The remainder of the panel were senior government bureaucrats chaired by Peter Shergold, Secretary of the Department of Prime Minister and Cabinet (Prime Ministerial Task Group 2007, pp. 145-148).

[99] In a transcript of a taped interview with Pearse, a senior AIGN executive details how the AIGN was a part of the negotiating team and the advantages that conferred.

[100] The Business Council of Australia (BCA) was established in 1983 and its executive has been dominated by the mining industry. Between 1983 and 2007, ten of the twelve directors of the BCA have been 'mining industry chief executives and or directors whose companies have interests in one or more of the most emissions-intensive sectors' (Pearse 2007, p. 240). This pattern continued in 2008 with the new BCA president, Greig Gailey, being

within the AIGN itself have been able to persuade other resource sectors such as farming, forestry and gas to remain silent on climate change (Pearse 2007, pp. 177, 188-189). This has allowed the AIGN to hide differences within industry and avoids the impression that industry greenhouse policy is being driven by narrow sectoral interests.

The AIGN has also threatened various governments with disinvestment in Australia, job losses, and relocation overseas should action be taken to reduce Australian greenhouse gas emissions. It cannot be assumed that these threats had a direct influence on federal energy and climate change policy. Nevertheless, *Securing Australia's Energy Future* (Australian Government 2004, pp. 25, 140) stated that an ETS would not be introduced in Australia ahead of comparable schemes overseas because it would lead to job losses as corporations relocated overseas. Similarly, the *Carbon Pollution Reduction Scheme* (Australian Government 2008d, secs.12-2, 13-21) proposed compensation for major polluters to retain them in Australia. There is no evidence that the Lavoisier Group has the resources to engage in these methods.

As a medium of communication operating in the public arena, the press rely on rhetorical and intellectual methods of persuasion. However, it is possible that a newspaper could threaten to sue opponents for alleged libel. Depending on the situation (e.g. the resources or lack thereof of a particular target), libel threats could be treated as a form of intimidation.

Donations and Funding

Donations to political parties in Australia are legal and are made by business, unions and individuals. Nevertheless, as a former industry lobbyist and Liberal Party member, Pearse (2007, p. 196) argues that donations are made in the hope of gaining political advantage. Between 1998 and 2005, AIGN members contributed at least $3.3 million directly to the Liberal Party, with further indirect funding of approximately $2 million channelled through the Liberal Party's think tank, the Menzies Research Centre and fundraising front groups such as the Cormack Foundation (Pearse 2007, pp. 195-197). Although the positions of the AIGN and the Howard Government were closely aligned during this period, there is no direct

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a former chairman of the MCA between 2003 and 2005. Moreover, AIGN members have dominated the BCA's high level advisory group known as the 'Chairman's Panel' (Pearse 2007, p. 241).

evidence that political donations by the AIGN made a difference to the position of the Howard Government on climate change. Indeed, corporate tax contributions to Treasury may be the most significant factor reinforcing the economic and political power of the resources sector (Pearse 2007, p. 199). This indicates that the business activity of major corporations confers on industry a significant degree of influence over issues of public policy.

Quasi-governmental and bureaucratic organizations such as ABARE and CSIRO have become dependent on corporate funding following reductions in the level of government funding (Pearse 2007, pp. 219-26). Between 1993 and 1997, several industry associations and corporations, many associated with the AIGN, contributed up to $50,000 each to be involved in developing the ABARE greenhouse model, MEGABARE (Hamilton 2001, p. 57). The Howard Government used MEGABARE to justify its position on lenient emission reduction targets for Australia in the lead-up to and during the Kyoto protocol negotiations. Corporations also paid $100,000 each to be involved in the CSIRO Energy Futures Forum (Pearse 2007, p. 224). The AIGN has also commissioned economic modeling work by ACIL Tasman and CRA International. Although economic models appear independent, funding enables AIGN members to insert their assumptions into official government models to provide results that suit their interests (Pearse 2007, p. 209). This implies that corporate funding may have helped shape policy outcomes in the greenhouse debate.

AIGN members have channeled funds to think tanks and front groups such as the APEC Study Centre at Monash University, (Pearse 2007, p. 201), the Energy Forum at the IPA (Pearse 2007, p. 282), and the IPA's environmental front group, the AEF (Pearse 2007, p. 200). Funding think tanks and front groups has resulted in a range of organizations with no visible link to corporations releasing a constant flow of materials that undermine climate science and support the position of the largest polluters. Beyond this, the AIGN has also hired influential greenhouse lobbyists John Hannagan and Noel Bushnell. Besides attending international negotiations, writing media releases, and running conferences designed to undermine Kyoto, Hannagan and Bushnell have also had direct access to John Howard at crucial stages of the greenhouse struggle (Pearse 2007, p. 209). Hiring lobbyists has therefore another important aspect of buying influence in the policy debate.

Conclusion

This chapter has detailed the important role of resources in the Australian economy and the financial power of the mining sector. However, the resources sector has not relied on its financial importance alone to maintain a dominant voice in economic affairs. Instead, it has actively pursued a long-term strategy to influence both the public and governmental agendas and to attack and negate its opponents. To this end, the fossil fuel and mining sector has resourced both industry-based lobby groups and a network of radical neo-liberal think tanks and front groups. Both types of organisations have been vital in helping the resources sector retain a dominant position in the debate.

The lobby group had privileged ‘inside’ access to government and was able to cover up those activities that could provoke public outrage such as the alleged improper manipulation of government processes. It also had the power to pressure other industry groups and sectors into retaining the appearance of a united front, make political donations and fund organisations, participate extensively in official channels, and reframe climate change as an economic issue based on the wealth generation of the fossil fuel sector. Lobby groups also undertake ‘outside’ media strategies to promote their economic contributions, an area in which it could be legitimately expected that industry would defend its interests. Crucially, however, industry lobby groups have avoided moves such as openly criticising science. Certainly, industry lobby groups would have the resources to carry out a public campaign to devalue climate science, but such tactics could backfire because they would appear self-serving and against the public interest.

Nevertheless, lowering the credibility of climate science is a critical factor in sustaining the appearance of scientific controversy, propagating doubt in the public and political arenas, and reducing outrage over delayed policy action by government. As seemingly independent grassroots organisations, front group can attack climate science, vilify environmentalism, and reinterpret climate change in terms that favour industry interests. Deceiving the public by concealing its backers allows the front group to use a range of inflammatory rhetorical methods that would backfire against industry if they were used by an organisation clearly associated with industry. Likewise, critical commentators in the Australian quality press are not up-front about their own potentially compromising connections to the same radical neo-

liberal organisational network within which the front groups are embedded. Cultivating the appearance of independence has enabled media commentators to indulge in similar rhetorical tactics to those employed by front groups. The tactics depicted in table 3 suggest a deliberately orchestrated pattern of operation.

Table 3: Tactics used by the lobby group, front group, and media sceptics

Tactical framework	**Lobby Group**	**Front Group**	**Media sceptics**
Cover-up	✓	✓	
Devaluation		✓	✓
Allegations			✓
Self-validation			✓
Validation of contrarians		✓	✓
Denial		✓	✓
Deception		✓	
Minimisation		✓	✓
Framing	✓	✓	✓
Official Channels	*		
Pressure	✓		
Donations and Funding	✓		

Key: ✓ indicates use of the method
* indicates participation in the method, rather than instigation of the method
Indented tactics indicate a subset of devaluation, and various forms of Reinterpretation

Using a tactical framework has significant advantages when studying industry strategy. My framework shows not only that industry has been able to use a full range of methods, but delineates a carefully crafted de-facto division of labour between the activities of the lobby group and those of the front group. In effect, this chapter has demonstrated that specific strategic advantages accrue to powerful players such as industry if they can simultaneously conduct a range of inside and outside strategies designed to influence both the public and policy agendas by creating different organisations with different tactical approaches to pursue them. Sympathetic columns in sections of the quality press complement the industry approach by communicating the message to a wider audience and indirectly influencing decision-makers.

Chapter 6: Scientists: Background to the ‘Hockey Stick’ controversy

Introduction

This chapter analyses the scientific and technical background to one particularly contentious aspect of climate science and then moves on to examine a series of exchanges between the scientists and their critics in the dispute. I subject both sides to a relatively symmetrical analysis and the chapter aims to generate some useful lessons about scientific communication. This chapter also provides the substantive basis for chapter 7 which will use my tactical framework to analyse the methods employed by the disputants. So whereas this chapter analyses some of the rhetorical exchanges, chapter 7 covers a much broader range of tactics.

Much of this thesis has analysed how the science of climate change affects political and economic decisions and what methods the various stakeholders such as government and industry use to respond to the science. This chapter inverts that process by analysing the ‘hockey stick’ as one example of how politics intrudes on science. The ‘hockey stick’ is a reconstructed climate graph of the last 1000 years whose name derives from its shape: the long flat handle of an ice-hockey stick laid horizontally followed by the sharp upturn of the blade. The IPCC *TAR* (2001) promoted the ‘hockey stick’ as a symbol of climate change. This had large political ramifications and the ‘hockey stick’ and the scientists that produced it became a target for climate sceptics. Climate scientists have been accused of improper data selection through to scientific corruption and fraud. The dispute has played out in diverse arenas from US Congressional hearings to various weblogs. How have scientists and scientific institutions responded to these allegations in the context of a strategic contest with their opponents? Or framed differently, what are the most effective tactics for the defence of an overwhelming scientific consensus that faces powerful opponents who can mobilise support using financial backing for think tanks and front groups, directly lobby governments, and spread their message via traditional and new media?

This chapter analyses the controversy over the ‘hockey stick’ reconstruction of climate change and the ongoing debate. The issue has typically been dealt with in terms of trying to elucidate who is right and who is wrong. Although I attempt to analyse the rigour of the arguments on both sides because a position on the scientific or technical merits may influence the outcome of the debate, my main interest is the methods used by the protagonists and how these may shape public perceptions of the debate, in turn influencing perceptions of who is right or wrong irrespective of the merit of technical arguments. This latter point is important; previously, it may have been assumed that the authority of scientific institutions and the scientific process would be sufficient to resolve the controversy. However, it may be that the response of the non-involved observers, the general public who constitute the majority in most debates, may influence the outcomes. Given that the technical aspects of the debate are beyond the understanding of all but a few relevant experts, the perceptions of the debate and the behaviour of the protagonists may be crucial in shaping the result.

Traditionally, the climate debate is presented as a conflict between mainstream scientists and environmental advocacy organisations on one side supported by a majority of governments. On the other side is industry and a range of industry-funded organisations such as think tanks and front groups, supportive media commentators, and a small number of dissident or contrarian scientists. This simplified picture is useful for presenting the major opposing antagonists. Both major protagonists – scientific institutions and industry – have power. Industry has financial power that is sometimes deployed politically. Dominant scientific views have institutional power and authority that are sometimes deployed politically by advocates. The dominant scientific view relies strongly on credibility and trust: damage to its credibility and erosion of public trust undermines the scientific establishment's ability to speak authoritatively on a particular topic. Consequently, mainstream scientific institutions and scientists are generally cautious and careful to retain credibility by making uncertainties clear and not over-stating conclusions.

However, the ‘hockey stick’ controversy can also be represented as a spectrum of opinion, with the IPCC and most scientist located somewhere in the middle. Further along the spectrum on one side are scientists such as James Hansen (2007a) who believe that natural scientific reticence has permeated most scientific findings, and that consequently, the IPCC

findings are overly conservative and do not fully reflect the magnitude and urgency of the problem. On the other side of the spectrum are critics who do not deny the reality of climate change, but are sceptical about the extent of warming that may eventuate from a given greenhouse forcing, or claim to have found significant errors in certain areas of scientific research. Further along the spectrum is a vociferous group that denies the existence of global warming and claims that the science is corrupted and fraudulent and that climate science in its entirety is a hoax confected by a vast global conspiracy of scientists for their own (generally unspecified) ends.

As I noted in the section on social constructivism in the Introduction, one of the dilemmas inherent in the social analysis of a controversy is the risk that a symmetrical analysis is almost always more useful to the side that lacks scientific authority or is weaker epistemologically: that is, the side with less scientific credibility (Scott, Richards and Martin 1990). An analysis of the ‘hockey stick’ risks being of more value to those who critique and/or deny the science than it does to those who promote the science. Nevertheless, the analysis here aims to provide some useful lessons about the way that scientists and scientific institutions operate and communicate, and about how they can better satisfy demands for public accountability and build trust for scientific conclusions in public debate.

I begin with the scientific context before the ‘hockey stick’ debate, and then give an outline of the ‘hockey stick’ and its adoption as a symbol of climate change. I cover the critique of the ‘hockey stick’ and the counter-response by climate scientists. Next I present two official investigations of the ‘hockey stick’. Then I move to a more recent ‘hockey stick’ reconstruction that aroused further controversy. A brief sketch of the UK ‘Climategate’ investigations is given before I deal in greater detail with the response of observers to the dispute by presenting some blog interactions. Finally, I analyse and classify some of the key interactions between scientists and their critics, and draw out some of the main findings.

The scientific context prior to the ‘Hockey Stick’

The case for global warming rests on different lines of evidence such as widespread melting of mountain glaciers and ice-caps, instrumental measurements of temperature rise over both land and oceans, satellite measurements of a warming troposphere, and sea level rise derived

at present mainly from thermal expansion of warming oceans, but with some contribution from ice melt. Yet this evidence does not by itself necessarily indicate human influence as opposed to natural fluctuation.

Although scientists had long suggested that the observed warming was likely to be of human origin, they had been unable to detect a weak human signal amongst the natural background noise (Oreskes and Conway 2010, pp. 199-202). Attributing warming to human causation required detecting the patterns of warming and matching them to what would be expected from an enhanced greenhouse effect as opposed to other sources such as increased solar forcing (IPCC 1996, pp. 4-5, 411-413).[101] In effect, scientists looked for a set of 'fingerprints' that would identify the source of the warming and rule out plausible alternatives.

Ben Santer and colleagues showed that the pattern of warming – a warming troposphere and a cooling stratosphere – was exactly what would be expected by heat-trapping gases accumulating in the lower atmosphere, and that this effect could not be produced by solar forcing which would be expected to raise temperatures in both the troposphere and the stratosphere. Santer demonstrated cause and effect and proved the link between human activities and greenhouse warming (Oreskes and Conway 2010, p. 202). Santer et al (1996) published their findings in the prestigious *Nature* journal.

Santer was subsequently asked to be a lead author of chapter 8, 'Detection of climate change and attribution of causes' for the 1995 IPCC report. Fellow lead authors included Tom Wigley, Tim Barnett and Ebby Anyamba, and another 32 climate scientists contributed to the chapter. The IPCC report announced that initial evidence of a human climate signal had been found and attributed the pattern of warming to the greenhouse effect (IPCC 1996, p. 439). This finding was cautiously communicated in the Summary for Policymakers as 'the balance of evidence suggests that there is a discernible human influence on global climate' (IPCC 1996, p. 5).[102]

[101] The IPCC 1995 *Second Assessment Report* (*SAR*) was published in 1996. Therefore, I call it the 1995 report in text, but reference it as IPCC 1996.

[102] Following the publication of the 1995 IPCC report, Ben Santer was attacked in the pages of the *Wall Street Journal* by a former head of the US National Academy of Sciences, Frederick Seitz, who accused him of deception and fraud. Details of the case and Seitz's links to neo-conservative think tanks in the US are given in Oreskes and Conway (2010, pp. 3-9).

The attribution of global warming to human causation was a significant breakthrough and pre-dated the negotiations on the Kyoto protocol. Nevertheless, questions remained about whether current temperatures were unusually warm or still within the bounds of natural variability. Thermometer records with a reasonable geographical spread only go back to the 1850s. The records show cold temperatures in the late 1800s and document a steady but uneven rise in temperature since that period. Historical data provides some evidence for the existence of what is colloquially referred to as a Medieval Warm Period in the northern hemisphere between approximately 800-1300AD and a Little Ice Age around 1600 to 1850. For example, a Norse colony existed on the margins of a few Greenland fjords between 985 and about 1450 before the onset of colder winters saw the colony collapse. Numerous stories and paintings such as ice fairs on the river Thames bear witness to periods of more intense cold during what is known as the Little Ice Age. As sceptics such as Donald Rapp point out, one might reasonably expect that current temperatures would be higher than those of two hundred years ago. Indeed, if the Little Ice Age was colder than normal, then might not current temperatures merely be returning to the warmth of the Medieval Warm Period? (Rapp 2008, p. 60).

Answering this question involves reconstructing temperatures for the last one or two millennia from proxy indicators that contain a temperature record. Proxy indicators include tree rings, corals, lake sediments, speleothems (stalactites and stalagmites) and ice cores. Proxy temperature reconstructions are an attempt to compare current temperatures with historical temperatures. Most proxy data goes back several hundred years, but a much smaller number extend back one or two thousand years. Proxy data must be calibrated and verified. Proxy data are calibrated against the temperature record for the 20th century. Next, the temperature for the second half of the 19th century is reconstructed from the proxy data and then verified by checking it against the temperature record for that period. If the proxy data passes statistical verification tests, then it is used to reconstruct past temperatures over past centuries and millennia.

The treatment of historical temperatures has changed markedly over the period of the first four IPCC Assessment reports. The IPCC First Assessment Report (1990, p. 200) indicated that the Medieval Warm Period ‘may not have been global’. However, the IPCC (1990, p.

202) did include a rough schematic diagram indicating a distinct Medieval Warm Period between approximately 1000-1300 AD with extended global temperatures well above the 20th century thermometer record. However, the diagram had no temperature scale and the report did not indicate the source for this diagram.

The *SAR* stated that ‘recent studies have re-evaluated the interval commonly known as the Medieval Warm Period to assess the magnitude and geographical extent of any prolonged warm interval’ (IPCC 1996, p. 174). Noting that studies showed regional variations (IPCC 1996, p. 175), the IPCC concluded that ‘mid-late 20th century surface temperatures appear to have been warmer than any similar period of at least the last 600 years’ and that ‘in at least some regions 20th century temperatures have been warmer than any other century for some thousands of years’ (IPCC 1996, p. 179). This was a significant shift from the 1990 report. Nevertheless, given that thermometer readings began during a cold period, questions about whether current warming was unprecedented on millennial timescales remained unanswered.

The ‘hockey stick’ climate reconstruction by Mann, Bradley and Hughes

Two ground-breaking papers by Michael Mann, Raymond Bradley and Malcolm Hughes (1998, 1999) published in *Nature* and *Geophysical Research Letters* respectively were an attempt to reconstruct temperatures based on a large range of proxy data. The initial paper was a global reconstruction for the last six centuries and the latter was a northern hemisphere reconstruction for the last millennium. The reconstructions produced by Mann and his colleagues depicted slightly cooling temperatures over several centuries with little natural variation (the proxy record), followed by sharply rising temperatures in the last few decades of the 20th century (the instrumental record). This became known as the ‘hockey stick’ reconstruction of climate: the handle was the long period of relatively flat temperatures, and the blade was the sudden rise in 20th century temperatures. Figure 8 (next page) shows the ‘hockey stick’ as it was represented in Mann et al (1999). The shaded area shows the error limits.

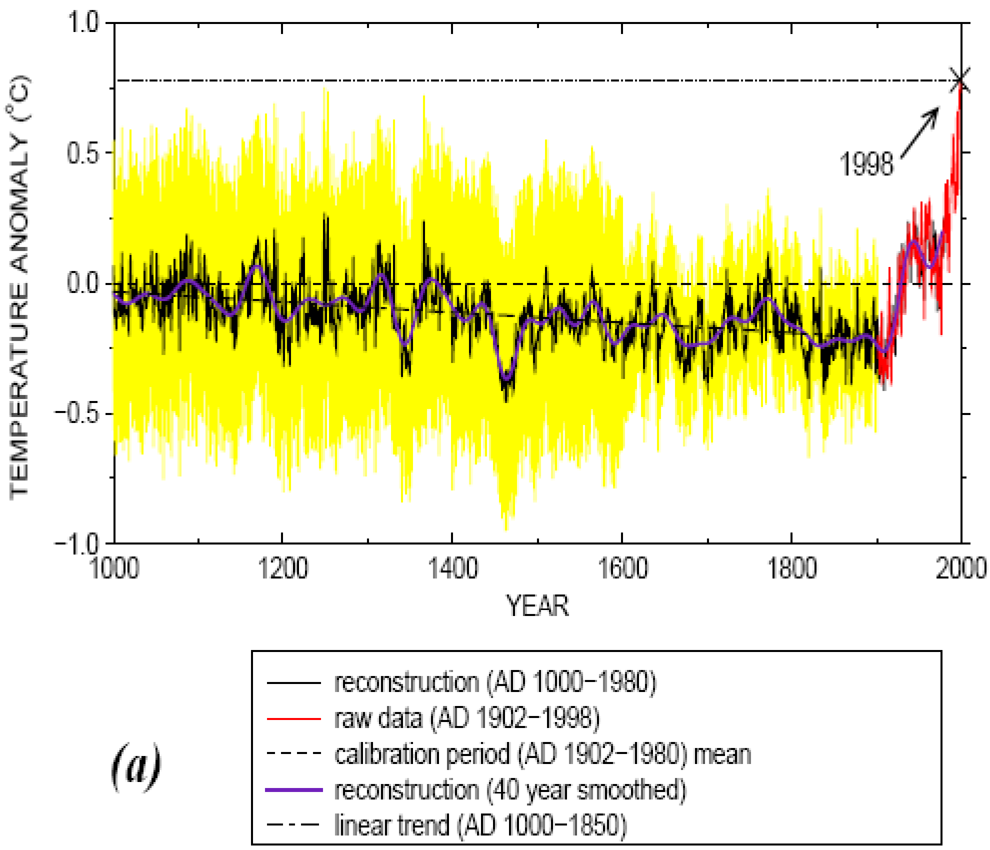

Figure 8: The 'hockey stick' millennial temperature reconstruction AD 1000-1998. Two standard error limits (shaded) are also shown. Source: Mann et al. 1999, fig. 3a.

Mann et al (1998) made some initial claims about unusual warmth during the 1980s compared to any period since 1400AD. Mann et al (1999) made some bold claims, but it did contain caveats about levels of uncertainty prior to 1400: indeed the paper was titled 'Northern hemisphere temperatures during the past millennium: inferences, uncertainties, and limitations'. Nevertheless, 'notwithstanding certain caveats' Mann et al (1999, p. 6) expressed their conclusions at moderately high levels of confidence:

> While warmth early in the millennium approaches mean 20th century levels, the late 20th century still appears anomalous: the 1990s are likely the warmest decade, and 1998 the warmest year, in at least a millennium.

Jones et al 1998 and Briffa 2000

The papers by Mann were not the only climate reconstructions undertaken at that time. Phil Jones from the Climatic Research Unit (CRU) at the University of East Anglia led a team that also reconstructed temperatures for the last millennium. Phil Jones, Keith Briffa, Tim Barnett and Simon Tett (1998, p. 469) also found 'the twentieth century is the warmest of the millenium'. However, Jones et al (1998, p. 463) showed evidence of medieval warmth that did not superimpose a thermometer record with a dramatic uplift in 20th century temperatures. Indeed, the proxy data showed current temperatures only slightly warmer than those of 1000 years ago. Despite reaching similar conclusions to Mann et al (1999), the visual image (figure 9) produced by Jones and colleagues was markedly different.

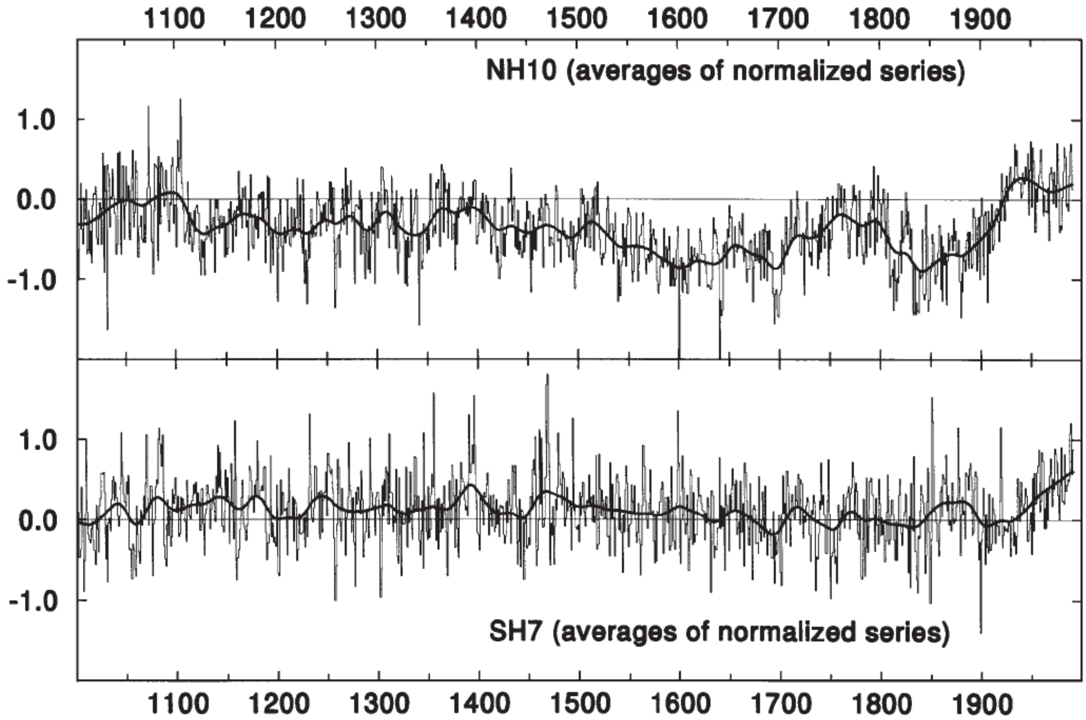

Figure 9: Averages of the reconstructions in the northern and southern hemispheres. Source: Jones et al 1998, p. 463, fig. 4.

Another paper at this time by Keith Briffa (2000, p. 96) pointed out an apparent divergence between the thermometer record after 1950 and tree ring density in certain tree ring

chronologies in the northern boreal forests of eastern North America and eastern Eurasia.[103] This was shown in his temperature reconstruction (figure 10). At the same time, Briffa (2000, p. 101) observed that some tree ring chronologies display anomalous 20th century growth and that this is 'being used to assemble a case for anomalous global warming, interpreted by many as evidence of anthropogenic activity'. However, back then, Briffa (2000, p. 101) advised that 'while this may prove to be a valid interpretation of the data, some caution is still warranted at this time'.

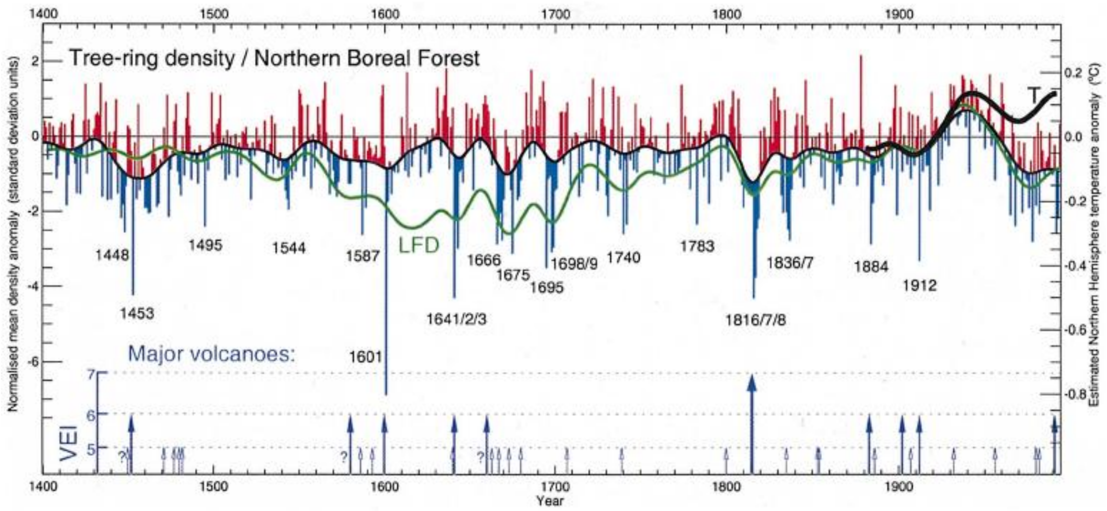

Figure 10: Tree-ring density / Northern Boreal Forest showing the recent disparity in density and measured temperatures (T). Source: Briffa 2000, p. 96, fig. 5

IPCC Third Assessment Report (TAR) and the 'Hockey Stick'

'Observed Climate Variability and Change', chapter 2 of the IPCC *TAR Working Group 1* covered paleoclimate science. There were two coordinating lead authors on chapter 2, Chris Folland of the UK Hadley Meteorological Office and Thomas Karl, director of the US National Climatic Data Center, eight lead authors including Michael Mann, and over 130 contributing authors.

At the time of the drafting of the IPCC *TAR*, there were different pictures of temperature variations over the last millennium: the Mann et al (1998, 1999) 'hockey stick'

[103] This discrepancy had been discussed previously and although the causes are unknown, the discrepancy may introduce bias into the reconstructions, potentially leading to an overestimation of previous temperatures (Briffa et al 1998, p. 681).

reconstructions, the Jones et al (1998) reconstruction that showed warmer 20th century temperatures but still included some warmth in the Medieval period, and the Briffa (2000) reconstruction with the tree density and temperature divergence in the second half of the 20th century.

Some of the 'Climategate' emails have revealed to a wider audience that the treatment of the various climate reconstructions were the subject of debate between some climate scientists in the lead-up to the IPCC *TAR*.[104] It is difficult to draw conclusions based on the contents of selected private emails. However, two aspects of the reconstructions appeared to cause particular anxiety.

The first area of contention was about whether the Mann et al reconstruction should receive prominence over the others. On 22nd September, Chris Folland (1999) sent an email out to the scientists contributing to chapter 2 stating that:

> A proxy diagram for temperature change is a clear favourite for the Policy Makers summary.[105] But the current diagram with the tree ring only data somewhat contradicts the multiproxy curve and dilutes the message rather significantly. We want the truth. Mike [Mann] thinks it lies nearer his result.

This statement contains several implicit assumptions: that the truth about a correct reconstruction could be discerned at that time, and that the most 'truthful' reconstruction would align with prior expectations and reinforce the picture of unusual recent warming.

Keith Briffa (1999), a senior paleoclimate scientist and tree ring specialist at the CRU emailed a reply that outlined concerns about how the paleoclimate reconstructions would be dealt with in the report. Briffa pointed to the difficulties in discerning what represents 'truth' at this stage, problems with the reliability of proxy indicators, and issues in calibrating the data. Briffa appeared keen to ensure that all the evidence was presented as it likely all contributed to a fuller understanding than one reconstruction alone. Briffa stressed 'that it should not be taken as read that Mike's series (or Jones's et al. for that matter) is THE

[104] The 'Climategate' emails are available from: East Anglia Confirmed Emails from the Climate Research Unit – Searchable (2011). All email correspondence is referenced to the author, and the text of relevant email exchanges is provided in appendix 1, pp. 367-377.
[105] Many emails contain typographical errors. For ease of reading in this chapter, I correct these errors but do not note them. The original text with errors is reproduced in appendix 1.

CORRECT ONE' (emphasis original). It is possible that the truth at that stage may have been that the evidence was still too messy to be confident of a clear message.

Briffa (1999) realised the dilemma facing climate scientists but argued that it would be best to acknowledge the full range of uncertainties and show any apparent data discrepancies:

> I know there is pressure to present a nice tidy story as regards 'apparent unprecedented warming in a thousand years or more in the proxy data' but in reality the situation is not quite so simple. We don't have a lot of proxies that come right up to date and those that do (at least a significant number of tree proxies) [show] some unexpected changes in response that do not match the recent warming. I do not think it wise that this issue be ignored in the chapter.
>
> For the record, I do believe that the proxy data do show unusually warm conditions in recent decades. I am not sure that this unusual warming is so clear in the summer responsive data. I believe that the recent warmth was probably matched about 1000 years ago. I do not believe that global mean annual temperatures have simply cooled progressively over thousands of years as Mike appears to and I contend that that there is strong evidence for major changes in climate over the Holocene (not Milankovich) that require explanation and that could represent part of the current or future background variability of our climate.

This exchange illustrates an important feature of scientific progress: scientific scepticism over evidence, uncertainties and conclusions. The scientific disagreement displayed in this email exchange is generally a healthy phenomenon because it indicates challenges to data and conclusions rather than mere acceptance of particular viewpoints. Part of the subsequent problem experienced by the IPCC appears to involve a decision to sideline some of the issues raised by Briffa in favour of presenting a clearer and more uniform perspective on the science.

When it was released, chapter 2 (IPCC 2001, p. 102) stated that:

> the 1990s are likely to have been the warmest decade of the millennium in the Northern Hemisphere and 1998 is likely to have been the warmest year.

The conclusions of Mann et al (1999) were therefore restated in the IPCC report. Furthermore, the Mann et al (1999) thousand-year 'hockey stick' reconstruction gained extra prominence in chapter 2 where it was featured as a separate graph (figure 11).

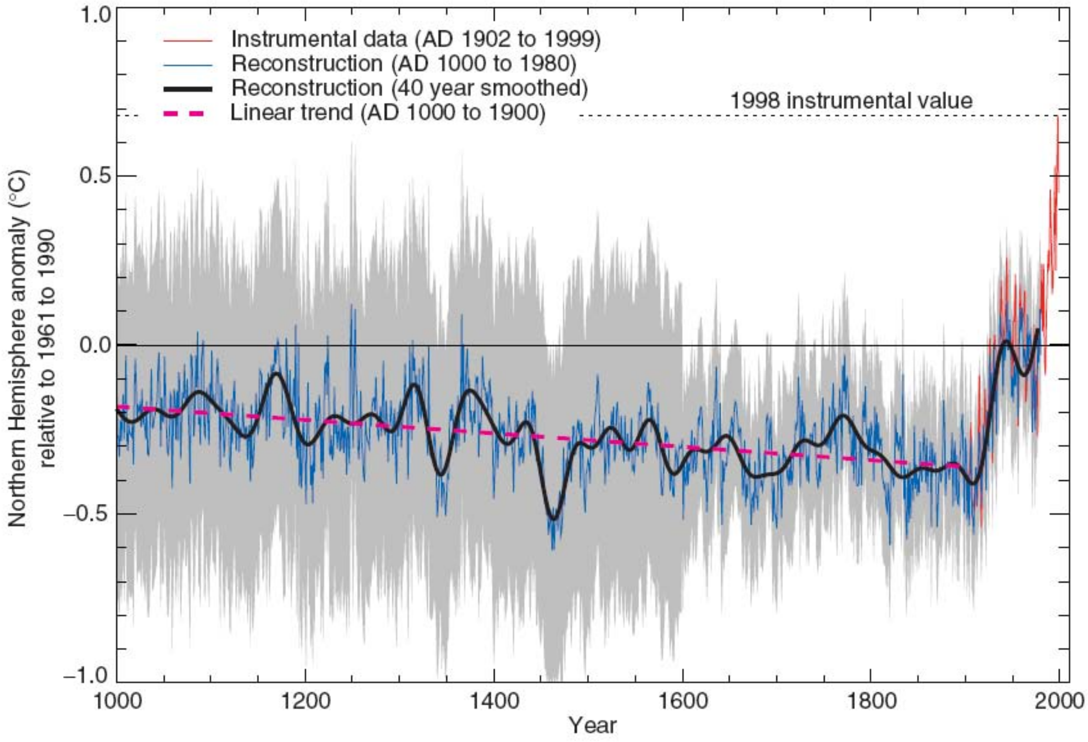

Figure 11: The 'hockey stick' millennial northern hemisphere temperature reconstruction (blue) and instrumental data (red) AD 1000 to 1999 as it appeared in the IPCC *TAR*. Two standard error limits (grey shaded) are shown. Source: IPCC 2001, p. 134, fig. 2.20.

It was followed by a composite graph that included the Mann et al (1998, 1999) reconstructions, the Jones et al (1998) reconstruction, the reconstruction by Briffa (2000), and the superimposed thermometer record. In chapter 2, senior scientists chose to highlight the Mann et al (1999) reconstruction over and above the others that were available at the time.

The second area of controversy revolved around the difficulties in reconciling the Briffa (2000) reconstruction with the picture of rapidly escalating late 20^{th} warmth shown by the instrumental data and depicted by Mann et al (1998, 1999). IPCC reports go through several draft and review processes. The zero-order draft is derived from the first lead author meeting. After internal review, the text is discussed at the second lead author meeting. Subsequent

drafts are then sent for extensive external review. According to Steve McIntyre (2009b), the Briffa reconstruction in the zero-order draft for the IPCC report showed much warmer temperatures than either the Mann et al reconstructions or the Jones et al reconstruction over the last 400 years. It also showed declining temperatures in the late 20th century. Figure 12 is from McIntyre's website and shows the 'problematic' Briffa reconstruction in yellow.

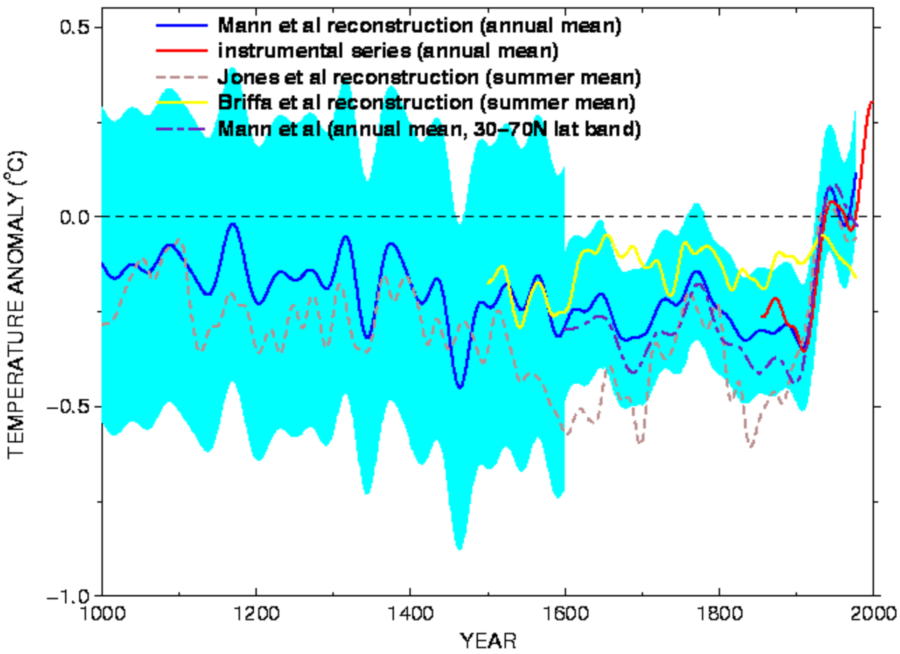

Figure 12: According to McIntyre, this is the IPCC *TAR* Zero Order Draft Comparison of millennial northern hemisphere temperature reconstructions from Briffa et al. 1998, Jones et al. 1998 and Mann et al. 1998, 1999. Source: McIntyre 2009b.

This Briffa reconstruction appeared to pose a dilemma for climate scientists, illustrated by an email sent by Michael Mann (1999) to Keith Briffa, Chris Folland, Phil Jones and Thomas Karl on 22nd September:

> This is the problem we all picked up on (everyone in the room at IPCC was in agreement that this was a problem and a potential distraction/detraction from the reasonably consensus viewpoint we'd like to show w/ the Jones et al and Mann et al series).
>
> So, if we show Keith's series in this plot, we have to comment that "something else" is responsible for the discrepancies in this case. Perhaps Keith can help us out a bit by explaining the processing that went into the series and the potential factors that might lead to

> it being "warmer" than the Jones et al and Mann et al series?? We would need to put in a few words in this regard. Otherwise, the skeptics will have a field day casting doubt on our ability to understand the factors that influence these estimates and, thus, can undermine faith in the paleoestimates. I don't think that doubt is scientifically justified, and I'd hate to be the one to have to give it fodder!

In effect, the Briffa reconstruction not only diverged from the instrumental record, but showed falling temperatures in the 20th century that directly contradicted the Mann et al (1998, 1999) reconstructions where the proxy data indicated sharply rising temperatures in the 20th century. According to Mann, this would create unjustified and unnecessary doubt about paleoclimate science.

McIntyre (2009b) observes that the Briffa reconstruction in the IPCC report was changed in important ways. Firstly, by the time of the final report, the Briffa reconstruction was aligned much closer to the other reconstructions (McIntyre 2009b). Secondly the Briffa plot in the final IPCC report differed from the original graph published in *Quaternary Science Reviews*. The original showed the widely discussed divergence, but the IPCC version (shown in figure 13, next page) was truncated around 1960 and did not show the period of greatest divergence when some of the proxy indicators suggested falling temperatures. Indeed, McIntyre (2009b) points out that the truncation occurred at the point where the Briffa plot disappeared at the point where several lines converged, and therefore the truncation is not clearly visible unless the zoom function on a computer screen is used. Moreover, McIntyre (2009b) notes that although the divergence issue had been discussed in the scientific literature, the IPCC did not mention the divergence problem.

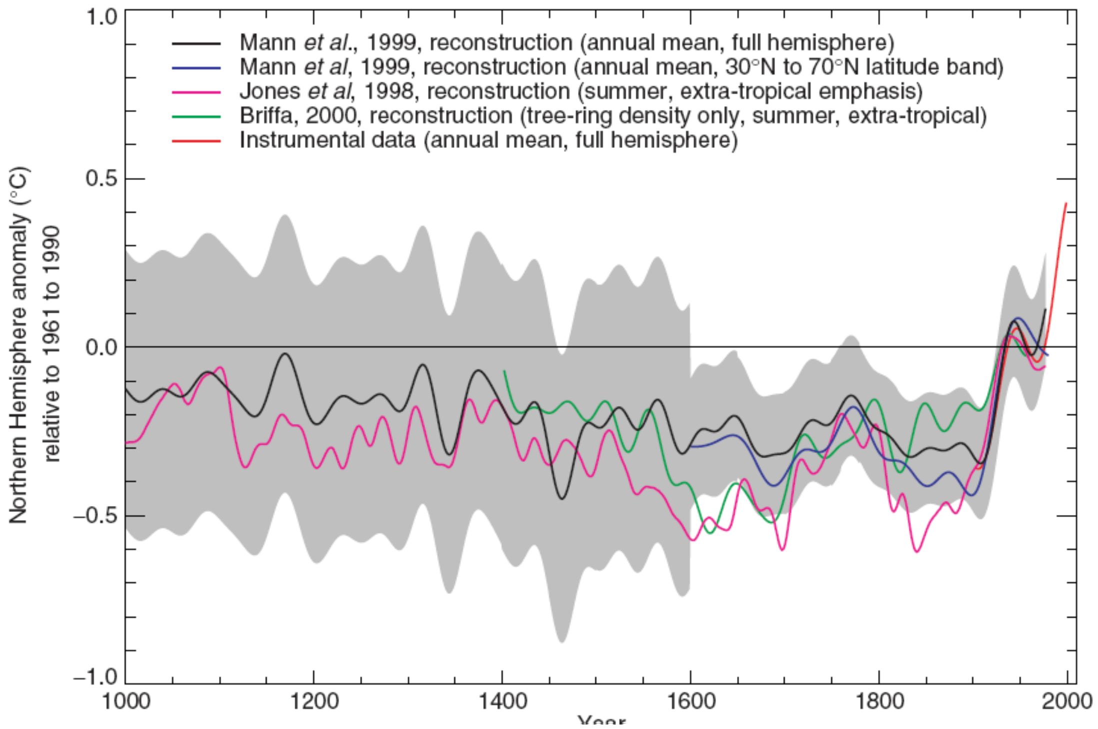

Figure 13: The comparison of Jones et al. 1998, Mann et al. 1998, 1999 and Briffa 2000 millennial northern hemisphere temperature reconstructions with recent instrumental annual mean northern hemisphere temperature record to 1999 as it appeared in the IPCC *TAR*. Source IPCC 2001, p. 134, fig. 2.21

The ‘hockey stick’ may have remained as one more piece of scientific evidence that pointed towards human influence on climate, either to be replicated or dismissed by further scientific inquiry. However, the prominence accorded to the Mann et al reconstruction was not restricted to its pre-eminent position in chapter 2 of *Working Group 1*. The ‘hockey stick’ appeared in the *Synthesis Report* (2001, p. 34, fig. 9-1b) and in the all-important Summary for Policymakers (IPCC 2001, p. 3, fig. 1). Furthermore, the IPCC adopted the ‘hockey stick’ as the official icon of man-made global warming. Figure 14 (next page) shows Sir John Houghton, chair of the IPCC, pictured at the IPCC press conference in Shanghai in front of a large ‘hockey stick’ graph.

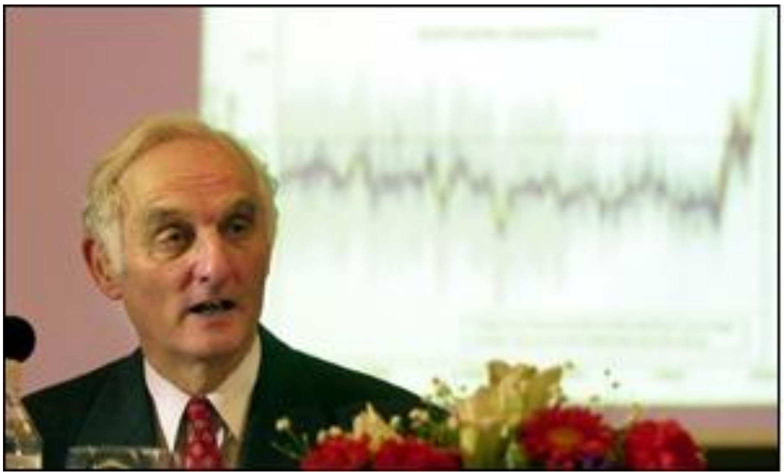

Figure 14: Sir John Houghton, co-chair of the IPCC Working Group 1, pictured in front of the 'hockey stick' graph at the IPCC press conference in Shanghai. Source: BBC News 2001.

The IPCC used the 'hockey stick' as a visual representation of its contention that current temperatures, attributed to human-induced warming, were unprecedented in the last millennium. The reconstruction has played a prominent part in the climate change debate, in part because senior IPCC scientists deliberately placed the 'hockey stick' at the centre of the debate because it conveyed complex scientific evidence in a clear and highly visible way.

The McIntyre and McKitrick critique

The main challenge to the 'hockey stick' has come from outside the scientific community. Steve McIntyre, a semi-retired mining executive from Toronto in Canada, became interested in the 'hockey stick' following its use by the Canadian government as part of a nationwide educational campaign. McIntyre was sceptical of the claims about unprecedented 20th century warming and decided to investigate further (Montford 2010a, pp. 57-59). McIntyre soon joined forces with economist Ross McKitrick, a prominent Canadian climate sceptic associated with the Fraser Institute, a think tank that has denied climate change. A detailed story of McIntyre's investigation is presented by climate sceptic Andrew Montford (2010a) in his book, *The Hockey Stick Illusion*.

The challenge by McIntyre and McKitrick was first published in a peer-reviewed social science journal *Energy and Environment*. Its editor Sonja Boehmer-Christiansen was a climate sceptic and critic of the Kyoto protocol, and had a deliberate policy of publishing

pieces critical of climate science (Boehmer-Christiansen in Barley 2011). Although McIntyre and McKitrick (2003, 2005a) did rely on *Energy and Environment* to publish their two longer papers, they did secure three short pieces in the peer-reviewed scientific journal *Geophysical Research Letters* (McIntyre and McKitrick 2005b, 2005c, 2005d). Most of the following section relies predominantly on the second paper in *Energy and Environment* (McIntyre and McKitrick 2005a) because it is a more detailed paper written after the authors had discovered more of the underlying code that Mann had used to process the data.

McIntyre and McKitrick (2005a) challenge the statistical methods used by Mann et al. They point out that Mann et al did not carry out a conventional principal component (PC) calculation. Instead Mann et al modified the PC algorithm by subtracting the 1902-1980 mean rather than the mean for the entire series from 1400-1980 prior to the PC calculations. According to McIntyre and McKitrick (2005a, p. 72; 2005b, p. 1), this approach de-centred the series and re-allocated variance, meaning that the uncentred Mann et al algorithm strongly overweighted hockey stick-shaped proxies and then mined the data for ‘hockey sticks’.[106]

McIntyre and McKitrick (2005a) also raise problems with the bristlecone pines used by Mann et al as proxy data for temperature records. Bristlecone pines are very long-lived with the oldest trees exhibiting a strip-bark form where the bark dies around the circumference apart from a small strip at one side. Bristlecone pines have shown a growth spurt in the 20th century that appears greater than can be explained by temperature increases alone. One possible explanation may be CO_2 fertilisation, particularly of strip-bark bristlecones (Graybill and Idso 1993). Donald Graybill’s co-author, Sherwood Idso, was a prominent climate sceptic specifically interested in the CO_2 fertilization hypothesis. The vast majority of tree rings collected by Graybill and Idso were the strip-bark variety of bristlecone. It was this series that featured prominently in the Mann et al reconstruction. According to McIntyre and McKitrick, using bristlecones as a temperature proxy, particularly the strip-bark variety, raises reliability problems and risks introducing bias into the analysis. McIntyre and McKitrick (2005a, p. 81) point out that because there were very few proxy series that dated back 1000 years, the bristlecone pine sites dominated the Mann et al network and the first PC simply because of their longevity.

[106] McIntyre and McKitrick (2005a, p. 89) define a hockey stick as a series in which the 1902-1980 mean differs from the long-term mean by more than one standard deviation.

McIntyre and McKitrick (2005a, pp. 75-76) claim that the inclusion or exclusion of just one tree series dramatically alters the results: they found that if the PC is de-centered as in the original Mann et al analysis, but the bristlecone sites are excluded, the 'hockey stick' showing rapid 20th century warming disappears. Furthermore, according to McIntyre and McKitrick (2005a, p. 75, p. 93), Mann actually carried out a sensitivity analysis on the effect of excluding the bristlecone sites, but did not report the adverse findings or state them publicly. McIntyre found these results on Mann's FTP (file transfer protocol) site in a file marked BACKTO_1400-CENSORED. By contrast, McIntyre and McKitrick (2005a, p. 89) also state that if centred PC is used, then the results are 'relatively insensitive' to the inclusion/exclusion of the north American PC1 (bristlecone pine series). In essence, McIntyre and McKitrick (2005a, p. 78) assert that the Mann et al temperature reconstruction for the 15th century is highly sensitive to slight variations of method and data.

McIntyre and McKitrick (2005a, pp. 70, 91) also note that Mann has refused to release his source code and has not provided the verification statistics for measures other than RE (reduction of error). They contend that normally 'a suite of verification statistics' is used in dendroclimatic reconstructions including r^2, and that Mann and Jones (2003) in fact reported r^2 when it validated the reconstruction (McIntyre and McKitrick 2005a, p. 91). The implication is that r^2 is not reported for Mann et al because it fails statistical verification tests, and would invalidate the reconstruction.[107]

The response from the 'hockey team'

Proponents of the 'hockey stick' have tried to rebut the arguments of McIntyre and McKitrick in the peer-review literature, but much of the dispute has also been conducted on two websites and their respective blogs, RealClimate (run by climate scientists including Michael Mann, Gavin Schmidt, Ray Bradley and Caspar Ammann) and Climate Audit run by Steve McIntyre. The peer-review response is considered in the next section. The web responses are dealt with in the later section on blog exchanges between Gavin Schmidt and Judith Curry.

[107] McIntyre and McKitrick (2005a, pp. 91-92) also claim that the multi-author network in paleoclimate studies mean that there is no effective independent confirmation of paleoclimate reconstructions. These issues are covered in greater detail by Montford (2010).

The Wahl and Ammann critique

Eugene Wahl and Caspar Ammann (2007, p. 36) address the two principal criticisms made by McIntyre and McKitrick: the use of contaminated proxy records, in particular the bristlecone pine series in NOAMER (North American) PC1, and second, the methods used to generate the PC summaries. In addition, Wahl and Ammann (2007, pp. 37-38) also address validation measures including the choice of validation statistics and appropriate thresholds for significance. The choice of validation statistics is crucial and is addressed first here because it informs the rest of the analysis.

Wahl and Ammann (2007) provides a justification for the choice of RE as a validation statistic. RE is widely accepted in the geosciences and is valued because it is useful in identifying when a reconstruction has skill in low frequency centennial timescales. This is the period of most interest in paleoclimate reconstructions because it allows comparison of, for example, the 20th century with previous centuries. By contrast, r^2 measures high frequency interannual variations, which are of less interest. Wahl and Ammann were concerned with a statistic that displayed climatological skill in the area of interest. Accordingly, Wahl and Ammann (2007, p. 39, emphases original) aimed to arrive at:

> an explicit balance *of jointly* reducing the likelihood of false positive and false negative errors. *A false positive error* occurs when a reconstruction is accepted as being of useful quality, but which in fact is of poor quality … A *false negative error* occurs when a reconstruction is rejected as of poor quality, but which in fact is of useful quality.

A long term low frequency span is defined by Wahl and Ammann (2007, p. 40) as the verification period: about 50 years. Wahl and Ammann (2007, p. 40) chose to ‘focus on low and high frequency fidelity in the calibration period, but only low frequency fidelity between reconstructions and data’ in the validation period because of the large downward shift in mean temperatures. This meant that even if the reconstruction performed poorly on inter-annual variations, it would be considered useful.

By contrast, McIntyre and McKitrick (2005a, 2005b) insist that the reconstruction must pass both high and low frequency tests in the validation period and argue that r^2 and CE should be used as measures for this task. Wahl and Ammann (2007, p. 40) consider that using r^2 and CE

introduces an unbalanced assessment that risks excluding valuable data: a false negative. Accordingly, Wahl and Ammann (2007, p. 41):

> specifically avoid interannual-oriented statistical measures that cannot recognize successful reproduction of differences in mean between the calibration and verification periods (such as Pearson's r [r^2], the sign test, and CE).

Wahl and Ammann therefore argue that the inappropriate use of verification statistics such as r^2 can lead to the inclusion of reconstructions that contain information with little or no climatological value, and conversely the exclusion of reconstructions that have much climatological value.

Wahl and Ammann ran a series of tests that replicated the Mann et al methods, plus a series that also addressed the McIntyre and McKitrick criticisms by rejecting various proxy sets and avoiding the PC analysis. The PC analysis in Mann et al was used to summarize all the data. Wahl and Ammann (2007, p. 74) avoided the contested PC step and instead included all the relevant information from the proxy data. This confirmed that although the short centring calculation in the PC analysis used by Mann et al did introduce a systematic bias into the results, it was not significant. The all-proxy scenario was very similar to the original Mann et al and showed good skill, indicating that the results were robust when the PC analysis was omitted.

Nevertheless, skill is a contested term. In a discussion on his blog, McIntyre (2007) argues that the term skill is used differently by meteorologists and statisticians. For example, the American Meteorological Society (2000) defines skill as 'a statistical evaluation of the accuracy of forecasts or the effectiveness of detection techniques'. By contrast, Wegman (in McIntyre 2007) argues that skill is not a term used by statisticians.[108] Furthermore, retired meteorologist and climate sceptic, Henk Tennekes, (in McIntyre 2007) claims that the:

> quest for an objective and universally valid metric for measurement of skill is unlikely to succeed. Skill, however defined, is ultimately a qualitative judgement, not a quantitative one. More precisely, it is a judgement, not a calculation.

[108] A statistical investigation of the 'hockey stick' by Wegman is covered in the following section, pp. 210-212.

The different ‘languages’ and meanings used in different disciplines is therefore another factor compounding the difficulties in coming to an objective and universal assessment of data measurement and evaluation. The conflict over the meaning of terms also provides ample scope for dissident voices to put forward contrary assessments.

Wahl and Ammann (2007, p. 51) also found that ‘the number of PCs required to summarize the underlying proxy data changes depend[s] on the approach taken’. Enough PCs must be used to capture the relevant information in the proxy data, and similar results are produced irrespective of the ordering of PCs or centring convention. Standardised data requires two PCs, but unstandardised requires four PCs. In a short and accessible paper available on the web, Schmidt and Ammann (2005, p. 3) refer to the Preisendorfer N-rule as the rule for appropriate selection of PCs in order to capture the significant variability in the data but exclude PCs that are not contributing any further significant information.

The original paper by McIntyre and McKitrick (2003, pp. 765-66) produced a climate reconstruction which they argue replicated the Mann et al methods but used what they referred to as ‘corrected and updated data’. The McIntyre and McKitrick version showed temperatures in the 1400s and 1500s that were significantly higher than the 20th century. Wahl and Ammann (2007, p. 52, emphasis original) reproduced this version, but found that it ‘*indirectly*’ omitted significant proxy information (the bristlecone/foxtail pines in PC4). Furthermore, they point out that it failed RE validation tests for both verification and calibration. According to Wahl and Ammann (2007, p. 48, emphasis original), the failed RE verification test means the McIntyre and McKitrick ‘corrected’ version ‘*does not have climatological meaning*’.

Wahl and Ammann also did reconstructions that excluded various contested proxy series including the bristlecone pine series, the Gaspe series and the Twisted Tree/Heartrot Hill. Omitting the bristlecone pines produced fractionally higher temperatures in the 1400s, but the verification statistics were very poor. According to Wahl and Ammann (2007, p. 49, emphasis original) this ‘suggests that bristlecone/foxtail pine record *do* possess meaningful climate information’. This implies the all-proxy record is more meaningful than a record that excludes bristlecone pines, but even so, it does not appear to make a material difference to the reconstructed temperatures in the 15th century.

Wahl and Ammann (2007, p. 53) therefore argue that:

> in general, the bristlecone/foxtail pine records do not introduce spurious information and their inclusion is justifiable; or said more strongly, their elimination is not objectively justifiable. Their inclusion by standardization of the individual proxy records (independent of the centering convention) or, even if non-standardized series are applied, by using at least four PCs (until the resulting climate reconstructions converge), leads to reconstruction models that demonstrate skill in both calibration and independent verification.

Wahl and Ammann (2007, p. 54, emphasis original) also point out that the 'hockey stick' is present in the data and is not a result of statistical malpractice:

> *Thus, it is the information content of the proxies themselves that drives the shape of the MBH [Mann et al] reconstruction, not methodological issues concerning PC summarization of the proxy series.* This conclusion is robust to several forms of assessment.

Wahl and Ammann (2007, p. 55) conclude that:

> Overall, the primary outcome from our results is that the work reported in MM [McIntyre and McKitrick]03, MM05a, and MM05b does not provide substantive reason to invalidate the general conclusion of anomalous warmth in the later 20th century derived from the MBH [Mann et al] reconstruction method and proxy data framework. We find that this result is neither an artifact of selection of the proxy series nor the result of formation or application of PC summaries in the reconstruction procedure.

One of the key aspects of the dispute between Mann et al and McIntyre and McKitrick revolves around the verification statistics. In the following section, I show that Wegman concludes that the statistics used by Mann et al were wrong and that the analysis by Wahl and Ammann is irrelevant to the dispute. Yet Wahl and Ammann received expert statistical advice from Doug Nychka, head of climatological statistics at the National Center for Atmospheric Research (NCAR). If the statistical methods and verification measures that paleoclimatologists are using are appropriate for purpose, then it would seem to nullify one of the key criticisms of McIntyre and McKitrick. Indeed, it would suggest that the methods used by McIntyre and McKitrick are themselves without merit in a climate reconstruction designed to gauge centennial scale temperature variations.

Investigations of the 'Hockey Stick'

Two official investigations of the 'hockey stick' controversy occurred during a similar timeframe in the US. The first investigation was instigated by Republican representative Joe Barton, Chairman of the US House Committee on Energy and Commerce. According to Eric Pooley (2010, p. 333),[109] Barton is 'a hardline climate sceptic'. Barton (2005) began by sending a letter to Mann, Bradley and Hughes requesting details on data, computer code, funding and past research associations. The letters provoked a strong response from Sherward Boehlert, the Republican Chairman of the US House Committee on Science. Boehlert (2005) accused Barton of unnecessary, unjustified and unprecedented interference that raised the spectre of political intimidation being directed towards scientists that produced unwelcome research.

Ralph Cicerone (2005), President of the National Academy of Sciences (NAS) also sent a letter to Barton expressing concern about Barton's methods and its potential for intimidation. Cicerone offered the services of the NAS to conduct an expert scientific review:

> the National Academy of Sciences would be willing to create an independent expert panel (according to our rigorous study process) to assess the state of scientific knowledge in this area.

However, Barton did not accept the offer by the NAS (Colglazier in Thacker 2005) and proceeded with his own investigation. This resulted in the production of a report by a panel led by Dr. Edward Wegman and culminated in Energy and Commerce committee hearings in July 2006.

The Wegman Report

There is little documentation about the background and briefings for the *Wegman Report*. According to the *Wegman Report* (2006, pp. 1, 7) itself, Wegman agreed to a request by Barton to assemble a team to assess the 'hockey stick' data. The committee organized itself on a pro bono basis. Wegman was a statistics professor at George Mason University and chair

[109] Pooley is deputy editor of *Bloomberg BusinessWeek*, former managing editor of *Fortune*, editor of *Time Europe* and national editor and White House correspondent of *Time*.

of the National Academy of Sciences' (NAS) Committee on Applied and Theoretical statistics. The panel included two other statisticians, David W. Scott, and Yasmin Said, a former PhD student of Wegman. The panel was presented as an independent investigation of the dispute.

In general, the *Wegman Report* was critical of Mann and supportive of McIntyre and McKitrick. Wegman (2006, p. 48) found the work of Mann et al 'to be somewhat obscure and incomplete' and the criticisms by McIntyre and McKitrick 'to be valid and their arguments compelling'. The report found that the PC analysis was misused and incorrect (Wegman 2006, pp. 28-29). Wegman (2006, p. 81) also summarises the critique of McIntyre and Mckitrick and notes that the lack of significance for the CE and r^2 statistics refutes the conclusions drawn by Mann et al. Furthermore, Wegman (2006, p. 51) was 'especially struck' by Mann's unwillingness to disclose his data and methodology. He also notes (2006, p. 51) that 'the public policy implications of this debate are financially staggering and yet apparently no independent statistical expertise was sought or used'.

Wegman also did some form of social analysis on the paleoclimate community. He found the paleoclimatic social and co-authoring network was so close and inter-connected that the peer-review process lacked independence and could lead to the propagation of errors. Moreover, Wegman (2006, p. 4) remarked that 'the work has been sufficiently politicized that this community can hardly reassess their public positions without losing credibility'. This criticism presumably refers to the dangers of the 'hockey stick' being highlighted above other reconstructions by the IPCC. Wegman (2006, p. 51) also recommended that authors of academic papers such as Mann should not author IPCC documents. However, this recommendation runs up against the fact that small groups of scientific authors are often precisely the most relevant and authoritative experts in highly specialised fields.

Wegman (2006, p. 27) also asserted that 'the work begun by Mann and his colleagues is still in its infancy' and that it is therefore unlikely that 'definitive conclusions can be made about the earth's climate over the past millenium'. Furthermore, Wegman (2006, p. 48, footnote 8) dismisses the Wahl and Ammann critique of McIntyre and McKitrick (2005a, 2005b) as missing the point because McIntyre and McKitrick were not trying to do a paleoclimate reconstruction.

Finally, Wegman (2006, p. 5) concluded that:

> Mann's assessments that the decade of the 1990s was the hottest decade of the millennium and that 1998 was the hottest year of the millennium cannot be supported by his analysis.

In essence, the *Wegman Report* was a refutation of the Mann et al 'hockey stick' reconstruction. Wegman found the centering method used in the PC analysis was wrong, and that the reconstruction was overly reliant on the RE verification statistic. Consequently, Mann et al lacked the evidence to support their conclusion. Wegman also made further comments on the lack of disclosure, an alleged lack of independence within the paleoclimate community, and noted a potential conflict of interest when scientific authors were lead authors on IPCC documents.

The National Academy of Sciences report

The second investigation into surface temperature reconstructions was produced by the NAS at the request of Boehlert. Chaired by Gerald North, it comprised an ad hoc cross section of scientists including some with statistical expertise, but none with specific knowledge of paleoclimatology. The report was subject to rigorous review. Prior to its release in March 2006, the draft was sent out for peer review, and the committee received 70 pages of single space criticisms which they were obliged to answer in full (North 2006).

The NAS devoted a chapter to validation statistics. The NAS (2006, p. 92) notes that 'the role of a validation period is to provide an independent assessment of the accuracy of the reconstruction method'. The NAS discussed common measures to assess the accuracy of statistical predictions including the mean squared error (MSE), reduction of error (RE), coefficient of efficiency (CE), and the squared correlation (r^2).

The NAS (2006, pp. 92-93, emphases original) provides an explanation of the different uses and values of different statistics:

> MSE is a measure of how close a set of predictions are to the actual values and is widely used throughout the geosciences and statistics. It is usually normalized and presented in the form of either the RE statistic (Fritts 1976) or the CE statistic (Cook et al. 1994). The RE statistic compares the MSE of the reconstruction to the MSE of a reconstruction that is constant in

> time with a value equivalent to the sample mean for the *calibration* data. If the reconstruction has any predictive value, one would expect it to do better than just the sample average over the calibration period; that is, one would expect RE to be greater than zero.
>
> The CE, on the other hand, compares the MSE to the performance of a reconstruction that is constant in time with a value equivalent to the sample mean for the *validation* data. This second constant reconstruction depends on the validation data, which are withheld from the calibration process, and therefore presents a more demanding comparison. In fact, CE will always be less than RE, and the difference increases as the difference between the sample means for the validation and the calibration periods increases.
>
> If the calibration has any predictive value, one would expect it to do better than just the sample average over the validation period and, for this reason, CE is a particularly useful measure. The squared correlation statistic, denoted as r^2 is usually adopted as a measure of association between two variables. Specifically, r^2 measures the strength of a linear relationship between two variables when the linear fit is determined by regression … However, r^2 measures how well some linear function of the predictions matches the data, not how well the predictions themselves perform. The coefficients in that linear function cannot be calculated without knowing the values being predicted, so it is not in itself a useful indication of merit. A high CE value, however, will always have a high r^2, and this is another justification for considering the CE.

The NAS (2006, pp. 94-95) notes that it is possible therefore that a reconstruction could correlate well with historical temperatures, but have no predictive skill. By contrast a reconstruction could have a high RE and low CE or r^2 because:

> the reconstruction identified the change in mean levels between the calibration and validation periods reasonably well but failed to track the variations within the validation period. One way that this discrepancy can occur is for the proxies and the temperatures to be related by a common trend in the calibration period. When the trend is large this can result in a high RE. If the validation period does not have as strong a trend and the proxies are not skillful at predicting shorter timescale fluctuations in temperature, then the CE can be substantially lower.

The NAS (2006, p. 95) notes that:

> Although some debate has focused on when a validation statistic, such as CE or RE, is significant, a more meaningful approach may be to concentrate on the implied prediction intervals for a given reconstruction. Even a low CE value may still provide prediction intervals that are useful for drawing particular scientific conclusions …
>
> Using CE to judge the merits of a reconstruction is known as cross-validation and is a common statistical technique for selecting among competing models and subsets of data. When the validation period is independent of the calibration period, cross-validation avoids many of the issues of overfitting if models were simply selected on the basis of RE.

The NAS (2006, p. 116) concludes that although the RE is a valuable statistic, a skilful CE performance would increase confidence in the reconstruction:

> The RE validation metric used by Mann et al. (1998, 1999) is a minimum requirement, but the committee questions whether any single statistic can provide a definitive indication of the uncertainty inherent in the reconstruction. Demonstrating performance for the higher-frequency component (e.g., by calculating the CE statistic) would increase confidence but still would not fully address the issue of evaluating the reconstruction's ability to capture temperature variations on decadal-to-centennial timescales.

This leads to an important general finding by the NAS (2006, p. 113) that the 'uncertainties of the published reconstructions have been underestimated'.

Another finding with relevance to the 'hockey stick' dispute concerned strip-bark bristlecone pines. McIntyre and McKitrick (2005a, p. 75-76) maintained that the 'hockey stick' in the Mann et al reconstructions disappeared when the bristlecone pine series was excluded. The NAS (2006, p. 52) stated that '"strip-bark" samples should be avoided for temperature reconstructions': a finding that could potentially invalidate the conclusions of Mann et al and several subsequent reconstructions that used them. However, this seemingly important conclusion and the implications that flowed from it did not appear in the summary at the front of the report.

In its summary, the NAS (2006, pp. 3-4) noted the value of temperature reconstructions and found that several subsequent reconstructions had produced similar findings:

> The basic conclusion of Mann et al. (1998, 1999) was that the late 20th century warmth in the Northern Hemisphere was unprecedented during at least the last 1,000 years. This conclusion has subsequently been supported by an array of evidence that includes both additional large-scale surface temperature reconstructions and pronounced changes in a variety of local proxy indicators, such as melting on ice caps and the retreat of glaciers around the world, which in many cases appear to be unprecedented during at least the last 2,000 years … Based on the analyses presented in the original papers by Mann et al. and this newer supporting evidence, the committee finds it plausible that the Northern Hemisphere was warmer during the last few decades of the 20th century than during any comparable period over the preceding millennium.

North (2006) clarified the vague language in a subsequent seminar in August 2006 by indicating that plausible means ‘reasonable’, that it is ‘impossible to bring a convincing argument against it’, but that the NAS were unwilling to put any numbers on their finding. Although the panel found it ‘plausible’ that current temperatures were warmer than the previous millennium, it expressed reservations about the conclusions drawn by Mann et al (1999):

> The substantial uncertainties currently present in the quantitative assessment of large-scale surface temperature changes prior to about A.D. 1600 lower our confidence in this conclusion compared to the high level of confidence we place in the Little Ice Age cooling and 20th century warming. Even less confidence can be placed in the original conclusions by Mann et al. (1999) that “the 1990s are likely the warmest decade, and 1998 the warmest year, in at least a millennium” because the uncertainties inherent in temperature reconstructions for individual years and decades are larger than those for longer time periods and because not all of the available proxies record temperature information on such short timescales.

This finding also means that there could be ‘even less confidence’ in those same conclusions as they were repeated in the IPCC TAR. Although the wording is ambiguous (presumably intentional), it appears the NAS were saying that the conclusions of Mann et al (1999) had been overstated. In effect, the NAS downgraded the confidence levels given in the IPCC report: the NAS placed no numerical confidence on recent warmth being higher than any

period in the previous millennium, whereas the IPCC (2001, p. 2) had regarded this as likely (66-90 per cent in numerical terms).

IPCC Fourth Assessment Report (AR4)

Chapter 6 of the IPCC *AR4 Working Group 1*dealt with paleoclimate. There were two coordinating lead authors, Eystein Jansen and Jonathon Overpeck and ten lead authors including Briffa but not Mann. McIntyre was a reviewer for chapter 6. One of the key findings relevant to the 'hockey stick' controversy was that recent paleoclimate studies had confirmed the original Mann et al conclusions:

> The TAR pointed to the 'exceptional warmth of the late 20th century, relative to the past 1,000 years'. Subsequent evidence has strengthened this conclusion. It is *very likely* that average Northern Hemisphere temperatures during the second half of the 20th century were higher than for any other 50-year period in the last 500 years. It is also *likely* that this 50-year period was the warmest Northern Hemisphere period in the last 1.3 kyr (IPCC 2007a, p. 436, emphases original).[110]

Compared to the TAR, the IPCC strengthened the conclusions for the last 500 years (similar to the NAS) and retained the same conclusions for the past millennium (somewhat stronger than the plausible conclusions of the NAS). It is notable that the IPCC *AR4* continued to express greater certainty about millennial temperature reconstructions prior to 1600 AD than the scientific assessment panel convened by the NAS.

The relevant graphs shown in figure 15 (next page) became known as the spaghetti graph. While they contained variations, they all exhibited rising temperatures through the 20th century.

[110] 1.3kyr means the last 1,300 years.

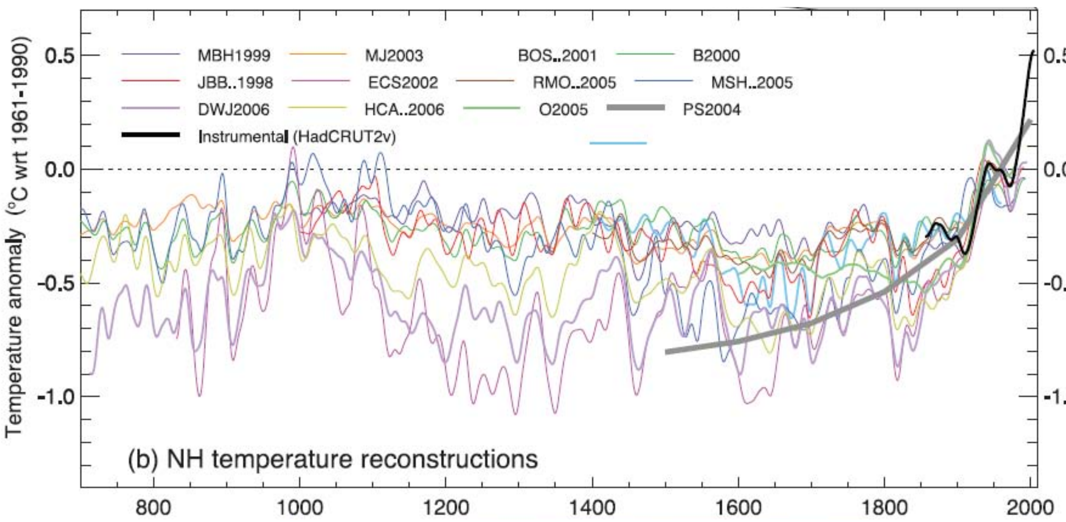

Figure 15: The spaghetti graph of northern hemisphere temperature reconstructions as it appeared in the IPCC *AR4*. Source: IPCC 2007, p. 467, fig. 6.10

Chapter 6 (IPCC 2007, p. 466) briefly mentioned the critique by McIntyre and McKitrick, but stated that Wahl and Ammann had addressed the key issues arising from their work.

Mann et al 2008 and the Tiljander sediment/no dendro controversy

The Mann et al (2008a) paper 'Proxy-based reconstructions of hemispheric and global surface temperature variations over the past two millennia' published in the *Proceedings of the National Academy of Sciences* (*PNAS*) was another controversial climate reconstruction. Its primary importance derived from the claim that it produced a 'hockey stick' without using tree ring proxies. Mann et al (2008a, p. 13252) state that:

> Recent warmth appears anomalous for at least the past 1,300 years whether or not tree-ring data are used.

The greater availability of other proxy data over the last decade meant Mann could obtain a reconstruction without using tree rings. This allowed Mann to sidestep criticism about bristlecone pines or other contentious dendroclimatic (tree ring) indicators.

Given that scientists had made the claim for anomalous warmth based on a reconstruction without tree rings, the other proxy data attracted close scrutiny. One of the proxy sets that attracted particular interest were four series of annually layered sediments (varve) collected and analysed by Mia Tiljander, Matti Saarnisto, Antti Ojala and Timo Saarinen from Lake

Korttajärvi in central Finland. The varve formed the basis of a 3000 year paleoenvironmental record for central Finland. Tiljander and colleagues were interested in natural climate variability during the Middle Ages, and the sediments were valuable because 'human disturbance on the Finnish lake ecosystem is a relatively recent event when compared to the more westerly and more southerly parts of Europe' (Tiljander et al 2003, pp. 566-567). However, Tiljander et al (2003, p. 572) noted that human impact in the catchment area had disrupted the record for the past 280 years, and therefore 'it is a demanding task to calibrate the physical varve data against meteorological data'.

In the original supplementary information, Mann et al (2008b, pp. 2, 13-14) acknowledged problems with the Tiljander sediments. Mann et al had performed two separate analyses: one without the tree rings, and another one without the Tiljander sediments or three other potentially problematic series. The comparison produced similar results.

In a letter to *PNAS*, McIntyre and McKitrick (2009) raise several issues including specific criticisms of the proxy data use by Mann et al (2008a). McIntyre and McKitrick state that the:

> non-dendro network uses some data with the axes upside down, e.g., Korttajarvi sediments, which are also compromised by agricultural impact.

In other words, McIntyre and McKitrick allege that Mann et al used sediments that were rendered unreliable by human impact, and moreover, Mann et al used them incorrectly. McIntyre and McKitrick also point out that Mann et al contravened specific advice from the NAS by including strip-bark bristlecones in the tree ring analysis.

In reply, Mann, Bradley and Hughes (2009a) dismissed the claim of incorrect data handling:

> The claim that ''upside down'' data were used is bizarre. Multivariate regression methods are insensitive to the sign of predictors.

In addition, Mann et al (2009a) state that problems with the Tiljander proxies were acknowledged in the supplementary information attached to the original paper:

> Potential nonclimatic influences on the Tiljander and other proxies were discussed in the SI [supplementary information], which showed that none of our central conclusions relied on their use.

The controversy and partial resolution of these three specific points of contention – use of stripbark bristlecones, use of some data upside down, and use of contaminated sediments – is discussed in the following sections as a means of illustrating how the debate has been conducted, and also because further issues arose about the validity of a Mann et al reconstruction that excluded both tree ring proxies and Tiljander sediments at the same time.

Critics claim the temperature signal in the bristlecone pine series is confounded by other factors and therefore the series is contaminated and unreliable and introduces bias into any reconstruction that uses them. Montford (2010a, pp. 357-360) claims that Linah Ababneh, a PhD student of Hughes (a member of the Mann et al team), did research on the bristlecone pine series originally sampled by Graybill and Idso. According to Montford, her updated series found no evidence of a growth spurt in the same trees that had exhibited large growth. Montford (2010a, pp. 354-357) also describes a series of tree rings obtained by McIntyre and Holzmann that apparently also failed to replicate any increase in tree ring size over the last two decades, again supposedly showing that tree rings are not capturing current warmth and contradicting the claim that current warmth may be anomalous. However, neither the findings of Ababneh or of McIntyre and Holzmann have been published in the peer-reviewed scientific literature.

By contrast, recent findings of anomalous growth in similar pine series have been published. Moreover, the published findings argue that the temperature signal is clearly detectable in these series and can be distinguished from other factors. Matthew Salzer, Malcolm Hughes, Andrew Bunn and Kurt Kipfmueller (2009, p. 20351) found no 'substantial difference in ring width between our strip-bark and whole-bark groups' and that the apparent contradiction between these results and those of Graybill and Idso (1993) is 'the result of the standardisation scheme they used'. Salzer et al (2009, p. 20351) argue that the NAS 'suggestion that strip-bark pines should be avoided during analysis of the last 150 years should be reevaluated'. This is an important finding, given that McIntyre and McKitrick use the NAS suggestion as a criticism of the Mann et al (2008a) reconstruction. Furthermore,

Salzer et al (2009, p. 20352) eliminate CO_2 fertilization and strip-barking as plausible explanations for the growth and conclude that 'upper forest border bristlecone pine ring widths have responded to temperature in the past and continue to do so'. These findings appear to rehabilitate the reliability of bristlecone pines as temperature proxies, and also indicate that they have a valuable role to play in temperature reconstructions. Consequently, supporters of the 'hockey stick' insist there is still valuable data contained within bristlecone pine series and there is no justification for discarding them.

The dispute over whether Mann et al handled the Tiljander proxies correctly is still unresolved in the peer-reviewed literature. However, a paper by Darrell Kaufmann et al (2009) also used the same Tiljander proxies. In a corrigendum published later, Kaufmann (2010) acknowledges criticisms of the paper and makes several adjustments. He thanks his critics and notes that the changes make the paper's conclusion stronger. Kaufman does not mention the Tiljander sediments in the corrigendum and instead refers interested readers to the draft revised supplementary information. However, McIntyre (2009a) points out that the revised information does refer to the Tiljander sediments, and that in effect, the corrigendum is an acknowledgment that Kaufman had used the Tiljander series upside down. McIntyre (2009a) also observes that McIntyre and McKitrick:

> pointed [out] Mann's upside down use of the data (with a worse impact than on Kaufman) in the correct channels. Mann denied it. Once the matter is pointed out, it's not rocket science to determine who was right, but *PNAS* took no steps to resolve the contradiction.

Furthermore, McIntyre (2009a) notes that bloggers at RealClimate have accepted Mann's position (that the upside-down accusation is bizarre) even though the same error was acknowledged and corrected by Kaufman.

Montford summarises the issues raised by McIntyre regarding the inclusion of the Tiljander sediments in a proxy reconstruction, and argues that the no dendro claim of Mann et al rests on a flawed argument. Montford (2010a, pp. 367-368) also implies the reconstruction is a con:

> It turned out that the twentieth century uptick in Tiljander's proxies was caused by artificial disturbance of the sediment caused by ditch digging rather than anything climatic. Mann had

> acknowledged this fact, but then, extraordinarily, rather than reject the series, he had purported to demonstrate that the disturbance didn't matter. The way he had done this was to perform a sensitivity analysis, showing that you still got a hockey stick without the Tiljander proxies.
>
> Great care is needed when reading scientific papers, particularly in the field of paleoclimate, and this was one of the occasions when one could have come away with an entirely wrong impression if the closest attention had not been paid. The big selling point of Mann's new paper was that you could get a hockey stick shape without tree rings. However, this claim turned out to rest on a circular argument. Mann had shown that the Tiljander proxies were valid by removing them from the database and showing that you still got a hockey stick. However, when he did this test, the hockey stick shape of the final reconstruction came from the bristlecones. Then he argued that he could remove the tree ring proxies (including the bristlecones) and still get a hockey stick – and of course he could, because in this case the hockey stick shape came from the Tiljander proxies. His arguments therefore rested on having two sets of flawed proxies in the database, but only removing one at a time. He could then argue that he still got a hockey stick either way. As McIntyre said, you had to watch the pea under the thimble.

To some extent, Montford's argument rests on the assertion that bristlecone pines are an unreliable temperature proxy: a claim disputed by Salzer et al (2009). The controversy over these claims and the issue of validation are discussed in the later section on the responses of observers to the 'hockey stick' dispute. First, however, I briefly cover the so-called 'Climategate' scandal and the investigations of it, because this affair has had a significant impact on the way that observers have viewed climate science and particular aspects of the 'hockey stick' controversy, and it appears to have motivated some climate scientists from outside the paleoclimate field to enter the 'hockey stick' dispute.

'Climategate'

The emails that were stolen, hacked or leaked from the Climate Research Unit (CRU) in November 2009 are partial and possibly intentionally selective. It is not my purpose to analyse the emails. 'Climategate' is relevant to this analysis insofar as many of the email correspondents are key players in the 'hockey stick' controversy, because the email disclosure has informed public perceptions of scientific behaviour, and because 'Climategate'

appears to have prompted certain non-paleoclimate scientists to move from observer status to active participants in the dispute.

Critics allege the emails revealed a deliberate and systematic attempt to manipulate data to reach pre-determined conclusions, exclude data that did not support current theories, prevent disclosure of adverse data and conceal adverse findings, control the peer-review process by rejecting critical papers sent out for review, intimidate journal editors into keeping the party line, and boycott peer-review publications with which they disagree. Furthermore, critics allege that the actions of certain climate scientists mean that scientific processes have been corrupted, and therefore scientists and even climate science in general, cannot be trusted. Finally, some critics allege that the whole of climate science is a fraud, held in place by an international conspiracy of scientists whose inner workings have been laid bare by the email scandal.

On the other hand, defenders of climate science point out that the emails demonstrate the normal working of science including disagreements between scientists over conclusions drawn from the data and the weight given to uncertainty, as well as a concern to present an accurate picture that is also consistent with what is already known. They also point out that many climate scientists have been under sustained attack for well over a decade based on unsubstantiated evidence and an ideological opposition to the 'inconvenient' and 'unwelcome' findings of climate scientists.

I give a brief synopsis of the various investigations into 'Climategate' because this helps clarify those aspects of the science that have been found to be accurate and credible and those aspects that may still be open to dispute. Three committees in the UK looked into different aspects of 'Climategate'. The first was an inquiry by the House of Commons Science and Technology committee that reported in March 2010. Two official investigations were commissioned by the University of East Anglia (UEA). The first, The Independent Climate Change E-mails Review chaired by Sir Muir Russell was instigated on 3rd December 2009. The second, a scientific assessment of the CRU science called The International Panel was announced on 11th February 2010 and was chaired by Lord Oxburgh. The Oxburgh Panel reported in April 2010 and The Independent Climate Change E-mails Review in July 2010.

House of Commons Science and Technology committee

The House of Commons Science and Technology committee focussed on the credibility of the CRU instrumental record and the actions of Phil Jones. Jones was head of the CRU and responsible for collating one of three global instrumental temperature records: the others are complied by GISS at NASA and by the National Climatic Data Center (NCDC) at the National Oceanic and Atmospheric Administration (NOAA). Jones, a leading paleoclimate scientist, is also a co-author alongside Michael Mann.

The committee noted that GISS and NCDC/NOAA in the U.S. used similar data but different methodologies and got similar temperature results. Furthermore, satellite data from the University of Alabama and the Remote Sensing Systems used different data to achieve similar results. The House of Commons Science and Technology Committee (2010, p. 17) therefore concluded that:

> there is independent verification, through the use of other methodologies and other sources of data, of the results and conclusions of the Climate Research Unit.

In other words, the results of the CRU regarding the instrumental temperature reconstructions were credible.

The Committee was critical of certain data disclosure practices at the CRU. For example, the Committee (2010, p. 32) found '*prima facie* evidence that CRU has breached the Freedom of Information Act 2000', but decided that the matter needed to be 'resolved conclusively' by subsequent investigations. But the key finding was the negative impact that scientific conduct such as non-disclosure of data could have on public attitudes in the climate change debate:

> Reputation does not, however, rest solely on the quality of work as it should. It also depends on perception. It is self-evident that the disclosure of CRU e-mails has damaged the reputation of UK climate science and, as views on global warming have become polarised, any deviation from the highest scientific standards will be pounced on. As we explained in chapter 2, the practices and methods of climate science are a key issue. If the practices of CRU are found to be in line with the rest of climate science, the question would arise whether climate science methods of operation need to change. In this event we would recommend that

> the scientific community should consider changing those practices to ensure greater transparency (The House of Commons Science and Technology Committee 2010, p. 34).

Therefore, although the committee confirmed the credibility of the global thermometer record, it did find that certain practices prevalent in the climate science community were counterproductive.

The International Panel: Lord Oxburgh

The International Panel produced a brief summary *Report*. The key conclusion was that the panel 'saw no evidence of any deliberate scientific malpractice in any of the work of the Climatic Research Unit'. Nevertheless there were criticisms. Firstly, like the *Wegman Report* four years previously, the panel found it 'very surprising that research… has not been carried out in close collaboration with professional statisticians' (Oxburgh 2010, p. 5). This implies that the findings of previous investigations had not been heeded. Secondly, the panel found that the IPCC, unlike the peer-reviewed literature, had occasionally failed to highlight underlying complexities in the data. This point is examined in more detail in the section on misrepresentation.

The Independent Climate Change E-mails Review: Sir Muir Russell

The Independent Climate Change E-mails Review answered many of the allegations arising from the email release. Muir Russell found that the data used by the CRU to reconstruct global instrumental temperatures was publicly available. Indeed, the panel accessed the data, wrote the relevant computer code themselves in two days, and performed a temperature reconstruction that matched that of the CRU (Russell 2010, pp. 45-49). Nevertheless, the review found the CRU was uncooperative in refusing to release data. The 'unhelpful and defensive' behaviour of the scientists (Russell 2010, p. 51) appears to have unnecessarily damaged public perceptions about the credibility of the temperature records. Still, despite finding 'a consistent pattern of failing to display the proper degree of openness', the review concluded that the 'rigour and honesty' of the CRU scientists is 'not in doubt' (Russell 2010, p. 11).

The *Russell Review* also addressed the peer-review process and found no evidence that either peer-review or editorial processes had been subverted by climate scientists (Russell 2010, p. 13). This issue is dealt with in more detail in the later section on cover-up. Criticisms of the review are covered in the section on official channels.

The response of observers

As an outside observer with no scientific or statistical expertise, I am unable to get to the bottom of the 'hockey stick' dispute. Even with the relevant expertise, it may not be possible to come to a clear or definitive assessment because the dispute also involves differences in values. This raises questions about how the dispute will be resolved.

Scientific controversies can be resolved in different ways. One outcome is that the side with the stronger epistemological authority carries the day. In the climate change debate, scientists and their scientific institutions would have the authority to ensure their consensus position was the dominant perspective. This authority has been minimally challenged in the high-ranking peer-reviewed scientific literature, although occasional papers have appeared in sympathetic peer-reviewed social-scientific journals such as *Energy and Environment*. Having been largely unable to penetrate the scientific journals, critics have instead published a stream of popular science books (e.g. Essex and McKitrick 2007; Evans 2008d; Montford 2010a) and resorted to various weblogs such as Climate Audit. The rapid growth in popular books and the blogosphere signals a major change in how the debate is conducted.

Even though fierce disputes occur in the scientific literature, the manner of communication in journals is rarely an issue. Instead, the main focus, at least in public, is on the content of the arguments. By contrast, the normal constraints on communication in the scientific arena do not exist in the blogosphere. Issues can be mixed with strident opinions, and tactics such as deliberate deception, misrepresentation, devaluation and ad hominem attacks can be widespread. Blog communication is on the one hand far more visible and accessible to the general public than the scientific literature which tends to be the preserve of specialists and experts. But on the other hand, blog communication can be far less transparent because it can be conducted anonymously. This lack of transparency provides an avenue for underhand attacks.

The ‘hockey stick’ and various other paleoclimate reconstructions have been heavily critiqued in the blogosphere. Many critics have gone far beyond technical criticisms and have insinuated or even directly accused climate scientists of perpetrating fraud and of being engaged in a conspiracy. Responding to web comments and attacks requires different skills to those required for journal submissions. The controversy that has ensued on the blogs between scientists and their various critics raises important questions because the manner of communication may have an impact on the outcomes of the debate aside from any issue of scientific correctness because of how the interactions are perceived and interpreted by observers.

Martin (2011) identifies three potential ways of responding to criticisms and attacks: ignoring the attacks and not responding, counter-attacking, and responding logically and politely. One way of analysing which is the most effective choice of response is to analyse the effect on observers. Generally, observers will form the majority in any dispute, with a small number of partisans on either side. In highly technical debates, neutral observers are likely to judge the debate by the style at least as much, if not more than, the content. The style or manner of communication may include the ability to simplify in a reasonable manner complex arguments and justify technical choices. Those observers who do care about the content of the dispute will be looking for just such a clear explanation. Although content may be very important, how it is expressed and how criticisms, mistakes, or lack of understanding by others are responded to is likely to be crucial.

This situation may be even truer after ‘Climategate’. When the level of technicality is beyond most observers, scientific findings must be taken on trust. When this trust is questioned, as in the wake of ‘Climategate’, then the manner in which the debate is conducted and the way that accusations are responded to exert a greater influence over how the media and the public judge the participants (see Pearce 2010d).

Of course, the difficulty with this scenario is evident. In the peer-review literature, the disputes get resolved on the substance, and the style is irrelevant to the extent that all participants must conform to a similar style in order to get published. Furthermore, the dispute is generally restricted to participants with the relevant expertise. In essence, the controversies eventually resolve around matters of what is correct or incorrect scientifically.

By contrast, the blogosphere is open to a far wider audience and the issue may not necessarily resolve around correct or incorrect scientific positions, but rather around public perceptions of those positions including how they are communicated. The difference here is that a perfectly civil critic may be scientifically incorrect, but may still persuade an audience that a scientist is wrong if the scientist's approach is seen as rude, dismissive or arrogant. This is accentuated when scientists feel that they have been provoked, sometimes deliberately, by critics that do not have a genuine interest in furthering understanding. It may be that the dynamic of the interaction influences the perceptions of the majority of observers rather than matters of scientific correctness.[111]

Another way of analysing this dispute is to look at the struggles over interpretation and their effect on participants and observers, especially those that are considered nominally independent. I use some of the interactions between Judith Curry and Gavin Schmidt to illuminate some of the points of contention that persist in the 'hockey stick' controversy, and the way that the 'hockey team' has responded to attacks. Neither Curry nor Schmidt is a paleoclimate scientist. Curry is a climate scientist at the School of Earth and Atmospheric Sciences at Georgia Institute of Technology. Schmidt is a climate modeller at NASA GISS. Curry entered the debate over the 'hockey stick' and scientific practices in the wake of the email scandal and has posted comments at several blogs including Climate Audit run by Steve McIntyre and RealClimate run by Schmidt, Mann and colleagues. Schmidt has been a prolific commentator and respondent at RealClimate since its inception in 2004.[112]

Following 'Climategate', Curry (2009a) argues that a 'lack of transparency in climate data, and "tribalism" in some segments of the climate research community' has damaged the public credibility of climate science. Curry regards the paleoclimate community and their blog defenders as a tribe. She feels that public credibility and transparency are now key issues for science and argues that higher standards must be enforced to ensure that climate data and

[111] This does not exclude the possibility that scientists participating in blogs may be factually incorrect in certain instances.
[112] The RealClimate website was established by climate scientists in 2004. Contributors include Gavin Schmidt, Michael Mann, Caspar Ammann, Rasmus Benestad, Ray Bradley, Stefan Rahmstorf, Eric Steig, David Archer, Ray Pierrehumbert, Thibault de Garidel, and Jim Bouldin.

data treatment is publicly available, transparent and well documented. She credits Steve McIntyre with bringing these issues to light.

Curry (2009b; see also Martin 2011) identifies three potential responses to sceptics:

> 1. Retreat into the ivory tower
>
> 2. Circle the wagons/point guns outward: ad hominem/appeal to motive attacks; appeal to authority; isolate the enemy through lack of access to data; peer review process
>
> 3. Take the "high ground:" engage the skeptics on our own terms (conferences, blogosphere); make data/methods available/transparent; clarify the uncertainties; openly declare our values

Curry (2009b) argues that it is incumbent on members of the scientific community to respond to citizen interest in scientific and technical questions, and therefore ignoring sceptics from outside the field and retreating into academia is inappropriate. Curry (2009a) makes a distinction between the interests of politically motivated deniers and the more technical blogs such as Climate Audit. She asserts that climate tribes have responded to politically motivated assaults by joining together and counter-attacking and is concerned that technical blogs and scientists that question some aspects of climate research have been targeted by tribal members. Curry (2009a) is also perturbed by an 'apparent systematic' attempt by senior scientists that hold editorial positions and participate in IPCC reports to apparently 'withhold data' and 'thwart the peer review process'. Furthermore, Curry (2009a) questions why some climate tribes persisted with a defensive and counter-attacking strategy when the public debate was turning their way, particularly post-2006. In effect, Curry (2009a) notes that some of the paleoclimate tribe appear to violate scientific codes regarding the scientific method and research ethics. Curry (2009a) regards these methods as counterproductive because they 'will backfire in the long run'. Instead, Curry recommends careful consideration of sceptical arguments combined with either rebuttal or acknowledgment of valid criticisms. She suggests engaging sceptics by posting to sceptical blogs.

However, Curry's recommendation raises awkward issues. In particular, it assumes that the motives of critics are genuine, and that scientists are able to distinguish between the politically motivated and the genuinely interested. For example, the Lavoisier Group in

Australia denies global warming and is bitterly opposed to any action on climate change. Yet the Lavoisier Group was set up by executives from one of Australia's largest mining companies, WMC and many Lavoisier Group members have links to the resource sector. As a front group for the resource sector, the Lavoiser Group has a vested interest in the outcomes of the debate. Accordingly, it has a hidden agenda and would fit Curry's definition of a politically-motivated denial group.

But would a free market think tank such as the Fraser Institute in Canada qualify as a politically-motivated group? Sourcewatch (2009) notes that the Fraser Institute has received funding from corporations such as ExxonMobil and US foundations such as the Charles G Koch Family Foundation.[113] Brendan Demelle (2010) points out that the Fraser institute has several oil industry directors on its board and that its published research and PR serve the interests of the oil industry. Moreover, the Fraser Institute has been very critical of the science behind climate change. On 5th February 2007, it released a publication, the *Independent Summary for Policy Makers* (McKitrick et al 2007) three days after the IPCC *AR4* Summary for Policymakers. The *Independent Summary* cast doubt on the science of climate change and concluded that it could not be deduced, to the extent that humans might be influencing the climate, 'whether or not such change is a good or bad thing' (McKitrick et al 2007, p. 8). By downplaying the seriousness of the problem, the report provided useful PR for industry interests pursuing a business as usual approach. The report was co-ordinated by Ross McKitrick. McKitrick and McIntyre were the co-authors of the 'hockey stick' critique.

These links are important because Curry suggests that Climate Audit operated by McIntyre should be treated differently to politically motivated organisations. Yet it is clear that the agenda of some organisations is to oppose climate change mitigation rather than help discern the truth on climate change. This matters because deliberately misleading or irrelevant arguments couched as genuine interest can be used to manipulate public perceptions (and reduce concern over the problem, thereby reducing public pressure for policy action). For example, it may be impossible for an outsider to discern a valid from an invalid criticism. Indeed, even experts can disagree on technical matters. Therefore, it is very difficult for

[113] David and Charles Koch have large oil interests and are two of America's richest men with a combined fortune of $35 billion. They have funded numerous think tanks and front groups that deny, or cast doubt on, climate change (Mayer 2010).

outsiders to judge whether a scientist's refusal to acknowledge a criticism accompanied by a scientific dismissal is justified. By contrast, it is often easier to understand the language and the tenor of the debate by observing how things are said. Accordingly, it may be that observers will judge the debate based on those aspects that they can understand: that is, they will judge the debate as much on the manner of the exchanges as on the actual merit of the technical arguments. This could mean that a scientifically justified position can be undermined by a rhetorically skilled but factually incorrect opponent.

Many scientists and their institutions spend time and energy responding to valid points for a wider audience. If scientists and their institutions can point out that the relevant standards have been met (for example, data, metadata and code are archived and publicly available; methods are transparent; uncertainties have been recognised; any mistakes have been acknowledged and rectified if possible), and can show that genuine efforts have been made to engage with valid concerns from citizen critics, then observers may view irrelevant questions as unjustified and harassment as reprehensible.

Curry and Schmidt blog exchanges

The 'hockey stick' controversy has been rekindled on several occasions, most recently at RealClimate when a blog by Tamino (2010) aimed to rebut many of the criticisms of the 'hockey stick' made by Montford. Curry and Schmidt interacted regularly on the thread that followed the Tamino post through various postings by Curry and inline responses by Schmidt.[114] In a brief opening post Curry (#74) rates Tamino poorly. Curry (#168) returns with a lengthy post that argues Tamino failed to address the main points raised in Montford's book, from Mann et al (1998, 1999) through to Mann et al (2008a) including 'problems with tree rings, the centered PC [principal components] analysis, and the r^2 issue'.

In his response, Schmidt is incredulous and begins 'Really? This is it?' He then goes on to post a series of detailed inline responses and rebuttals to all of Curry's nine main points. Schmidt begins by explaining why he believes the PC analysis is 'completely moot': it was dealt with by Wahl and Ammann (2007). This raises a question of judgement about whether

[114] All references to comments on this thread can be traced via the #. All comments are contained within the original post which is referenced as Tamino (2010).

to concede a point. For example, using the de-centered PC analysis has been judged improper (e.g. by Wegman et al 2006). Yet, it has also been shown to make very little difference (Wahl and Ammann 2007). A choice then has to be made and the difference is subtle. Does one defend the decision to use de-centered PC analysis as a choice that made little difference? Or does one concede that an improper decision was made, but point out that the impact on the final result was negligible. The impression of scientists such as Curry is that RealClimate have chosen to defend an improper choice and that this is a mistake (see also a similar comment in the same thread by Flack #261). A decision (real or apparent) to defend the choice may easily be construed as obstinacy, and therefore may represent a poor tactical choice.

Curry (#168) accuses Mann of cherry-picking a statistical validation test to suit his purpose. Schmidt (#168) points out 'this is simply insulting' and notes that the choice of statistical validation was well covered by the National Academy of Sciences (2006, pp. 83-97) which appears to substantiate the statistical validation choices made by Mann et al. Montford (2010a, p. 216) had claimed that the failed r^2 stats in Wahl and Ammann (2007) 'demonstrated finally and conclusively that the MBH98 [Mann et al] reconstructions were not reliable'. This issue is raised several times on the thread and Schmidt (#92) provides a relatively straightforward justification for using RE as opposed to r^2 as a verification measure:

> the metric you look at for any particular application depends on what it is you are trying to assess. The low r^2 values are associated with year to year variability which is not really what is being looked for, rather you want a statistic that works at capturing the general level. The RE score does that and demonstrates that there is skill (which obviously decreases as you go back in time). The way you should look at this is that the metric you use defines what you can infer from the reconstruction. So at 1450 say, you can't trust the year-to-year variability, but the longer term average is more skillful.

Schmidt (#317) also argues that the low r^2 numbers in Wahl and Ammann merely show the reconstruction 'isn't useful for the high-frequency variations in the earlier part, but that the overall mean does have some skill'. In essence, Schmidt notes that because early millenium proxy networks are so sparse, determining inter-annual variability would be futile and

therefore of little interest. If inter century comparisons are being sought, then the r^2 is not the right value to be using and the RE and CE statistics are perfectly adequate.

Schmidt (#168) also corrects Curry on her misrepresentation of some of the conclusions in the IPCC *TAR*. He argues it seems reasonable to conclude that the late 20th century was likely to have been the warmest period of the millennium,[115] but notes that the IPCC in its *AR4* moved away from a characterisation of individual years and decades as being warmer on a millennial scale, and noted instead that recent years were the warmest in the instrumental record. Schmidt argues this is a sensible realisation that individual years are difficult to quantify. Schmidt also deals with issues around the treatment of uncertainty and relative levels of certainty; addresses the issue of divergence; points out that problems with tree rings have been openly discussed in the literature and that 'good reconstructions' without tree rings go back centuries and 'aren't grossly different to the ones using tree rings'. Most of Schmidt's responses appear to provide a comprehensive reply to the criticisms raised by Curry.

However, the claim about a no-dendro reconstruction producing similar results reignites a controversy over Mann et al (2008a). In his response to Curry (#168), Schmidt provides a link to 'a modified figure from the SI [supplementary information] in Mann et al (2008) to show the impact of removing 7 questionable proxies and tree ring data together'. In a response to Robinson (#171), Schmidt argues that 'the Tiljander stuff is moot since the Mann et al (2008) paper showed both with and without and found no material difference'. Yet, this does not appear to be entirely true. Later in the thread, in a response to Clarke (#382, emphasis original), Schmidt says:

> There *was* a no-tree ring reconstruction in Mann et al (2008) which was valid to ~1000AD for one method, back to ~1500AD for another.

In a response to Curry (#414), Schmidt clarifies this statement:

> the no-dendro/no-Tiljander sensitivity test is also part of the SI in Mann et al (2009) (figure S8), where it is noted that it doesn't validate prior to 1500 AD.

[115] However, given the choice of validation statistics and the paucity of data, it appears from the rest of Schmidt's argument that Mann et al (1999) were wrong to have used such a high level of confidence to describe particular years and decades as the warmest.

Mann et al (2009b) produced another paper called ‘Global signatures and dynamical origins of the Little Ice Age and Medieval Climate Anomoly’ that used the same proxy dataset that they had employed in Mann et al (2008a). It was accompanied by supplementary online material. The supplementary online material appeared in November 2009, and contained the admission that a no-dendro no-Tiljander ‘reconstruction no longer passes validation’ before AD 1500 (Mann et al 2009c, p. 31, fig. S8; 2009d). This is shown in figure 16.

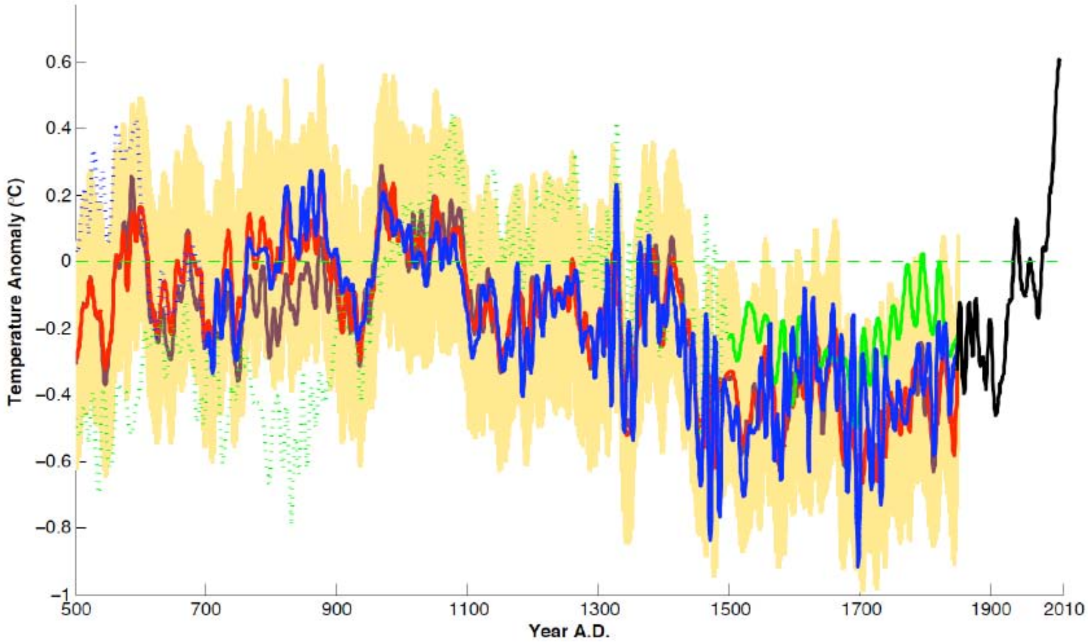

Figure 16: Sensitivity of NH mean reconstruction to exclusion of selected proxy record. Reconstructions are shown based on: all proxy network (red, with two standard error region shown in yellow); proxy network with all tree-ring records removed (blue);proxy network with a group of 7 long-term proxy with greater uncertainties and/or potential biases (brown); both tree-ring data and the group of 7 records removed (green; *dashed before AD 1500 indicates reconstruction no longer passes validation*). Source: Mann et al 2009c, p. 31, fig. S8. Emphasis added.

In other words, the Tiljander sediments were essential in this particular instance to achieve a valid no-dendro reconstruction back to 700 AD. Given their importance in the reconstruction, and the fact that questions about their reliability and treatment have been raised by McIntyre, it appears that the issue of the Tiljander sediments is *not* moot.

Still, the technical and methodological criticisms are only one aspect of the dispute. Of equal importance appear to be the manner of the debate and the behaviour of participants. Curry

(#168) admits to frustration in trying to get to the bottom of the dispute, but asserts that Montford's book is 'coherent, well argued and well documented'. By contrast, she accuses RealClimate of using 'snarky replies to serious posters' and asserts that failing to address contentious issues in an adequate manner will merely cause people to gravitate towards the opposition.

In reply, Schmidt argues that the issue is contentious because opponents refuse to recognise that climate change is a problem and that their sole tactic seems to be the 'continued repetition of long debunked talking points'. In his response to Curry (#168, asterisks original, ellipsis original, edit original), Schmidt expresses his exasperation at what he regards as irrelevant criticism and a refusal to move on by people outside the scientific community:

> The fact of the matter is that we are far beyond the point where people need to either s*** or get off the pot. Continuing to whine about what selection rules were used in a PC analysis 12 years ago without coming up with any constructive alternative, continuing to complain about a centering convention that makes no difference whatsoever, continuing to moan about error analyses being inadequate without doing a single stitch of work to improve them... enough, already! Science moves forward because people do actual work. Nothing happens when people just sit in a room and [edit] complain about the state [of] the world. The people who are actually publishing in this field are doing all of the things you seem to think are being ignored, while the people whose work you are reading are doing nothing but complain about how they are being ignored. I'm very confident about which group will make the most progress in future.

Curry (#185) retorts that:

> your attempt to rebut my points are full of logical fallacies and arguing at points I didn't make. As a result, Montford's theses look even more convincing. Once you're in a hole, you can try to climb out or keep digging. Well keep digging, Gavin. My final words: read the book.
>
> [Response: Thanks for passing by. In future I will simply assume you are a conduit for untrue statements rather than their originator. And if we are offering advice, might I suggest that you actually engage your critical faculties before demanding that others waste their time rebutting nonsense. I, for one, have much better things to do. - Gavin]

What is an outsider to make of this exchange? Here we have two working scientists talking past each other and trading insults. Schmidt who is associated with Mann via the RealClimate website feels that he has made an attempt to understand the technicalities, assumptions and uncertainties in the field by reading the relevant scientific papers. By contrast, he accuses Curry of relying on knowledge acquired from popular science books and blogs. Schmidt feels he has answered the technical criticisms and exposed their flaws. Curry feels Schmidt has failed to address the criticisms of tree rings and scientific process. If they have stayed with the exchange this far, observers are more likely to be convinced by the content of the arguments and may conclude that Schmidt has, in general, made an adequate response to the main points. Whether the frustrated descent into sarcasm detracts from the arguments and would lead observers to ignore the potential merit of his technical rebuttals and side instead with the vanquished opponent is difficult to determine.

Curry and Schmidt hold fundamentally different views about the value of Montford and Climate Audit. Curry (#419) argues that Montford and the ‘climate auditors’ make a vital contribution to the field and that the dismissive response of RealClimate further reinforces the negative perceptions regarding scientific integrity. Schmidt (#414, 418, 419) counters by arguing that insinuations over methodological and data choices are unhelpful because critics never do their own work or attempt to publish a justification for their own choices: instead they just sit on the sidelines and snipe. This can also be seen as attempt by Schmidt to locate the debate and the authority to determine its outcomes in the arena where scientists hold the advantage: the peer-reviewed journals.

Curry (#435) attempts to draw a distinction between the scientific/technical points and seemingly more general issues of scientific processes and conflict avoidance. She asserts that:

> This conflict is fundamentally different from a merchants of doubt conflict …
>
> So the issue that Montford raises, and that I have raised in my posts, are general issues, about the integrity of science, how to avoid conflicts, how to deal with mistakes, how science should be conducted when there are a lot uncertainties and the field is immature, when the situation is politicized, etc.

> So I have no intention of debating any aspects of the science on this topic. In spite of the fact that most people on this thread thought the point of all this should be defending Mann's science (and Ammann, etc) and identifying scientific "truth" in all this. This is highly uncertain science in a young field. So get over it, we aren't going to get "truth" on this anytime soon. The challenge is to avoid these crazy conflicts and move paleo reconstructions forward

In a further post, Curry (#467) shares her perspective on the blogging methods used by proponents and critics of climate change. She claims that Montford's sceptical blog is polite and reasoned, but light on science. She attributes the success of Climate Audit to its heavy reliance on the scientific method and the lack of sarcasm in posts by McIntyre. By contrast, she claims that although RealClimate uses the scientific method, it also relies on appeals to authority, clings to initial beliefs, ignores contrary information, and contains 'a heavy dose of appeal to motive and ad hom attacks'. Moreover, she finds inline comments by Schmidt are often belligerent. Curry says she is:

> prepared to declare victory if anyone is seriously looking at both sides of the arguments, there are any new readers for Montford's book, if people have wandered over to Climate Audit to check it out, if people (especially the RealClimate principals) are starting to get it that the watchdog auditors (e.g. McIntyre) are different from the merchants of doubt.

In his response to Curry (#467, emphasis original), Schmidt retorts that:

> What *is* being pushed back against is the continual barrage of innuendo, accusations of corruption and fraud, and insinuations of misconduct because people had the temerity to do their jobs and publish results which some people do not like. This has happened to Ben Santer, Phil Jones, Mike Mann, and many others and follows in a long line of similar tactics employed by the 'merchants of doubt'. McIntyre might not fall exactly into that mold (almost certainly very different motivations), but he feeds that machine quite willingly.

Schmidt raises a fundamental point of disagreement: namely the motives of Montford and the Climate Auditors. Presumably 'merchants of doubt' refers to Oreskes and Conway (2010) who detailed the concerted efforts of industry and a small group of contrarian scientists to cast doubt on the scientific evidence behind a whole array of environmental and public health problems ranging from tobacco to acid rain, ozone to climate change. Curry (#435) did not

want to debate the scientific points, yet it is precisely the technical and scientific aspects that get raised continuously, and form the basis for insinuations about the ulterior motives of scientists. Therefore, it is hard to have a debate about general issues while ignoring scientific and technical disputes that can end up being used in claims of corruption.

In this sense, getting details correct does matter, as does attempting to resolve technical conflicts. If the science is essentially correct, then much of the criticism raised by climate Audit and Montford becomes either irrelevant, or of a second order because the fundamentals are not in doubt. If the technical issues are irreconcilable, at least at present, then there may be a dispute with valid arguments on both sides. If aspects of the science such as Mann's handling of the Tiljander proxies are incorrect, then it needs to be acknowledged and corrected. Still, Curry's assertion that the current dispute is fundamentally different from a 'merchants of doubt' conflict is unconvincing. Even if some of the technical disputes are valid, the very doubts being raised by Climate Audit are in fact used extensively by the denial and delay lobby, and this is a crucial problem because doubt can be used to endlessly postpone policy action on what many scientists consider a serious and urgent problem.

The dispute over the Tiljander proxies has played out without resolution on various blogs including RealClimate run by climate scientists, Climate Audit run by Steve McIntyre, Collide-a Scape run by Keith Kloor, Stoat run by William Connelly,[116] and Roger Pielke Jr's blog. Pielke (2009b) notes Kaufmann et al had issued a corrigendum regarding their use of the Tiljander proxies and argues that this resolves the issue in the scientific literature. In a response, McIntyre (#34) states that the contamination from human influence precludes the Tiljander sediments from being used as a climate proxy because it is not possible to calibrate it to the thermometer record. Furthermore, he argues that in applying an incorrect calibration, the temperature reconstruction created by that proxy becomes inverted. These criticisms were raised again at Keith Kloor's blog, giving rise to a question about whether the Tiljander proxies are calibratable to the thermometer record, and to a dispute over whether the reconstruction without either the Tiljander proxies or the tree rings is materially different from the other reconstructions.

[116] Connelly is a former climate scientist and was previously a member of RealClimate.

Schmidt begins a thread at Kloor's Collide-a Scape (in Kloor 2010, 16 June, reference original)[117] that points out why he feels there is little prospect for constructive engagement between scientists and their critics. Schmidt argues that a key problem is insincere critics refusing to accept the answer given by scientists:

> One of the pathologies of blog comment threads is the appearance of continual demands that mainstream scientists demand retractions of published work or condemnations of specific scientists for supposed errors or other sins. Most often the issue in question has been discussed dozens of times previously and is usually based either on an irrelevancy, or was acknowledged clearly in the original or subsequent paper or is based on some misperception of the science. [See Mann et al (2008) paper].
>
> Nonetheless, these demands are being used as some kind of litmus test for the kind of scientist one can respect and they clearly resonate with people who don't know anything about the subject. However, for those that do, it serves only to signal that there is no reason to engage since the first explanation should have dealt with the issue. How many times do you need to correct someone's misperception of a point of science? If they were sincerely looking for truth, the answer would be once. If instead they are trying to find issues with which they can bash scientists for another reason, the answer is apparently infinite. No scientists have time for that, and this kind of continual low-level insinuation is simply too tiresome to deal with.
>
> Thus what we have is not scientists refusing to engage with serious questions, it is the critics refusing to accept the answer. Since the answer is not going to change, the prospect of actual dialogue is limited.

Lucia Liljegren (in Kloor 2010, 16 June, 2.27pm, #1, emphasis original),[118] a mechanical engineer who operates her own skeptical climate blog, responds to Schmidt's question about how often a question needs to be answered. She identifies several instances when an answer given by scientists may not correct a disagreement. This situation may include the quality of the response by a scientist, and may also arise when the disagreement is not in fact about a misperception:

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[117] The following thread numbers (#) can all be traced to through the reference to Kloor (2010). Dates and times are provided as the numbers are partially obscured on the blog thread.

[118] A fuller citation is given for references to this blog because the numbers fade out later in the blog and the entries can only be followed by date and time.

> I think the correct answer is: *In principle,* exactly once. But it's important to understand this answer can only apply when all of the following are true:
> a) someone actually has a misperception,
> b) you correctly identify what someone is perceiving and can pinpoint what precisely is wrong with their view,
> c) your correction is responsive to the actual misperception,
> d) your answer is clear and convincing and does not contain any holes,
> e) readers can tell you actually addressed a misperception harbored by someone, somewhere, rather than merely rebutting a watered down point that might appear similar to you,
> f) your answer doesn't send people down blind allies by suggesting that the question was answered in a blog post addressing another subject. (This red herring tactic will often make people stop reading, preventing them from ever noticing the convincing arguments that might be contained in later portions of the post.)
> g) the answer is provided in a forum read by people actually who harbor the misperception you address
> h) your responses to their arguments does not appear to contain slams insinuating that people asking you questions are not seeking the truth.
>
> If your correction fails on any of these points you will almost certainly need to repeat your attempt to correct their misperception. You will feel like you keep repeating the same thing over and over.

Curry (in Kloor 2010, 16 June, 8.00pm, #21) adds that ‘the onus is really on the people who wrote the papers (or by proxy their blogospheric defenders) to address the questions’. Furthermore, she argues that these ‘are serious questions from educated people that have dug into the subject’. She then raises issues about how knowledge is created and contested and how scientific progress is made:

> If a scientist can't convince such a group of people, then I'm not sure who they can expect to convince, other than by "appeal to authority" arguments. The blogosphere is a brave new world that is enabling nontraditional groups to develop expertise and challenge the "elite" science conducted by academic and government researchers. This is good for science, and it’s good for policy to have a populace that is educated in these matters. Let’s figure out how to put this energy and expertise to productive use, rather than dismissing it.

Schmidt (in Kloor 2010, 16 June, 11.30pm, #29, asterisks original) responds to the questions and criticisms that have been posed. He argues that his critics have:

> simply regurgitated points they've made before without bothering to read what I said, and without clicking on the link (where, if they had cared to look, a reconstruction without both tree rings *and* the Tiljander proxies is shown – and yes, it looks similar to the others). Secondly, the 'issue' is boiled down to a demand that I answer some 'simple' question and denounce the original paper as 'a bad mistake'.

Although it is true that Schmidt has pointed out this graph before, this particular graph appeared a year after the original paper, apparently in response to criticism of the Tiljander proxies in the original paper. However, the point about whether this graph is materially different is disputed by the participants in the debate.

Schmidt (#29, asterisks original) continues by stating that his opponents are being disingenuous by wasting time on minor points. Schmidt notes that this is a typical debating ploy and that scientists will not participate because their job is to concentrate on the issues that matter:

> But trying to reduce the whole issue of paleo-climate reconstructions to a simple yes or no question about a single set of proxies is disingenuous. Why? Because the answer is either yes or no; if yes, they can be useful in the Mann et al method, and if not, they can't – but both possibilities were *already* presented in the paper. For any actual practical purpose the question posed is moot. It simply doesn't matter. If you don't like those proxies, use the reconstruction without them (and without the tree rings as well if you want), and if you do like them, then use the reconstruction that includes them. The differences are minimal. As stated above, the code and data are all available, so just go ahead and knock yourself out.
>
> This is actually a very typical dynamic. There is a focus on a very specific point – that does in fact have a very easy resolution – but one which has no actual import. Discussing something that doesn't matter is by definition a waste of time, and so scientists will disengage. Indeed, it is precisely the role of scientists to distinguish between questions that do or do not matter – and pursue the former at the expense of the latter. Continually focusing on issues that do not matter is a classic diversionary tactic in any debate and this is evident in almost all of these blog conversations.

At this point, someone will say that my declaration that something 'doesn't matter' is just my opinion, and that in their opinion it does! In which case they are fully at liberty to discuss it – but just don't expect any input from the scientists.

Schmidt points out that the original paper did a reconstruction both with and without the Tiljander proxies because of doubts about the reliability of the sediments. Finding that it appeared to make little material difference, the proxies were included. In response to further criticisms, a graph without either tree rings or sediments was produced, and again, according to Schmidt, there was little material difference. Therefore, the criticism ‘simply doesn’t matter’. However, the thread does not rest there because firstly, critics still point out that Schmidt has refused to give a straightforward answer to the calibration question, and second, because critics argue that the link provided by Schmidt appears to contradict his claim: critics argue that in fact the no-dendro, no-Tiljander reconstruction is substantially different from the others because the reconstruction without those proxies shows much higher temperatures in the medieval period (the pale blue line in figure 17), and furthermore, it does not pass validation prior to 1500 AD. The reconstruction is shown in figure 17.

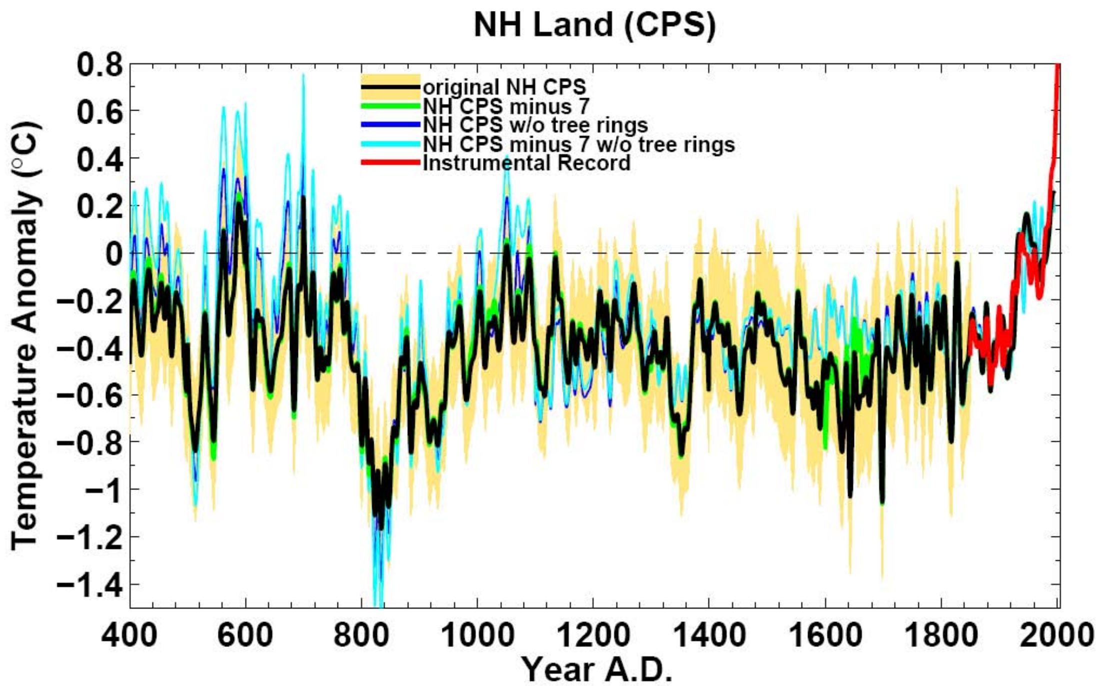

Figure 17: supplementary figure S8a (relating to Mann et al 2008a) shows the reconstruction without both the Tiljander proxies and tree rings. The pale blue NH CPS

minus 7 w/o tree rings is the reconstruction without the Tiljander sediments and the tree rings. Source: the link provided by Gavin Schmidt (2010, #5 in Kloor 2010). Also available as Mann et al 2009d.

Liljegren (in Kloor 2010, June 18, 2.33pm, #115) sums up the critics perspective:

> What seems to have happened in comments here is a scientist gave what appears to be an answer so flawed that people of good faith could easily consider it to be flat out wrong. Critics refuse to accept the answer given by Gavin – a scientist – because the answer appears flat out wrong. People who support Gavin are suggesting the critic's refusal to accept the answer somehow reflects badly on the critics. We await to see if Gavin returns to explain why his critics should not consider his answer … either flat out wrong or at best, highly misleading. Because currently, Gavin's claim appears to be contradicted by the evidence he gave to support it.

Given that climate science has implications for policy, scientists have some responsibility for answering questions by citizens. Although the question and the answer may not have any import for the whole question of global warming and its causes, it does appear important as far as public perceptions of scientific credibility are concerned. A refusal to answer simple questions by pointing out that the issue cannot be reduced to a simple question appears evasive even if it may be true. It suggests that some scientists are unwilling to admit mistakes and thus polarizes the debate, a consequence that scientists recognize, but which, at least in Schmidt's case, he regards as a deliberate tactic by critics to frustrate scientific consensus and delay policy action.

By contrast, Curry points out that there are many technically literate commentators drawn to McIntyre's blog and that they are asking serious questions about data quality and scientific procedures. She argues that citizen participation in science is democratizing the process and challenging scientific elites to lift their game. Curry points out that there may be differences between scientific knowledge and technical knowledge. Scientific knowledge can include asking the right questions and avoiding questions that do not appear relevant. Curry (in Kloor 2010, 17 June, 9.20am, #50) argues that elite scientists can develop scientific intuition with time and experience and that this is valuable for pursuing research at the frontier. However, she argues that it is no guarantee of technical expertise or logical argument. By contrast, she argues that:

> citizen scientists often have deep technical skills and good understanding of logical arguments, and this makes them very effective as "auditors", if not producers of original research on the topic.

The distinction drawn here by Curry suggests that different types of scientific pursuit require different skills: scientific intuition may be most valuable in experimental areas where new knowledge is developed, and technical expertise may be more valuable in manipulating observational data such as temperature series. Dutch climate scientist, Bart Verheggen (in Kloor 2010, 18 June, 3.59am, #98) agrees in part, but points out that this may over-simplify the situation and lead to incorrect conclusions being drawn about an entire field:

> scientific intuition and broad background knowledge of the field is very important in placing results in context and therefore also in making a coherent scientific argument. These (esp [sic.] the former, the forest-and-trees problem) are what's missing in many (not all) of the citizen scientists efforts, and yet, the conclusions are often uncritically taken to be of paramount importance for the field as a whole.

This suggests that scientists may also have struggled to convey to the public the fact that science involves higher order judgments about what is actually important beyond purely technical matters.

The intrusion of citizen science poses difficulties for scientists in discerning between genuine interest on the part of a questioner and illegitimate time-wasting and obstruction. The empowerment of lay critics through the blogosphere, combined with the time available to retired or semi-retired professionals, means working scientists face a difficult task in providing the depth of detail required to answer scientific and technical questions. Critics argue that many technical points could be answered to the satisfaction of a knowledgeable lay audience within a reasonable period of time, and that scientists tend to disregard questions that they do not want to answer or argue that the questions are irrelevant. Many critics appear to have the time, inclination and some relevant expertise to engage in an ongoing dissection of certain aspects of climate science. The appearance of a refusal to engage with critics reflects badly on climate scientists and undermines their credibility. Furthermore, critics have the appearance of an underdog, and there may be a greater public tolerance for taunts or insinuations by opponents merely because they are directed at what critics portray as an

authoritarian elite. By contrast dismissive statements by scientists may be perceived as arrogant. Therefore, differing standards of behaviour may be applied to both sides.

An impression of the effect on observers can be gained by analysing blog interactions such as those illustrated above. However, the debate is also influenced by perceptions of other conduct beyond rhetorical exchanges: this includes cover-up, official channels and intimidation. These techniques and a wider range of rhetorical methods including devaluation and misrepresentation are considered in the next chapter.

Chapter 7: Tactics of climate scientists and their critics

Introduction

This chapter examines the tactics of a group that is often portrayed as powerful, particularly within their own scientific arenas: scientists and their professional organisations. Processes such as peer-review journal publication and scientific panels are commonplace in the scientific arena and provide legitimacy to scientific views and findings. This means that proponents and supporters of a dominant view are in a powerful position because they are generally better placed to use these processes to maintain and reinforce the dominant scientific perspective on an issue.

However, the arena(s) in which the battle is fought and the balance of power in any given arena of conflict have a major bearing on the tactics that the antagonists can use. This chapter interrogates the extent to which scientists have power across different arenas as well as examining the degree to which that power is constrained and/or negated by their opponents in the debate. Furthermore, the chapter aims to show how the methods of engagement adopted by the protagonists may impact on observers. Given that both sides are trying to mobilise broader public opinion, the way that observers and participants see particular tactics as reflecting on the credibility of the user indicates that tactical choices and the perception of those choices may have a bearing on the outcomes of the conflict.

In the chapters on government and industry, I used my tactical framework to analyse and compare the tactical moves of two different governments and two different industry-resourced organisations. Both government and industry are typically deemed to be powerful players and indeed my analysis revealed that both groups had the ability to use the full range of tactics available to powerful players even if wider strategic considerations sometimes constrained how specific tactics were deployed.

By contrast, the power dynamic unveiled in this chapter is markedly different to the earlier chapters: even though scientists have access to prestige and authority, they are opposed by determined opponents with access to significant resources of their own. The balance of power is therefore relatively even. The difference between examining an arena of conflict where

there is a power imbalance and one where it is relatively evenly distributed has necessitated flexibility in how I use the tactical framework. Whereas the chapters on government and industry used a tactical framework based on what Martin (2007) terms the perpetrator methods: cover-up, devaluation, reinterpretation, official channels, intimidation and bribery (with the assumption that opponents will need to rely exclusively on counter-methods), this chapter illustrates a different scenario: both scientists and their critics have access to some (not all) of the perpetrator methods, and both sides also have had recourse to some of the counter-methods typically used by the relatively powerless.

Having covered much of the technical background to the dispute between scientsist and their critics in the previous chapter, this chapter moves straight into a classification of the main methods adopted by both mainstream scientists and their critics in the 'hockey stick' dispute.

Cover-up

Some of the allegations made by critics against mainstream scientists could be treated as two aspects of cover-up: firstly, the blocking of opposing views or evidence, and secondly, a refusal to disclose data, code, methods and relevant uncertainties. As Martin (2010, p. 234) points out, there is an apparent contradiction at the heart of the scientific process because 'cover-up is a violation of the expectation of openness in science, but in practice many parts of science are not open'. Firstly, the peer-review system is anonymous and secondly, full data disclosure is not the norm in science. Both these scientific norms have been challenged by critics amidst claims for greater public accountability. I look firstly at criticisms of the peer-review process and the allegations made by critics that climate scientists have blocked opposing views. Then I examine the allegations that climate scientists have withheld data and methods to prevent replication of their findings.

There is a common perception that scientists are objective in their examination of evidence and disinterested in their pursuit of the truth. Yet within the scientific realm, there are often fierce struggles between partisans over rival explanations of a particular phenomenon. Certain tactics may be used by the orthodoxy against dissident theory. Typically, there is a pattern of suppressing criticisms or not giving the alternative theory a reasonable opportunity to be expressed (Martin 2010). Routine scientific processes such as anonymous peer-review

are traditionally carried out with a degree of secrecy. It may be very difficult for outsiders to determine if an opposing view has been unfairly dismissed because the system is not designed to be publicly accountable.

Critics of the dominant perspective on climate change have struggled to get their views published in the scientific literature. Critics make two main allegations: firstly that comments by journal editors may have effectively closed the debate, and secondly that the paleoclimate group may have blocked critical publications. McLean (2007, p. 5) claims that in 2002, the editor-in-chief of *Science* magazine stated that the science of climate change possessed a high degree of consensus and was settled. McLean argues that this position generally compromises debate and dissent, and is likely to prejudice the opportunity for challenges to the orthodox explanation.[119] Rapp (2008, pp. 87, 95) argues that the paleoclimate group may have blocked independent researchers from publishing their findings in prestigious peer-reviewed journals such as *Nature*. Rapp (2008, p. 98) asserts that paleoscientists were more interested in defending their position, right or wrong, than in advancing verification of the scientific findings. Because most of the reviewers with the relevant expertise would have been members of the paleoclimate group, Rapp alleges they operated as a cohesive club that exercised a de facto veto over any research that challenged the established hypothesis.

These allegations were given renewed impetus after 'Climategate' as critics said the emails exposed the previously hidden details of how climate scientists used their power to block opposing papers. The methods included the apparent outright rejection of critical papers, threats to boycott journals that published sceptical papers, and the discussion of whether to try and get particular journal editors removed. Veteran science reporter in the UK, Fred Pearce, conducted an in-depth investigation into the 'Climategate' emails through *The Guardian* online (including comments from some of the protagonists) and in book form. Pearce (2010e, p. 125) suggests that many of the emails reveal 'strenuous efforts by the mainstream climate scientists to do what some outside observers would regard as censoring their critics'. He notes that the scientists claim they were merely upholding scientific standards by trying to prevent the publication of poor science. But Pearce (2010c) finds that

[119] Of course, it could be argued that the fundamentals of climate change are understood and agreed by the vast majority of scientists and that the so-called dissent is actually contrarian posturing.

‘either way, when passing judgement on papers that directly attack their own work, they were mired in conflicts of interest that would not be allowed in most professions’.

Scientists have addressed these allegations. Le Page (2009) argues that attempting to block papers from scientific journals does not amount to the suppression of information: rejected papers or views can still be published online, in newspapers or in popular books. Top rank scientific journals reject most of what gets sent to them before any peer-review process. If peer-review journals are supposed only to publish the best science that makes a contribution to the field, rejecting substandard science is a crucial and legitimate function of the scientific process. Stefan Rahmstorf (in Pearce 2010c; 2010e, p. 136) argues that:

> No scientist would advocate keeping scientifically well-founded, differing viewpoints out of the peer-reviewed literature. But keeping politically-motivated papers with flawed methodology out of the scientific record is the professional duty of all scientific reviewers.

Indeed, scientists point out that the publication of flawed science would raise questions about the role and capacity of editors at particular journals. Many of the climate scientists in the emails felt that a particular editor at *Climate Research* and well-known climate sceptic, Chris de Freitas, was not doing his job properly (Le Page 2009; Rahmstorf in Pearce 2010e, p. 136). Hans von Storch (2009; see also Pearce 2010e, pp. 134-137), a climate scientist who has been critical of Mann, resigned as editor-in-chief of *Climate Research* because he felt that poor science had been published and the journal publisher would not allow him to correct the record.

The *Russell Review* into the ‘Climategate’ emails also addressed the peer-review process and the accusation that climate scientists had illegitimately censored views that were critical of their own perspective and prevented their publication in the peer-reviewed literature; threatened editors; organised mass resignations from the editorial boards of journals that published sceptical articles; and blacklisted allegedly non-compliant journals. Although I treat the *Russell Review* as an aspect of official channels, I include this section here as it deals with the specific peer-review allegations.

In an attempt to gain an objective and realistic appraisal of the peer-review process including the role of reviewers and journal editors, particularly in relation to contentious issues, the

Russell Review relied in part on outside input from Richard Horton, editor of *The Lancet*, a top-rank peer-reviewed general medical journal. Horton (in Russell 2010, pp. 126-43) submitted an essay on the various aspects of peer-review that was included as appendix 5.

Horton (2010, p. 134) observes that 'Science does not exist in a political vacuum' and that scientists are not neutral observers. It is only natural that they may be strong advocates for a particular position. Consequently, Horton (2010, p. 133, ellipsis added) explains that in controversial issues under peer-review:

> it is common for editors to have multiple, intense, and sometimes sharp interactions with authors and reviewers. Publication matters. Authors and reviewers are frequently passionate in their intellectual combat over a piece of research. The tone of their exchanges and communications with editors can be attacking, accusatory, aggressive, and even personal. If a research paper is especially controversial and word of it is circulating in a particular scientific community, third-party scientists or critics with an interest in the work may get to hear of it and decide to contact the journal. They might wish to warn or encourage editors. This kind of intervention is entirely normal. It is the task of editors to weigh up the passionate opinions of authors and reviewers and to reflect on the comments (and motivations) of third parties. To an onlooker, these debates may appear as if improper pressure is being exerted on an editor. In fact, this is the ordinary to and fro of scientific debate going on behind the public screen of science. Occasionally, a line might be crossed … Defining that line is the crucial task when judging the role of CRU scientists.

Horton (2010, p. 135) states that the line 'between vigorous scientific exchange and improper attempts to close down debate … can be remarkably close'. However, Horton (2010, pp. 135-36) also points out that it is not just scientists who may influence the peer-review process. Political and economic interests can intrude into the peer-review process and that this may have a 'chilling' effect on scientific research by inducing a degree of self-censorship amongst scientists working in controversial areas, presumably where their research may lead to conclusions that are inconvenient for powerful interests.

The *Russell Review* looked in detail at three incidents: firstly, the Soon and Baliunas (2003) paper that repudiated the findings of the Mann et al (1998, 1999) papers, and the controversy over its publication in the journal *Climate Research*; secondly, the conflict with Sonja

Boehmer-Christiansen, editor of *Energy and Environment*, the journal that published the two longer McIntyre and McKitrick (2003, 2005a) papers; and thirdly, Briffa's editorship of *Holocene*. Bearing in mind the evidence of Horton regarding robust positions taken in contested areas of science, the review found no evidence in any of these cases that either peer-review or editorial processes had been subverted by climate scientists (Russell 2010, p. 13).

Still, public perceptions are critical. The public accountability of science has become increasingly important because stakeholder interest in scientific findings has increased considerably as public funding of science has grown and also as scientific findings can have significant economic and social policy outcomes (Jasanoff 2010). Sheila Jasanoff argues that scientific procedures such as peer-review have generally been sufficient to allow scientists to communicate with each other 'at face value' by weeding out obvious mistakes and thereby establishing credibility within scientific fields. Yet peer-review lacks public accountability and it is difficult for outsiders to determine whether papers have been blocked for scientifically legitimate reasons or not. The impression of climate scientists being able to block critical publication by exercising their authority behind the scenes has backfired because public trust in climate science has been damaged. Indeed, part of the outrage generated by 'Climategate' arose not so much from the exposure of previously hidden processes, but from the perception, amplified by critics, that routinely hidden scientific procedures were widely abused. The *Russell Review* determined that these allegations were unfounded.[120] Even though peer-review may be necessary, it is not designed to be publicly accountable, and therefore may be insufficient to rebuild trust and credibility with citizens. These issues are explored further in the sections on official channels and reinterpretation.

Critics assert that Mann deliberately withheld data that indicated his conclusion were overstated or untenable. Wegman (2006, p. 51) who produced a report for the Barton congressional investigation was 'especially struck' by Mann's unwillingness to disclose his data and methodology. Rapp (2008, p. 78) notes that McIntyre discovered a secret file of censored data that Mann had hidden for seven years. Rapp states that Mann knew beforehand that his study was compromised and yet he hid the negative findings that contradicted his

[120] Critics such as Montford (2010b, pp. 6-8, 37-51) argue that the *Russell Review* failed to thoroughly investigate specific breaches of the peer review process.

preferred conclusions and instead published on the basis of flawed statistics. Rapp implies that covering-up the failed r^2 verification statistics amounted to deliberate deception. Furthermore, Rapp (2008, p. 98) notes that after his work was criticised, Mann defended his findings. McIntyre and McKitrick (2005a, p. 70) note that Mann has refused to release all his source code or supporting calculations. This behaviour appears to contravene the scientific method and implies Mann withheld his code to prevent the exposure of flawed methods and statistics. In essence, critics allege that Mann covered up flaws in his method to protect his findings from adverse criticism.

With regard to data disclosure, Horton (in Russell 2010, p. 136) says that providing access to raw data would be 'highly unusual', but that this is now being debated more openly in the scientific realm. The House of Commons Science and Technology committee in the UK looked at the data disclosure practices of Phil Jones at the CRU, a co-author with Mann of paleoclimate scientific papers. Although they found the actions of Jones regarding data disclosure were in line with common practice in the climate science community, they considered his actions were counterproductive and that full disclosure of data and methodologies including computer codes would have alleviated many problems (House of Commons Science and Technology Committee 2010, pp. 3, 14, 18-19). The Committee (2010, p. 34) deemed unacceptable an apparent culture of withholding information and resisting disclosure that had taken hold in the CRU. Disputes over data access, as well as distinctions between auditing data and replicating studies, is discussed further in the section on reinterpretation.

The House of Commons Committee concluded that scientific conduct such as non-disclosure of data, whether in line with currently accepted practices or not, had significantly damaged the reputation of climate science. In other words, scientific behaviour toward critics had backfired because it looked bad when exposed to the general public. Cover-up is outside the norms of proper scientific behaviour and democratic debate. The impression that scientists have engaged in aspects of cover-up such as blocking opposing views and hiding inconvenient evidence is therefore highly detrimental to scientific credibility.

Official channels

Official channels are typically the preserve of institutions such as governmental authorities. In many of the cases studied by Martin, governments use official channels as a means of reducing concern over an injustice. For example, the announcement of an investigation can diffuse anger about an injustice. Typically, when the investigation is concluded, much of the original uproar has dissipated and the energy of activists has been sapped by participation in drawn-out official proceedings. Official channels are a central part of science too. They have been used in the climate change debate by scientists and scientific institutions both to build legitimacy for their findings and also to investigate and allay concern over allegations of scientific malpractice. In addition, critics have also been able to use official channels to attack climate science.

Much of the scientific process itself is an official channel, including the process of peer-reviewed scientific publication, the deliberations of scientific organisations such as a National Academy of Science, and the scientific assessment reports of the IPCC. These official channels are a routine and accepted part of science. The endorsement of a prestigious scientific body provides legitimacy to the findings of climate science and help build scientific authority. Official channels are also used in the form of scientific panels and investigations into areas under dispute and their findings may be used as proof that high standards of scientific practice were upheld in the areas under investigation. These official channels imbue scientists and their professional institutions with a lot of power. Consequently, one might expect that in a strategic engagement, particularly with stakeholders from outside the scientific arena, scientists would just play it straight, avoid improper procedures or methods such as cover-up, deception or devaluation that have the potential to backfire, and instead rely on official channels to exert authority and achieve dominance in a debate.

Because official channels are an accepted part of the scientific process, there is little point in criticising the use of official channels per se. Instead, critics are generally restricted to pointing out instances where official channels may have been biased, or used inappropriately or unfairly, for example to promote the orthodoxy, exclude rival viewpoints, or cover up mistakes or instances of malpractice. If critics can demonstrate that the rules of official channels have been breached, this may trigger outrage towards the scientific orthodoxy.

Various aspects of official channels have been used by both sides in the debate, and they have been used for different purposes. I first look at the IPCC, followed by peer-reviewed publication, official investigations of the 'hockey stick', allegations of improper procedures, and the official investigations into 'Climategate'.

The IPCC

The IPCC is a crucial official channel for communicating the overall state of climate science to other stakeholders such as governments, the media and the public. Over four assessment reports, the IPCC has distilled the state of the science from the peer-reviewed literature. The IPCC has built a reputation for thoroughness, impartiality and caution, and this reputation has given it the legitimate authority to speak on behalf of climate science.

The 'hockey stick' graph and the conclusions of Mann et al (1999) featured prominently in the Summary for Policymakers (IPCC 2001, p. 3), typically the only section of the whole report that is widely read. It seems reasonable to conclude that senior scientists working on the IPCC summary report decided to give the 'hockey stick' prominence over the other lines of evidence available at the time. The authority of official channels – in this case the IPCC Summary for Policymakers – was used to convey the preferred message about recent anomalous warmth.

Given that the IPCC is the foremost legitimate means of conveying official scientific information, this is a powerful tool for ensuring a dominant view. In effect, critics can only challenge it by arguing that there are specific instances where this authority has been used improperly and selectively.[121] The claim that the IPCC misrepresented the state of scientific complexity with regard to the paleoclimate reconstructions is covered in the section on misrepresentation.

Peer-review publication

Peer-review journal publication is an authoritative aspect of scientific official channels. Once an article is published, it can be used to support a particular perspective and rebut criticisms

[121] Of course, corporate-funded think tanks, front groups, dissident scientists, and individual bloggers can simply deny the science and claim that the IPCC is entirely corrupt.

from opponents. Michael Mann has been very productive over the last decade as lead author and co-author of numerous paleoclimate reconstructions. Using a variety of proxy data and different methods, these reconstructions reaffirm both the robustness and findings of previous proxy-based climate reconstructions (e.g. Mann and Jones 2003; Rutherford et al 2005; Mann et al 2007). One of the key arguments reiterated by many climate scientists, and by the NAS (2006) Report, was that the original 'hockey stick' had been replicated through numerous other studies. The fact these studies have appeared in the peer-review literature has leant considerable weight to scientific claims that current temperatures are anomalous.

Wahl and Ammann (2007) has been cited by proponents as vindication of the findings of Mann et al (1998, 1999) and a decisive rebuttal of the critiques by McIntyre and McKitrick. For example, in a written reply to initial requests from Chairman Barton, Mann (2005b, pp. 7, 8, 9) referred to the forthcoming paper in *Climatic Change* by Wahl and Ammann as evidence that supported his findings and rebutted those of McIntyre and McKitrick. The IPCC (2007a, p. 466) also cited Wahl and Ammann (2007) as confirmation of the original Mann et al 'hockey stick' (and, by implication, of the previous IPCC report), as well as a substantive rebuttal of key criticisms made by McIntyre and McKitrick. Wahl and Ammann (2007) was important precisely because it was peer-reviewed. The fact that it has not been refuted in the peer-reviewed literature is used by climate scientists as a powerful reminder that its critics are unable to mount a credible scientific argument against it.

Allegations of improper procedure regarding Wahl and Ammann

Although critics have been unable to directly challenge or refute the science behind the 'hockey stick' in the peer-reviewed literature, critics allege improper procedure regarding the treatment of Wahl and Ammann at the stage of both journal review, and inclusion of the paper for review by the IPCC in the *AR4*. These allegations about the improper use of official channels are used by critics to undermine not just the credibility of Wahl and Ammann and Mann et al, but the IPCC as well.

Wahl and Ammann came to prominence when the University Corporation for Atmospheric Research (UCAR) in Boulder, Colorado issued a press release on 11 May 2005 stating that

two new papers had ‘found the MBH [Mann et al] method is robust even when numerous modifications are employed’. Furthermore, the press release announced that:

> Ammann and Wahl’s findings contradict an assertion by McIntyre and McKitrick that 15th century global temperatures rival those of the late 20th century and therefore make the hockey stick-shaped graph inaccurate. They also dispute McIntyre and McKitrick’s alleged identification of a fundamental flaw that would significantly bias the MBH climate reconstruction toward a hockey stick shape. Ammann and Wahl conclude that the highly publicized criticisms of the MBH graph are unfounded (UCAR 2005).

This statement appeared to be a decisive rebuttal of the criticisms made by McIntyre and McKitrick.

However, the two related papers – Wahl and Ammann, and Ammann and Wahl – were not peer-reviewed published claims at that time. The UCAR press release was about the submission of two papers to the journals *Geophysical Research Letters* and *Climatic Change*. Critics such as Montford (2010a, p. 202) note that this was an unusual step to take. Furthermore, as Martin (1991b, p. 47) observes, a pre-publication media release:

> is contrary to the traditional view that scientists should present their work in scholarly venues (journals and conferences) before any reporting in the mass media occurs.

Pre-publication media publicity has the potential to backfire as it becomes easier for the critics to accuse scientists of improper behaviour by implying that the issue is ‘being touted more in the manner of a public relations exercise than a carefully considered scientific discussion’ (Martin 1991b, p. 47).

Critics also allege senior IPCC scientists misled politicians about the status of the two Wahl and Ammann papers. *Geophysical Research Letters* rejected the paper by Ammann and Wahl. Montford (2010a, p. 213) argues that the rejection of this paper was significant because it ‘contained the statistical arguments to support the assertions’ made in the other paper. Yet according to McIntyre (2006) and Montford (2010a, pp. 207-08), the two papers – one of which was rejected and the other which was under review at that time – were still cited in July 2005 by Sir John Houghton in testimony before the US Senate in defence of the findings of the IPCC and as a refutation of McIntyre and McKitrick. McIntyre reproduces

Houghton's testimony where Houghton responds to questions from two senators and describes the papers as 'in review' and 'in press' respectively. Wahl and Ammann (2007) and Ammann and Wahl (2007) went through a protracted review process, and eventually both papers appeared in *Climatic Change*.

Questions have also been raised about the procedures for accepting the Wahl and Ammann papers in the IPCC *AR4*. Because the Wahl and Ammann paper submitted to *Climatic Change* critiqued McIntyre and McKitrick, Stephen Schneider, editor of *Climatic Change*, asked McIntyre to review the paper. McIntyre had recommended rejection based on what he saw as severe flaws and a flouting of the journal data policy: McIntyre (in Montford 2010a, pp. 206-207) accused Wahl and Ammann of withholding adverse verification statistics. McIntyre was not invited to review the resubmitted paper which was provisionally accepted on 12th December 2005. The 'in press' cut-off date for inclusion in the IPCC *AR4* was 15th December. Yet, Montford claims that the paper was substantially revised after provisional acceptance to include the verification statistics: the statistics that showed Wahl and Ammann and Mann et al failed the r^2 verification. According to Montford (2010a, p. 217), this meant:

> the version of the paper that had gone forward to the IPCC didn't include the adverse verification statistics, but the version accepted by the journal did.

Critics point out that the Wahl and Ammann paper could be used as a vindication of the 'hockey stick' in the IPCC report, but the IPCC could ignore the adverse verification statistics because they did not receive them. Critics imply that scientists had the power to bend the rules in their favour when it suited them: they could ensure supporting evidence got through the peer-review process and could be included in IPCC reports.

The dispute over the use of official channels has a similar pattern to that regarding the allegations around the blocking of opposing views in the section on cover-up.[122] The critics are unable to gain publication access to the peer-reviewed literature. In both cases, critics point to instances of apparent malpractice. Although scientists are in a powerful position to ensure that their perspective on the science is dominant because they control the main

[122] See chapter 7, pp. 246-251.

components of official channels, a failure to play by the rules – or be seen to do so – has the potential to damage that reputation and undermine the credibility of the scientific message.

Official investigations

Barton and the Wegman report

The *Wegman Report* on the 'hockey stick' was commissioned by the US Congressional chair of the House Energy and Commerce committee, Joe Barton. Critics have used the findings of the *Wegman Report* to undermine the credibility of climate science. Critics argue that the 'hockey stick' was a key piece of evidence for climate change and its reliability has been destroyed by the findings of the Wegman panel. Furthermore, critics have taken the social network analysis in the *Wegman Report* to assert that climate science has been dominated by an incestuous group of paleoclimate researchers with a politically pre-determined position on climate change who have dogmatically defended their theories against reasoned criticism. Many of these assertions were aired in the industry chapter that analysed the methods of the Lavoisier Group and the media commentators.[123] The Barton investigation and the use made of the *Wegman Report* show how official channels can sometimes be used as a method of attack to arouse concern rather than serving their more customary role of defusing concern.

Alleged improper use of official channels by Barton

From the outset, senior politicians and scientists objected to the nature of the Barton investigation into the 'hockey stick'. Sherwood Boehlert, the Republican Chairman of the US House Committee on Science, drew a distinction between the process of scientific investigation that his Science committee could instigate and what he regarded as a political inquisition by the Chair of the Energy and Commerce committee. In a letter to Barton, Boehlert (2005) objected strongly to 'the misguided and illegitimate investigation', describing the approach as 'chilling', and that it:

> raises the specter of politicians opening investigations against any scientist who reaches a conclusion that makes the political elite uncomfortable.

[123] See chapter 5, pp. 156-187.

Boehlert regarded the Barton investigation as a dangerous precedent and pointed out that the investigation was completely unnecessary as the Mann et al papers had already ‘prompted a spirited and appropriate debate in the scientific community’. Consequently, Boehlert could only conclude that ‘the only conceivable explanation for the investigation is to attempt to intimidate a prominent scientist’ in the hope of silencing inconvenient scientific findings.

Climate activists have also raised questions about the instigation and operation of the Wegman panel. Deep Climate (2010) casts doubt on the independence of the *Wegman Report*. He points out that according to Wegman’s colleague Yasmin Said (2007), Wegman was originally approached about conducting the investigation by Dr. Jerry Coffey on 1st September 2005. Coffey is a statistical expert, but is also a ‘Tea party’ Republican and convinced climate sceptic (Deep Climate 2010). Wegman subsequently received large quantities of materials for review from Energy and Commerce Republican staffer Peter Spencer (Said 2007). Moreover, the approach adopted by Wegman does not appear impartial: Wegman (2006, p. 29) worked with McIntyre to reproduce the criticism of the ‘hockey stick’, but made no attempt to contact Mann or his colleagues regarding the original reconstruction (Mann 2006). According to Deep Climate (2010), the fact that Wegman was sounded out by a sceptic and that the panel had its information channelled by a Republican staffer indicates that the investigation was biased from the beginning.

Furthermore, climate scientists have noted that the Wegman panel did not have scientific expertise and it was given a very specific remit: it was asked only to assess whether the challenge by McIntyre and McKitrick had statistical merit. RealClimate (2006b) point out that the panel failed to ask whether the statistical challenge made any material difference to the results. As we have seen, Wahl and Ammann found that the statistical challenge may have some merit, but it was largely immaterial to the results. This implies that one of the key findings of the Wegman panel – that the statistical challenge was valid – was itself largely immaterial to the scientific findings.

Official channels are the preserve of the establishment such as governments and their officials, and scientific institutions. In this sense, they are a relatively exclusive tactic. Only a powerful political player such as Barton would have been able to challenge the science in this way. Normally, official channels are used by the dominant power as a means of allaying

concern over an injustice. The Barton investigation illustrates a reverse process where official channels were used to attack a particular party and amplify outrage about their conduct.

Climate activists, climate scientists and the scientific establishment responded in three main ways. Firstly, climate activists and politicians challenged the legitimacy of the attack by questioning its independence and asserting that it was politically motivated attempt to intimidate scientists into silence. Secondly, climate scientists pointed out the limitations in the investigation such as its failure to address the scientific merit of the statistical challenge. Thirdly, politicians and the scientific establishment responded with their own official investigation as a scientific counter-point to the political and statistical investigation.

Scientific panels: The NAS

Both sides of the 'hockey stick' dispute have cited different aspects of the NAS investigation to support their case. Proponents of the 'hockey stick' such as the scientists at RealClimate (2006a) point out that the NAS agreed with the main findings of the original Mann et al analysis. RealClimate note that the NAS (2006, p. 119) recognised the uncertainties expressed in Mann et al (1999) such as the moderate confidence (66-90 per cent) about their own conclusions, and caveats and greater error bars for their data prior to 1600. RealClimate also point out that the NAS (2006, p. 109) acknowledged that the original work has been supported by numerous other reconstructions over the ensuing period.

Furthermore scientists refer to the in-depth treatment of verification statistics in the NAS (2006, pp. 83-97) report as confirmation that the validation statistics used in paleoscience are appropriate (e.g. RealClimate 2006a; Schmidt in Tamino 2010, #168). RealClimate (2006a) argue that the NAS report favoured the selection of verification statistics (RE and CE) generally used in the paleoclimate field, and dismissed 'without merit the use of simple correlation coefficients' such as r^2. Proponents therefore use the NAS report to argue firstly that the conclusions and inferences drawn by Wahl and Ammann and Mann et al are valid and based on sound science and statistics, and secondly that the statistical criticisms of McIntyre and McKitrick are spurious and without merit.

Nevertheless, the statistical dispute continues. According to critics, Wahl and Ammann's work is unsuitable for assessing historical climate and useless as a substantiation of Mann et

al. Montford (2010a, p. 216) claims that the failed r^2 statistics for Wahl and Ammann 'demonstrated finally and conclusively that the MBH98 [Mann et al 1998] reconstructions were not reliable'. Yet the NAS report does not support such a claim. The struggle conducted on the blogs over what the verification statistics mean for climate science is covered in more detail in the section on reinterpretation.[124]

The NAS report was an official scientific inquiry and most of its findings could be read as supporting the Mann et al reconstructions. Critics have therefore tended to argue the NAS investigation was biased. Montford (2010a, p. 234) accuses the NAS of political manoeuvring. He alleges Ralph Cicerone significantly rewrote the panel's task, and thereby redirected the NAS panel away from the original awkward questions posed by Boehlert in his requisitioning brief. Such an interpretation is supported by the Wegman (2006, pp. 64-65) report which reproduces the two sets of questions and notes that the NAS decided to refocus on broader issues rather than specific questions.

Montford (2010a, pp. 229-31; see also Holland 2007, pp. 959-60) also argues that the NAS panel was hardly impartial, and therefore breached its own guidelines. He notes that several panel members had connections to Mann, and implies that Doug Nychka from UCAR had a conflict of interest: he was a panel member and statistical expert, but he had also been consulted for the Wahl and Ammann paper (Montford 2010a, p. 242). Furthermore, critics note that on several occasions, the NAS panel failed to pursue seemingly pertinent issues and avoided difficult questions. For example, Montford (2010a, pp. 241-43) states that the statistical experts on the panel, including Nychka, failed to question Mann about his r^2 statistics, or the fact that Mann appeared to mislead the panel about not having calculated the r^2 statistics.

Critics also observe that seemingly crucial findings and admissions from the body of the report did not make it into the all-important summary at the beginning. Strip-bark bristlecones were the main proxy of contention in the Mann et al reconstructions and without them, McIntyre and McKitrick argued that the 'hockey stick' in the proxy data disappeared. In the body of its report, the NAS (2006, p. 52) conceded that '"strip-bark" samples should be avoided for temperature reconstructions'. This would seem to invalidate the findings of Mann

[124] See later this chapter, pp. 270-274.

et al and subsequent paleoclimate reconstructions that used them. But this finding did not appear in the summary. Indeed, the NAS summary noted that the Mann et al reconstruction was supported by several other reconstructions that showed similar findings. Yet, critics point out that of the other reconstructions shown by the NAS report, ‘all except one included bristlecone pines in their proxy rosters’ (Montford 2010a, pp. 246-47). As Montford (2010a, p. 247) observes, the panel managed to reconcile a recommendation that strip-bark bristlecone pines were unacceptable as proxy indicators with support for a range of reconstructions that used them. The position of the NAS therefore appears self-contradictory.

By failing to specifically address the criticisms of McIntyre and McKitrick and provide clear answers, the NAS panel provided some comfort for both sides and left the debate open. Proponents were able to point to the fact that the NAS substantiated the key findings of Mann et al. By contrast, critics asserted that the NAS only provided the appearance of investigation, whilst concealing some inconvenient points (Montford 2010a, p. 248). This allegation parallels the general findings of Martin (2007a) about the use that powerful players make of official channels: as a means of dispelling disquiet by giving the appearance of addressing the issues of concern.

‘Climategate’ investigations

The University of East Anglia (UEA) which houses the CRU set up two official investigations into ‘Climategate’: a *Scientific Assessment Panel* chaired by Lord Oxburgh and *The Independent Climate Change E-mails Review* headed by Sir Muir Russell. The two investigations indicate the power of the establishment to set up official investigations, determine their terms of reference, and select the panel heads and members.

The Oxburgh Panel

The Panel chaired by Lord Oxburgh found ‘no evidence of any deliberate scientific malpractice in any of the work of the Climatic Research Unit’. This appears to be a substantial vindication of climate scientists, and these findings can be used to reassure the various stakeholders and the public that the conduct of climate scientists meets recognised standards for the conduct of scientific research.

However, critics have raised shortcomings associated with the investigation, in particular the selection of Panel members, and changes to the Panel's terms of reference. Firstly, Montford (2010b, pp. 29-30) argues that Oxburgh had a conflict of interest and that the Panel was biased towards scientists that had a pre-determined position on anthropogenic global warming.

Secondly, contrary to the expectations of the House of Commons Science and Technology committee (2010, p. 7, no. 10) and the express announcement by Edward Acton Vice-Chancellor of the UEA (in House of Commons Science and Technology committee 2010, p. 36), the Oxburgh Panel was not given a remit to examine the science undertaken by the UEA. Instead the narrow focus was on whether climate scientists had committed malpractice (Harrabin 2010; Oxburgh 2010, p. 1). According to critics such as Montford (2010b, pp. 31-36), this restricted focus meant that crucial areas of CRU paleoclimate science such as the apparent failure of the CRU to update the Polar Urals chronology remained unexamined.[125]

Furthermore, Montford (2010b, pp. 31-32) argues that the Oxburgh Panel's remit was narrowed to avoid a thorough investigation into how CRU paleoclimate science was presented by the IPCC. This allegation is covered in the section on misrepresentation.

The Muir Russell Review

The *Muir Russell Review* answered many of the allegations arising from the 'Climategate' email release. One of the most important aspects of the 'hockey stick' controversy is the issue of peer-review. In many cases of injustice, perpetrators launch official investigations with the aim of dissipating outrage. Even if the investigation finds fault with the perpetrator and makes specific recommendations, by this stage powerful players have evaded much of the initial furore and can avoid implementing some of the more onerous recommendations. However, in this instance, the *Russell Review* exonerated climate scientists of inappropriate interference in the peer-review process and made no recommendations for changing the system. Proponents can therefore use the *Russell Review* as vindication of the actions of climate scientists in this regard.

[125] The critics' angle on the dispute over the Polar Urals chronology is covered in Montford (2010a, pp. 270-277).

Devaluation and validation

Martin (2010, p. 234) observes that although derogatory comments by scientists and even vicious attacks are commonplace behind the scenes, ‘public attacks on opposing scientists are a serious violation of expectations for behaviour in science, and can be counterproductive’. Nevertheless, devaluation by scientists has been a feature of the ‘hockey stick’ controversy and the wider climate change debate. Several factors may have contributed to the relatively prominent role of devaluation. Firstly, unlike controversies conducted wholly within the scientific realm, McIntyre and McKitrick are from outside the scientific field. Accordingly, scientists may have viewed the ‘auditors’ and their work as more acceptable targets for devaluation. Secondly, the controversy has not been restricted to the scientific realm: much of the debate has been conducted on weblogs where the rules of conduct are more lenient. Finally, ‘Climategate’ has made public what were once private behind the scenes remarks revealing a host of derogatory comments directed towards critics by climate scientists.

Devaluation of critics by scientists

Scientists have made various points regarding critics including that they are amateurs who have failed to publish in peer-reviewed scientific journals and appear unwilling to do so, that they are not genuinely sceptical because they fail to question the assertions made by others on their own side, that their criticisms are spurious, and that their critiques serve the fossil fuel-funded conservative think tanks. Proving that an argument is wrong, or pointing out that certain sceptical arguments lack credibility is not devaluation. Likewise, demonstrating that people have links to conservative think tanks is not devaluation. However, there is often a fine line between pointing out hidden interests and casting aspersions and ad hominem attacks.

For example, scientists frame themselves as the experts and frame their research as authoritative in terms of the legitimacy conferred by peer review. Challengers may be framed as amateurs and non-experts operating outside the legitimate authority of peer-review. Although this may be true, critics may claim that this unfairly devalues the contribution of those outside the field.

Mann is one of the members of the RealClimate website that blogs on climate change. The RealClimate blog has allowed Mann and others to respond to criticism in a much more forthright way than would be acceptable in a peer-reviewed paper (e.g. Mann 2004a, 2004b, 2005a; RealClimate 2009). This has provided the paleoclimate group and their defenders with access to a wider range of methods. For example, it may be possible to devalue an opponent on a weblog, but this would risk destroying a career if conducted within the more narrow confines of the scientific arena. The choice of arena is therefore a critical factor in choosing methods to respond to allegations and rebut challenges.

Nevertheless, some blog commentators (e.g. Curry 2009a, Curry in Tamino 2010, #168, #468) have remarked on the tone of the exchanges and have accused climate scientists on the RealClimate blog of tribal defensiveness and an over-reliance on sarcasm and ridicule. It is not my intention to determine whether climate scientists have used devaluation against their opponents. What may be more relevant is noting the impact that the rhetorical tone and methods used by climate scientists have on observers and other participants. Clearly climate scientists are being frustrated by many of their opponents who surely recognise the value of goading climate scientists into intemperate remarks. Furthermore, devaluation is particularly risky when the targets, such as McIntyre and McKitrick, are professional people. These people are not defenceless and have a degree of credibility derived from their professional skills and expertise.

The following two examples are from blog exchanges where generally sympathetic participants have identified the potential for devaluation, in particular ridicule and sarcasm, to backfire against climate scientists. The first was in response to an inflammatory blog by James Delingpole (2009, emphasis original) in the UK *Daily Telegraph* titled ‘How the global warming industry is based on one MASSIVE lie’. Delingpole concluded global warming is a hoax based on fraudulent science that included both the ‘hockey stick’ and the Yamal tree ring series by Briffa. In a response, the group at RealClimate (2009, emphasis original) made several pertinent points, but also counter-attacked by labelling McIntyre as the ‘self-styled slayer of hockey sticks’. They also reframed McIntyre’s role in the controversy, arguing that he has failed to take responsibility for his actions or play a constructive role in

the debate, and drew links between McIntyre's behaviour and the more outrageous position taken by critics such as Delingpole:

> What *is* objectionable is the conflation of technical criticism with unsupported, unjustified and unverified accusations of scientific misconduct. Steve McIntyre keeps insisting that he should be treated like a professional. But how professional is it to continue to slander scientists with vague insinuations and spin made-up tales of perfidy out of the whole cloth instead of submitting his work for peer-review? He continues to take absolutely no responsibility for the ridiculous fantasies and exaggerations that his supporters broadcast, apparently being happy to bask in their acclaim rather than correct any of the misrepresentations he has engendered. If he wants to make a change, he has a clear choice; to continue to play Don Quixote for the peanut gallery or to produce something constructive that is actually worthy of publication.
>
> Peer-review is nothing sinister and not part of some global conspiracy, but instead it is the process by which people are forced to match their rhetoric to their actual results. You can't generally get away with imprecise suggestions that something might matter for the bigger picture without actually showing that it does. It *does* matter whether something 'matters', otherwise you might as well be correcting spelling mistakes for all the impact it will have.
>
> So go on Steve, surprise us.

The first response to this blog (Sean #1) stated:[126]

> I love this blog, but I have to say that the dripping sarcasm and condescension evident in your tone here does the world of true science no favors when it comes to the public. I understand the frustration, but we can never give pseudo-scientists a toe-hold, especially an emotional one.

In the second example, a similar charge is levelled at Schmidt (2010) after he posted a piece on RealClimate titled 'Whatevergate'. Schmidt criticised the media for 'bad reporting, misrepresentation and confusion' about 'Climategate' summing it up as 'So far, so stupid'. Schmidt also attacked *The Guardian* for 'digging up baseless fraud accusations against a scientist at SUNY that had already been investigated and dismissed'. Presumably this refers

[126] Responses on this thread can be found under RealClimate (2009).

to environment reporter Fred Pearce and his 'Climategate' investigative series, part of which covered fraud allegations against veteran climate scientist, Professor Wei-Chyung Wang at the University of Albany, State University of New York (SUNY). The University exonerated Wang after finding 'no evidence of the alleged fabrication of results' (Videka n.d.). Still, the attack on *The Guardian* by Schmidt is risky, firstly because SUNY University refused to disclose the details of its in-house investigation into Wang, and secondly because the leaked 'Climategate' emails show that the former head of the CRU, Tom Wigley, was also concerned about Wang's scientific conduct and about the way that the University of Albany conducted its investigation (Pearce 2010b; Wigley 2009).[127] Schmidt concluded his piece by stating that 'Climategate' is likely to be a 'bump' in the road, rather than a major problem. Richard Tol (#29),[128] an economist who works on the economics of climate change,[129] responded to Schmidt (2010):

> Wishful thinking. It takes years to build a reputation, days to destroy it. More worryingly, I note that you are set in your way: Ridicule those that do not agree with you. That worked, sort of, until November. Not any more. If you care about climate policy, it is time to change your tune.

Many blog participants, including climate scientists such as Curry, have called for polite and logical responses to sceptics, as opposed to devaluation and ad hominem attacks. Nevertheless, this is not as simple as it sounds. Firstly, climate scientists such as Schmidt (in Tamino 2010, #168) accuse Curry herself of insulting insinuations based on a failure to grasp the fundamentals of the dispute and a too-trusting attitude towards critics and their motives. Secondly, part of the difficulty for scientists arises from trying to separate legitimate

[127] Although the details of this controversy are beyond the scope of this research, a brief summary is given here. Wang was a co-author with Phil Jones of a seminal study on the magnitude of the urban heat islands on temperature data. Jones et al (1990) found that the urban heat island effect on temperature records was negligible. The paper was a key reference in the IPCC 2001 (pp. 105-06) *Third Assessment Report* that concluded the urban heat island effect was indeed negligible (see IPCC 2001, p. 106, Box 2.1: Urban Heat Island and the Observed Increases in Land Air Temperature). The paper used data from Chinese weather stations and claimed that most of the stations had not moved. Wang was responsible for the compilation of Chinese weather station data. In the *Energy and Environment* journal, Douglas Keenan (2007) accused Wang of fraud by fabricating some of the Chinese weather data. Keenan also accused Jones of covering up flaws in the research. *Guardian* columnist, George Monbiot (2010), also pointed out that the otherwise thorough *Russell Review* did not deal adequately with these allegations. The online article by Pearce (2010b) features inline comments and competing interpretations of the controversy by climate scientist Schmidt and critic Keenan.

[128] Responses on this thread can be found under Schmidt (2010).

[129] For a biography, see Tol (2010).

challenges that would clarify points and improve understanding from deliberate contrarian time wasting and confusion. This may sometimes be an impossible task and certainly requires large amounts of energy. Many challenges have been convincingly refuted and similar ongoing challenges can therefore be seen as deliberate attempts to mislead. On the other hand, challenges that have merit require an adequate response rather than an attempt to minimise the problem. Thirdly, climate scientists have been subjected to a sustained and seemingly co-ordinated public attack from critics and deniers (see industry chapter).[130] More sinister abuse including death threats occurs behind the scenes (covered in the section on intimidation).[131]

Scientists are therefore in a difficult position. The apparent disconnect between the revelations in the emails and the way that the public typically perceives scientific conduct – as the disinterested assessment of competing theories – may explain some of the shock that the 'Climategate' emails elicited regarding how science is actually conducted and what is said behind the scenes. The 'Climategate' emails reveal that scientists are no different to anyone else: they denigrate their critics and rivals in private just as much as the rest of us.[132]

What are the options for scientists who are attacked and devalued? Emails sent by other climate scientists to Phil Jones in the wake of the Keenan fraud allegations are interesting because they illustrate scientists canvassing three potential responses to criticisms and attacks. Michael Mann (2007) suggests ignoring the attacks, Kevin Trenberth (2007) suggests a counter-attack, and two years later, Tom Wigley (2009) suggests acknowledging a mistake. These options correspond quite closely to the three potential responses to criticism identified by Martin (2011): ignoring attacks, counter-attacking, and rational response.

Martin argues that a better understanding of strategic engagement will enable the best choice of response to criticism. Martin (2011, pp. 4-5) cautions against counter-attack because it is unlikely to win over those observers who have not made up their mind on the issue. Given that the response of observers is a central part of the climate change debate, devaluation of

[130] See chapter 5, pp. 142-187.
[131] See pp. 274-275.
[132] Pearce (2010a) notes that Mann made several derogatory email comments about climate scientist Hans von Storch during 2005. In an article in the *Wall Street Journal* after 'Climategate', Storch (2009) returned the compliment and likened certain paleoclimate scientists to the sceptics in terms of their 'methods and contempt'.

critics is potentially counter-productive. Instead, Martin recommends either ignoring the criticism or rational response depending on the circumstances. Ignoring criticism 'is usually best when the critics have little credibility or visibility compared to the person being attacked' (Martin 2011, p. 3). However, Martin (2011, p.3) points out that not responding is risky 'if the critics are high-profile and their criticisms are reported in widely read outlets'. For example, although Keenan is not a high-profile figure, his fraud allegations have been published in a peer-reviewed social science journal and broadcast through the think tank (i.e. Heartland Institute) and front group network (i.e. Lavoisier Group) as well as through alternative media such as the critics blog network. A failure to respond could therefore be interpreted as a manifestation of 'a stonewalling establishment' (Martin 2011, p. 4). The third option is a polite and sensible response without counter-attacking. This may lead neutral observers to regard provocative critics as bullies. However, when critics do have a legitimate point even if their argument is skewed, Martin (2011, pp. 8-9) suggests that appropriately conceding a point or admitting a mistake displays honesty and can increase credibility. By contrast, constantly rebutting every point made by a critic as utterly wrong or false risks being seen as arrogant.

Still, responding to critics rationally does not necessarily solve the issue of surviving the torrent of abuse directed at many scientists. Possibly the best approach is to compile the abuse and expose it through various media (discussed further in the section on intimidation).[133] Combined with polite and rational engagement by scientists, wider exposure of the pressure and abuse to which many climate scientists are subjected may alter the perceptions of uncommitted observers of the debate.

Self-validation by scientists

Scientists naturally tend to self-validate through the everyday operation of their official channels, in particular peer-review publication. Peer review validates scientific authority and the legitimacy of scientists in a debate.

[133] See pp. 274-275.

Devaluation of scientists by scientists

There has been a small amount of implicit devaluation of scientists by other climate scientists.[134] Curry (in Tamino 2010, #168, #468) and Storch (2009) have both framed some members of the paleoclimate community as arrogant and dismissive, unwilling to answer serious questions and unwilling to admit mistakes. This feeds into wider critical narratives that depict scientists as the guardians of a select club that rebuffs criticism with appeals to authority rather than deigning to engage in dialogue. As debates polarise, protagonists line up on opposing sides. Each side is typically composed of sturdy defenders of that side's position, and more nuanced voices tend to drop out of the debate (Martin 1991a, pp. 35-37). Criticism by one's own side in a debate is rare, at least in public, though it may occur behind closed doors. In his study of the fluoridation controversy, Martin (1991a, p. 37) observes that:

> Peer group pressure restrains individuals from criticising others on the same side and thus breaking ranks since, in the context of the controversy, this would, indeed, seem to help the other side — at least in the short term.

The public criticism expressed by Curry and Storch towards some of the paleoclimate community is somewhat unusual and indicates that the manner in which some climate scientists have engaged their critics is a matter of serious concern to some other scientists.

Validation of critics by climate scientists

It is rare in a debate to raise the value of opponents, either implicitly or explicitly.[135] However, Curry (2009a; in Tamino 2010, #419; in Kloor 2010, 16 June, 8.00pm, #21; in Kloor 2010, 17 June 9.20am, #50) portrays auditors such as McIntyre as well-educated technically-competent professionals capable of making a valuable contribution to the field. Furthermore, Curry frames the sides as citizen scientists and elite scientists. This implicitly increases the value of the challengers with regard to the traditional guardians of scientific knowledge. Curry sees this development as beneficial for both science and policy because it improves citizen education on the issues.

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[134] Devaluation of scientists by critics was covered in the industry chapter, pp. 165-172.
[135] Validation of critics by supportive conservative media commentators was covered in the industry chapter, pp. 172-174 .

Reinterpretation

Framing is ubiquitous in debate: it is accepted that almost everyone uses it to show themselves and their case to best advantage. For example, both sides may try to present a favoured selection of evidence that supports their case and assign the onus of proof to the other side. This is generally acceptable if protagonists are seen to be behaving above board. However, other forms of reinterpreting a debate such as misrepresentation and deception lie outside the norms of scientific debate and are less easy to justify.

Both sides accuse each other of bringing the debate into disrepute. I look at one example each of lying, misrepresentation and minimisation. Although scientists may point out that these instances are relatively minor compared to the bigger picture, it illustrates the damage that can occur in a debate when an opponent has the ability to hold scientists to account and amplify concern about inappropriate comments and inequitable or incorrect procedures.

Lying

Critics accuse Mann of lying about the reasons for *Nature* rejecting a comment by McIntyre and McKitrick. Montford (2010a, pp. 116-133) notes that McIntyre and McKitrick submitted a letter to *Nature* that responded to the original Mann et al paper published in that journal. The response passed the first round of peer-review with seemingly favourable comments. However, the response was eventually rejected as unable to comply with the word limit, even though it apparently complied with the word limit requested by *Nature*.

In a piece on the RealClimate website, Mann (2004b, myth #4) states that the claims of McIntyre and McKitrick are false and tries to denigrate McIntyre and McKitrick by implying that the criticism was rejected because of deficiencies in the argument:

> False claims of the existence of errors in the Mann et al (1998) reconstruction can also be traced to spurious allegations made by two individuals, McIntyre and McKitrick (McIntyre works in the mining industry, while McKitrick is an economist). The false claims were first made in an article (McIntyre and McKitrick, 2003) published in a non-scientific (social science) journal "*Energy and Environment*" and later, in a separate "Communications Arising" comment that was rejected by *Nature* based on negative appraisals by reviewers and

> editor [as a side note, we find it peculiar that the authors have argued elsewhere that their submission was rejected due to 'lack of space'].

Mann himself implies that McIntyre and McKitrick are lying about the real reasons for the *Nature* rejection. This is a risky and unnecessary move particularly when opponents are able to publish the reviewer's original comments and the responses from *Nature* to suggest that the treatment of McIntyre and McKitrick may not have been even-handed.

Misrepresentation

Martin (1979, pp. 29-34) identifies the selective use of evidence, the selective consideration of uncertainties, and the selective use of results as various means for pushing a particular scientific argument. As Martin (1979, p. 29) points out, selection of evidence is inevitable because 'all the evidence and arguments cannot be presented'. Nevertheless, depending on the field, evidence can be selected to support a particular viewpoint. Similarly, uncertainties that have little impact on results may be considered and highlighted, but uncertainties that may reduce the persuasiveness of the argument may be de-emphasised or ignored.[136] Finally, some results can be highlighted over others, caveats present in the body of the text can be dropped from the abstract or summary and contradictory findings can be ignored.

There is a difference between the conclusions drawn in a single scientific paper, and those given endorsement by a respected scientific institution. Alan Irwin (1995, p. 28) has noted that the tendency of scientific institutions to filter out uncertainties and supplant the messiness and caveats of scientific studies with a clearer and more authoritative official message is increasingly open to challenge from citizens. Endorsements are a powerful component of expert authority (Martin 1991b, pp. 9-10). However, the injudicious use of endorsement has the potential to backfire and damage the reputation of the expert authority.

Critics accuse the IPCC of contravening scientific norms by minimising the extent of scientific uncertainty surrounding the paleoclimate presentations in the *TAR*. Pielke Jr (2009c) points out that 'the IPCC presented some data in a way that was different from how the data was originally presented in the peer-reviewed literature' without disclosing the

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[136] In *The Independent Climategate Emails Review*, Richard Horton (in Russell 2010, p. 137), editor of *The Lancet* states that the full acknowledgement of uncertainties is 'of paramount importance' to science.

difference. Critics say the truncation of the Briffa curve at 1960 in the IPCC (2001, p. 134, fig. 2.21) graph amounts to omission of data. Furthermore, as McIntyre (in Montford 2010, p. 328) points out, the omission is deceptive because it does not present a full picture about the relevant uncertainties in proxy reconstructions. Pielke (2009c) argues that this demonstrates senior climate scientists 'stage managed' the science to accord with their preferred message and minimise complicating evidence. Pielke argues that this 'trick … is clearly an effort by activist scientists at the highest levels of the IPCC to misrepresent scientific complexity to policy makers and the public'. This implies that the evidence is not conclusive enough to be convincing without some degree of inappropriate manipulation. It also indicates a mistaken approach to uncertainty. Pielke notes that being seen to de-emphasise uncertainty is likely to be more damaging to the scientific message than displaying the full range of complexities.

The Oxburgh Panel convened to investigate allegations of scientific malpractice at CRU after 'Climategate' also expressed similar concern about the presentation of data by the IPCC. The Panel notes that the full range of uncertainties is discussed in the peer-review literature, but somehow not in the IPCC assessment report:

> CRU publications repeatedly emphasize the discrepancy between instrumental and tree-based proxy reconstructions of temperature during the late 20th century, but presentations of this work by the IPCC and others have sometimes neglected to highlight this issue (Oxburgh 2010, p. 5).

The panel found the behaviour of the IPCC 'regrettable' (Oxburgh 2010, p. 5). Even though CRU scientists Jones and Briffa (as well as Mann) were all IPCC authors on the paleoclimate chapter of the IPCC *TAR*, and the emails showed the tensions amongst them on this point, Oxburgh does not pursue the issue further.

McIntyre (2010) argues that the decision not to highlight the issue was taken deliberately by the IPCC in 2001 as the emails indicate that some scientists were concerned that showing the full range of uncertainties would 'dilute the message' the IPCC wanted to present. Consequently, McIntyre implies that the Oxburgh Panel was a whitewash because it presented the divergence as an issue of neglect rather than as an intentional choice to misrepresent the full range of uncertainty.

McIntyre (2010) also points out that as a reviewer for the IPCC in 2007, he specifically requested that the divergence be represented graphically, but Briffa, the IPCC lead author for the chapter, made a decision not to do so. The Russell inquiry found the treatment of uncertainty in the IPCC *AR4* to be a significant improvement on the *TAR* and did not find the IPCC (2007, p. 467) fig 6.10 to be misleading because reference to divergence is present in the text (Russell 2010, pp. 12, 56-59).

Minimisation

Critics accuse climate scientists of trying to downplay the importance of the 'hockey stick' now that it has received adverse criticism. For example, some scientists (e.g. Schneider 2009) have claimed that the 'hockey stick' was never used as proof of global warming. This may be true in a literal sense. Schneider (2009) points out that the 'hockey stick' was never used to prove the cause and effect of global warming and that the 'fingerprint' proof had in fact been detected by the time of the IPCC (1996) *SAR* before the 'hockey stick' was produced. However, the IPCC used the 'hockey stick' as an official representation of its position to try and ensure the public equated the simple graph with global warming. Given that it was senior climate scientists that originally decided to emphasise the 'hockey stick', it may be counter-productive for climate scientists to try and downplay the role of the 'hockey stick' in the debate.

Framing

Climate scientists have framed their opponents in the 'hockey stick' controversy as unconstructive time-wasters (as distinct from critics who just deny climate change) whose arguments frustrate progress on climate change policies. Scientists argue that most of the criticisms are actually irrelevant to the bigger picture because their opponents lack the ability to make higher order scientific judgements about what is relevant. Furthermore, scientists argue that their critics make no substantive contribution to the field, but instead prefer to snipe from the sidelines. Although they acknowledge that McIntyre may have different motivations to contrarian scientists that receive fossil-fuel funding, establishment scientists assert that the criticisms of McIntyre are used by the fossil fuel lobby for political ends.

Climate scientists also frame the peer-review literature as the best mechanism for settling disputes. Scientists argue that peer-review imposes discipline and helps ensure disputes get dealt with constructively. Blogs are devalued in comparison because scientists argue that they lack accountability and provide forums for personal attacks and baseless accusations of fraud. In sum, scientists argue that peer-review helps resolve disputes whereas blogs help perpetuate disputes. By contrast, critics argue that peer-review lacks public accountability and is prone to conflicts of interest and unseen pressure by dominant players. Critics argue that blogs do provide greater transparency and public accountability. These attempts to frame a particular forum as more worthy and constructive can also be seen as an attempt by both sides to locate the dispute in the arena where they have the most power.

Intimidation

Intimidation is not an option normally available to scientists. Although scientists canvassed in private emails the ideas of serving libel suits on opponents, or dealing with auditors in a dark alley, there is no evidence of scientists trying to directly intimidate their opponents and the *Russell Review* found no evidence of scientists exercising inappropriate pressure during the peer-review process.

By contrast, scientists have been threatened with criminal prosecutions. In February 2010, a *Minority Report* of the United States Senate Committee on Environment and Public Works (2010, p. 34) claimed that climate scientists 'may have violated federal laws'. The Committee (2010, pp. 35-37) listed 17 leading climate scientists — Michael Mann, Raymond Bradley, Malcolm Hughes, Phil Jones, Keith Briffa, Gavin Schmidt, Ben Santer, Stephen Schneider, Susan Solomon, Thomas Karl, Kevin Trenberth, Thomas Wigley, Michael Oppenheimer, Jonathan Overpeck, Timothy Carter, Edward Cook and Peter Stott. In March 2010, one of America's most prominent climate change deniers, Republican Senator James Inhofe, a ranking member of the Environment and Public Works Committee, called for criminal investigations of the British and American scientists (Goldenberg 2010). Climate scientist Oppenheimer described it as a 'McCarthyite tactic', while Rick Piltz, a former US government official in the climate science program stated that:

> Scientists who are working in federal labs are being subjected to inquisitions coming from Congress. There is no question that this is an orchestrated campaign to intimidate scientists (in Goldenberg 2010).

Gavin Schmidt says the threat of criminal prosecution raises the intimidation experienced by climate scientists to new levels and is designed to silence leading scientists and prevent them from communicating their evidence to the public:

> The idea very clearly is to let it be known that should you be a scientist who speaks out in public then you will be intimidated, you will be harassed, and you will be threatened. The idea very clearly is to put a chilling effect on scientists speaking out in public and to tell others to keep their heads down. That kind of intimidation is very reminiscent of other periods in US history where people abused their position (in Goldenberg 2010).

Scientists have also been subject to a barrage of cyber abuse, harassment and death threats with the aim of 'driving them out of public debate' (Hamilton 2010b). Hamilton (2010b; see also Hamilton 2010c) points out that many of the attacks are now being 'arranged by one or more denialist organisations'. Richard Littlemore (in Fisher 2010) says the bullying begins with a handful of paid campaigners and 'filters out from there'. Distinguished Australian scientists such as Andy Pitman and David Karoly as well as others such as Gavin Schmidt, Kevin Trenberth, Tom Wigley, Stephen Schneider and Ben Santer (in Hamilton 2010b, 2010c; Fischer 2010; Pearce 2010d) regularly received threatening and abusive emails including death threats. The abuse has continued despite the fact that scientists such as Pitman have responded calmly and rationally (Hamilton 2010b). Hamilton (2010c) reports that scientists have even been targeted in their own homes and that 'climatologist Ben Santer found a shredded animal on his doorstep late one night after someone rang his doorbell'.

The most effective response may be to do what Clive Hamilton (2010b) has done - compile the abuse and publish it as an example of the intimidation to which scientists are subjected merely for doing their job and communicating their findings. This approach also personalises scientists as public-minded individuals subject to faceless attack. Furthermore, exposing the coordinated nature of these attacks is likely to cause observers to regard the perpetrators and organisers as cowardly bullies, and will indirectly cast scientists in a more positive light.

Conclusion

This chapter used a different approach and a revised tactical framework in order to analyse the tactics of climate scientists and their critics. Firstly, I looked at both sides in the dispute, and secondly my analysis drew on both the tactics that the backfire model assumes are available to powerful perpetrators as well as the set of counter-methods available to a target. This change in approach was necessitated because the balance of power in the 'hockey stick' dispute was different to the case studies normally considered under backfire analysis, and also different to the case studies of government and industry in this thesis: that is the resources available to scientists and their critics were reasonably evenly matched. Therefore the dynamics of this engagement differed from the more predictable line up of tactics in situations where power is more concentrated in the hands of a powerful player such as government or industry and that player can be examined in relative isolation from their opponents.

Table 4: Tactics used by mainstream scientists and their critics in the 'hockey stick' dispute

Tactical framework	Mainstream Scientists	Critics
Cover-up	✓	#
Exposing cover-up	✓	✓
Official channels	✓	✓
Discredit official channels	✓	✓
Devaluation	✓	#
Denial		#
Deception/Lying	✓	#
Misrepresentation	✓	#
Minimising	✓	#
Framing	✓	✓
Intimidation		✓
Resisting/exposing attacks	✓	

Key: ✓ indicates use of the method
\# indicates use of this method by critics covered in industry chapter
Italicised tactics indicate counter-methods to the preceding tactic

Table 4 presents a summary of the main tactics used by both sides in the 'hockey stick' dispute, although the summary is likely to be contested by both sides. Some of the tactics attributed to critics in table 4 have not been covered in any detail in this chapter, but were

covered in the industry chapter. Furthermore, many of the critics covered in the last two chapters would argue that any alleged intimidation has nothing to do with them and that in fact the evidence shows that it has been scientists who have tried to intimidate their opponents. By contrast, scientists might argue that several official investigations have cleared them of any cover-up and that the instances of alleged deception or misrepresentation are selective, isolated and unrepresentative. Still, my primary aim is not to provide a definitive judgement, but rather to try to present a picture that captures the dynamics of a relatively evenly-engaged dispute even if some of the tactics relate more to allegations or perceptions.

Both establishment scientists and their opponents have had the ability to deploy official panels and investigations as tools for both offence and defence. This indicates not only the depth of resources on both sides but also reflects the relative parity between them in that neither side was able to monopolise the tactic. At the same time, both sides attempted to resist the moves of their opponent by drawing on counter-methods and asserting that the official channels used by their opponents were biased and incomplete.

Critics were quick to set the agenda on ‘Climategate’ and the allegations against scientists remained unchallenged during the original furore. Critics accused scientists of cover-up. Although official reviews generally cleared the scientists of improper practice, ‘Climategate’ damaged the reputation of climate science. This indicates that the ability to expose cover-up (real or perceived) has the potential to engender backfire against the perpetrator. Furthermore, favourable official findings may be insufficient to rebuild public trust in scientific institutions because the traditionally concealed areas of peer-review and data disclosure lack public accountability.

Citizen critics have accused scientific institutions of misrepresentation by deliberately filtering out the full extent of known climate uncertainties in order to present a clearer and more authoritative picture of climate change. The IPCC took a risk by endorsing a particular version of climate history rather than presenting the full (and messy) range of evidence. This appears ill-advised given that the key conclusion of the IPCC regarding the human causation of the remarkable warming trend over the last three decades uses instrumental data sets for the last century, not proxy data such as tree rings. The key conclusions of climate science do not therefore rely on climate reconstructions such as the ‘hockey stick’. Rather, proxy data is

used to provide a comparison of recent temperatures with those of the last one or two millennia: an interesting and useful exercise, but hardly one that goes to the heart of the case for human-caused climate change.

Scientists and their institutions have been unable to resolve the ensuing dispute over proxy reconstructions through the authority of official scientific channels alone. The intense criticism of the 'hockey stick' has led some mainstream scientists into a public debate where they have risked their credibility by denigrating their critics. This indicates that public counter-attacks can be risky particularly when the target has professional standing and the resources to amplify outrage over the nature of the attack. It also implies that it may be better for scientific assessment panels to present the full range of evidence and let other players including politicians and citizens fight over what it means and what should be done about it.

The extent to which external criticism can make a contribution to the scientific field is disputed. Some climate scientists argue that the criticisms made by their opponents are utterly false and without any merit whatsoever. It is rare for critics to be completely wrong, and subsequent official investigations were ambiguous on some points. If observers see that there may be points on both sides and yet one side claims the opponent is entirely wrong, then that protagonist may lose credibility. In addition, establishment scientists are more easily portrayed as part of a powerful elite and their refusal to acknowledge the potential validity of any point made by citizens is likely to be viewed negatively. Acknowledging ambiguities, uncertainties and criticisms helps retain credibility, which may be especially important when trying to demonstrate that those same criticisms, even if valid, may have little overall significance for the main argument.

Disputes typically feature partisans on both sides, but once an issue is expanded, observers often constitute the majority in a controversy. It is difficult for observers to get to the bottom of highly technical disputes such as the 'hockey stick'. Observers who are looking for content will need clear explanations of the technical issues. However, many observers may judge the debate on those aspects that they can understand such as the language and the tenor of the exchanges. This means the conduct of the participants may be a factor in influencing the outcome of the debate. Rather than counter-attacking, clear and calm engagement may be the most effective method for winning over uncommitted observers.

On the other hand, despite maintaining a polite and rational approach, many scientists have been subjected to a raft of cyber abuse and threats. Some climate advocates have compiled the threats made against scientists and exposed the bullying in public forums. This has the effect of portraying scientists as the victims of relentless intimidation. In these circumstances, it is important that scientists do not undermine this frame by attacking their more measured critics.

Conclusion

This thesis has analysed aspects of a bitter and protracted struggle between a financially powerful fossil fuel industry and the professional power of scientists. In doing so, I have made several contributions to the social science literatures. Firstly, I have advanced a procedure for analysing tactics within the social sciences. By making key modifications to Martin's backfire model, I have developed a revised tactical framework with greater flexibility and wider applicability, including the ability to clarify tactical choices in a conflict irrespective of whether power is distributed equally or unequally between players. Secondly, by employing a classification system for analysing and comparing the tactics used by different players, I have shown that it is possible to uncover particular patterns of operation and to illuminate what is happening in a dispute. Thirdly, by examining power and politics in a complex and controversial debate from the perspective of agency, I have demonstrated that strategy and tactics matter to the progress and outcomes of a conflict and that a dynamic debate cannot be fully understood or explained by attention to structures alone. Fourthly, I have shown that strategy and tactics are augmented or limited (but not determined) by structural factors such as access to resources (economic, social, cultural and political), and the balance of power in the various arenas in which the conflict plays out. Finally, although any system of classification is necessarily a simplification of reality, my analysis may have a practical contribution by enabling participants to assess their options in a conflict.

In this concluding chapter, I begin with a few broader points about achieving compliance and inhibiting opposition, further theoretical development, and other applications of my procedure. I then sum up the similarities and differences between the tactics of the various players in the climate change debate and draw conclusions about what this implies about the use of particular tactics.

Although popular wisdom about power suggests that superiority in the means of violence is the definitive means of getting one's way, intellectual and rhetorical persuasion is usually seen as the most self-sustaining approach to obtaining compliance in liberal democracies because it implies some degree of consent to a shared set of values about the way society is organised and the resulting outcomes. However, as Miller and Dinan (2010, p. 3) point out, drawing a simple boundary between coercion and consent is problematic. Following Martin, I

have treated deception and devaluation as categories of rhetorical communication. This thesis has presented several instances where misrepresentation and the malicious denigration of an opponent and their ideas can be seen as coercive forms of communication that aim to manipulate how an audience perceives an issue or an actor. Depending on the arena and the opponent, rational debate and the technique of constructing a problem according to a preferred definition may be superseded by coercive rhetorical techniques deployed to gain an advantage or negate the opposition.

Theorists such as Gaventa (1980, p. 258) have argued that in instances of power inequality, conflict rarely reaches a pluralist stage because the powerful have the ability to control the political agenda and there is likely to be an ingrained belief amongst the powerless that they are indeed powerless. From a backfire perspective, Martin would argue that the powerful have access to resources and a wider range of tactics that would enable them to manage the agenda. In a situation where power is more evenly distributed, such as the climate change debate, conflict is more likely to resemble the pluralist conception of competing interests. However, a pluralistic conception does not translate as easily into the backfire framework because it suggests that the competing groups might all have access to the 'perpetrator' methods. The typical dichotomous allocation of tactics in the backfire model does not work when resources are distributed relatively evenly. Furthermore, power dynamics and interests in a debate can shift rapidly as alliances form and fracture. My modifications allow changes in power structures, interests and strategy to be more easily accommodated and open up the conceptual framework to a wider range of applications beyond those for which it was originally intended.

Nonetheless, the theoretical reasoning for the non-existence of backfire needs further elucidation because periods of relative quiescence in a conflict cannot necessarily be attributed to the successful deployment of various tactics by powerful players. Structural factors such as systemic bias, cultural legitimacy and what Lukes (2005, p. 34) describes as 'the favourable alignment of social relations and forces' also require consideration. There is scope for theoretical examination of how resistance or outrage develops, why certain structures persist, what shifts a relatively stable situation into a dynamic problem, the importance of strategic choices when compared to existing power structures and resources

and how this changes over time and across disputes, how values (and changes in values) interact with tactics, and whether it is possible to gauge how effective a tactic will be and what outcomes will eventuate. Some of these explorations would cross disciplinary boundaries and may very well be contingent because as Jasper (2006) argues, strategy is infrequently based solely on rational calculation and players rarely think more than one or two moves ahead. Indeed, successful action may be stumbled upon, and what works in one arena may not be successful elsewhere, sometimes because opponents have learnt from painful experience how to counter a particular move more successfully.

The procedure for studying tactics that has been advanced in this thesis could be applied to other controversies. In the climate change debate, science lines up against industry, but in the debate on pesticides or genetically modified organisms (GMOs) for example, science and industry typically line up together. In the climate change debate, NGOs proclaim the legitimacy of science to speak authoritatively, but the same NGOs may denounce scientific legitimacy as contaminated by vested interests in disputes over pesticides and GMOs. In both the climate change debate and the debate over pesticides and GMOs, NGOs oppose vested industry interests. Similarly, conservative media critics may challenge the scientific evidence in the climate change debate, but promote it uncritically in the pesticide and GMO debate. In both instances, conservative media critics line up with industry interests.

Science is challenged in all these debates. In the pesticide and GMO debates, citizens are relatively weak compared to the power of those defending the science (industry and often government). In the climate change debate where scientists are enduring intense scrutiny from a coalition of forces, it is crucial that scientific institutions present themselves as disinterested and focussed on the public good. Although scientific institutions may try to do this in other disputes where they face less pressure, it is more difficult for scientists in the pesticide debate to dissociate themselves from the vested interests. Comparative studies that analysed tactics across two or more conflicts with different dynamics could indicate not just the varying tactics adopted across a range of debates, but also expose potential double standards on all sides of the debate. Whether strategic lessons learned in one debate are applicable in other debates may depend on the arrangement of forces.

In this thesis, I have appropriated various analytical concepts for a particular purpose: to display the techniques that the various antagonists have used, and to link them to some degree to interests and resources. Compliance with the current state of affairs in the climate change dispute is dynamic and contested and tactical struggles over legitimacy, credibility and the attempt by both sides to shape people's perceptions of their interests can be seen as part of the third dimension of power and can be analysed and compared via a tactical framework. In the struggle to define coal as dirty or clean for example, agency is now prominent. Powerful corporate players no longer have the luxury of operating within a system wherein their product automatically enjoys legitimacy. Instead, they are now forced to actively account for their activities, defend their product and engage in a struggle to shape the debate and define the issues. The fact that battle is joined indicates that what may have been previously hegemonic concepts such as the precedence of economic interests can no longer be taken for granted, but instead need to be constantly legitimated in a range of arenas and by a range of organisations created for that specific purpose.

My analysis has revealed parallels between the methods of the various protagonists in the debate. Framing is ubiquitous, indicating that all players frame climate change according to their preferred perspective. This is generally an accepted part of debate. More problematically, most players employ some aspect of cover-up. This suggests they have something to hide. Powerful players such as governments and lobby groups are relatively secure in their ability to prevent widespread exposure of cover-up. However, less powerful players such as front groups and media sceptics are more vulnerable. If their links to industry and corporate-funded think tanks are made transparent, this could compromise their presumed integrity and reduce the level of trust in their message. Revealing industry cover-up is valuable precisely because cover-up has such great potential to backfire if exposed. Scientists are also vulnerable, and the experience of 'Climategate' has already revealed the backlash that can occur when the public believes cover-up has occurred. However, unlike their opponents, scientists would have less to lose by opening up traditionally concealed aspects of their activities. Indeed, given the onslaught on climate science by vested interests, and the criticisms of presumed scientific objectivity in general made by social constructivists, acknowledging scientific interests and finding ways to make scientific processes more

transparent and publicly accountable should be a key strategy in rebuilding public trust in science.

The choice of rhetorical methods is influenced by various dynamics including the extent to which one's true interests and connections are obscured, the arena in which one operates, the resources and tactics of opponents, and one's perceptions of the conflict. The Lavoisier Group, media sceptics, and Prime Minister Howard all used various forms of coercive rhetorical persuasion to varying degrees including devaluation, denial, deception and minimisation. With no visible connections to industry, the Lavoiser Group and media columnists have a relatively free hand because they operate in the public arena and their targets, climate scientists, have little ability to defend themselves. By contrast, Howard faced greater constraints particularly after public opinion became more significant in 2006. When Howard switched strategies in late 2006, he renounced denial and diverged from the rhetoric of the media critics and the Lavoisier Group. The AIGN and Rudd both avoided denial of climate change: the AIGN because it could backfire against an obviously self-interested lobby group, and Rudd because he could use Howard's denial and devaluation to portray his opponent as out of touch. Although most scientists have avoided devaluation, some responded to their critics by counter-attacking. This is a risky move in a debate where critics, many of whom have professional standing in their own fields, are plugged into a global network that can mobilise concern about the methods that scientists are using. Devaluation is an indication that sceptics lack sufficient evidence to counter scientific claims and retaliation is counter-productive because it makes attacks by sceptics easier to justify. If scientists are visibly transparent, devaluation of climate science is more likely to backfire against the perpetrators.

Official channels are typically the preserve of powerful institutions. Scientists rely heavily on official channels as a routine aspect of scientific communication and deliberation. However, critics had the power to mobilise official investigations, much of it targeting alleged abuse of the scientific process. It is therefore crucial that the various scientific processes are seen to be of the highest standard for scientific communication to be trusted. Violation of these tenets, including obfuscation and attempted denial or cover-up of even seemingly minor transgressions, can backfire against scientists and their institutions, potentially increasing

public scepticism about scientific evidence. Rudd made sophisticated use of official channels both in opposition and government, whereas Howard neglected to make full use of them and his belated attempts failed because he lacked the credibility to deploy them successfully at that stage. This indicates that a change in political strategy, even if it employs the tried and trusted techniques of the powerful, may be viewed as shallow and opportunistic without a convincing explanation for a change that contradicts one's previous approach.

The use of financial measures was restricted to government and industry. Rudd used financial inducements to reduce vocal opposition from industry interests, a tactic that would have been replicated by Howard had he been re-elected in 2007. Industry also made financial donations in an effort to ensure their interests were promoted within government and bureaucratic organisations. Similarly, the application of pressure to ensure the dominance of a preferred perspective was restricted to industry groups and government.

Table 5 (next page) shows the main methods used by the respective players, and indicates a pattern of methods common to several protagonists. Only two groups had the resources to use the full panoply of tactics: government and industry. This is not unexpected because corporations and government are generally regarded as the most powerful organisations in capitalist societies. However, neither government used all the tactics, but rather selected particular tactics for specific purposes. Although industry used all the tactics, lessons around public credibility drawn from environmental and public health conflicts over the last fifty years have forced industry to resource a range of groups in order to more effectively combat its opponents. Moreover, both governments and industry have the resources to play in various arenas. By contrast, even though scientists have power within the scientific realm, their effective repertoire of tactics is limited by their resources and constrained by perceptions of the 'proper' role and domain of science.

Table 5: Strategies and tactics of the key players

Tactics deployed	AIGN	Lavoisier Group	Media critics	Howard govt	Rudd govt	Scientists
Cover-up	✓	✓		✓		✓
Devaluation		✓	✓	✓		✓
Denial		✓	✓	✓		
Deception		✓	✓	✓	✓	✓
Minimisation		✓	✓	✓		
Framing	✓	✓	✓	✓	✓	✓
Blaming					✓	
Displacement					✓	
Official channels	✓			*	✓	✓
Funding/Donations/ Inducements	✓			**	✓	
Pressure	✓			✓		

Key: ✓ indicates use of the method
* indicates partial use
**indicates this method would have been used if Howard had been re-elected in 2007
Indented tactics indicate the various forms of reinterpretation

Despite the obvious resources of some individuals and groups, the limitations and challenges of operating independently provide an incentive to form alliances. As chapter 5 demonstrated, powerful industry players have the resources to create organisations and alliances that can exploit all available tactics and engage in multiple arenas. Coalitions enable less powerful actors to influence the debate and, depending on the tactics and power of the other side, may allow activities such as undeclared interests, misleading claims, and double standards to remain unchecked if there is no counter-force holding them to account. This dynamic appears particularly relevant to the newspaper debates: occasional letters to the editor by climate scientists rebutting critical claims appear to have little influence on media columnists. By misleadingly portraying themselves and their allies as the underdog in the debate, sceptical media columnists have more licence to engage in dubious tactics. Typically, when scientists call attention to industry connections, a lack of relevant credentials amongst opponents, and fallacies in a critical argument, media sceptics turn a lost argument into a claim of ad hominem and insist they have therefore won the argument.

Policy debates are resolved in the public and political arenas. Although scientific assessment reports allow scientists some direct input into the political arena, when scientific knowledge is brought into the public and political arena, it enters into venues that deal in large part with

conflicting values rather than some notion of objective ‘truth’. Furthermore, the public and policy arenas are governed by different rules such as lower standards of evidence than those governing the scientific arena. Scientists and their evidence are vulnerable in the public and political arena because deception and misrepresentation are only weakly restrained and attacks are generally considered part of the cut and thrust of vigorous debate. Defending scientific credibility in the public arena requires that the methods used by scientists and their institutions are transparent and defensible. Still, even though ‘Climategate’ provided critics with ready-made ammunition, the politicisation of climate science occurred long before ‘Climategate’ and it would hardly be accurate to blame scientists for the political impasse when scientists are confronted by a well-resourced disinformation campaign.

In sum the opponents of action on climate change are in a stronger position than those advocating action for several reasons. Firstly, the financial power of corporations is more important than the professional power of scientific organisations. Corporations generate investment and wealth and this places them in a uniquely powerful position within the current economic system. Not only do these attributes carry weight with government, but the financial resources of corporations allows them to mobilise a range of organisations and deploy the full range of tactics to influence both public and governmental agendas. Secondly, maintaining the status quo is far easier than instigating change. Vested interests do not need to win the climate change debate. When critics propagate doubts about science and try to persuade their audience that the economic and social costs of reducing emissions will far outweigh the benefits, these frames may allow politicians to appear moderate, considered and rational in either delaying or significantly modifying climate change policy to protect vested industrial interests. Even those governments that do profess to understand the seriousness and urgency of the problem have been unwilling to prosecute the policies covered in chapter 2. Instead, a succession of agenda management techniques have been designed to convey the impression that either the problem of climate change is inconsequential, that the costs of tackling it are unjustifiably high, or indeed that effective action is being taken.

Given that powerful corporations have been adept at conflating their economic self-interest with the national interest, climate advocates (both inside and outside government) face a dilemma: whether to appeal primarily to extrinsic values such as economic self-interest (cost-

benefit analysis), green consumerism and international competitiveness, or whether to appeal primarily to shared values, moral suasion and international cooperation. The *Stern Review*, the *Garnaut Review*, and Rudd did both, though arguably with the main focus on economic self-interest. Howard and industry focussed on economic self-interest and international competitiveness. The ability of powerful players to manipulate and monopolise the self-interest frame suggests that scientists and citizen organizations should further explore the benefits of invoking intrinsic values such as shared interests.[137]

[137] See Tom Crompton (2010) for a full exposition of this argument.

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Appendix 1

Selected Emails from the Climate Research Unit[138]

1.1: Emails between Folland, Briffa and Mann in 1999 over priorities for the IPCC TAR in 2001.

At 01:07 PM 9/22/99 +0100, Folland, Chris wrote:

Dear All

A proxy diagram of temperature change is a clear favourite for the Policy Makers summary. But the current diagram with the tree ring only data somewhat contradicts the multiproxy curve and dilutes the message rather significantly. We want the truth. Mike thinks it lies nearer his result (which seems in accord with what we know about worldwide mountain glaciers and, less clearly, suspect about solar variations). The tree ring results may still suffer from lack of multicentury time scale variance. This is
probably the most important issue to resolve in Chapter 2 at present.

Chris

At 04:19 PM 9/22/99 +0100, Keith Briffa wrote:

Hi everyone

Let me say that I don't mind what you put in the policy makers summary if there is a general consensus. However some general discussion would be valuable. First, like Phil, I think that the supposed separation of the tree-ring reconstruction from the thers on the grounds that it is not a true "multi-proxy" series is hard to justify. What is true
is that these particular tree-ring data best represent SUMMER temperatures mostly at the northern boreal forest regions. By virtue of this, they also definitely share significant variance with Northern Hemisphere land and land and marine ANNUAL temperatures - but at decadal and multidecadal timescales - simply by virtue of the fact that these series correlated with the former at these timescales. The multi proxy series (Mann et al. Jones et al) supposedly represent annual and summer seasons respectively, and both contain large proportions of tree-ring input. The latest tree-ring
density curve (i.e. our data that have been processed to retain low frequency information) shows more similarity to the other two series - as do a number of other lower resolution data (Bradley et al, Peck et al ., and new Crowley series - see our recent Science piece) whether this represents 'TRUTH' however is a difficult problem. I know Mike thinks his series is the 'best' and he might be right - but he may also be too dismissive of other data and possibly over confident in his (or should I say his use of other's). After all, the early (pre-instrumental) data are much less reliable as indicators of global temperature than is apparent

[138] Errors in original emails are reproduced, but are not noted.

in modern calibrations that include them and when we don't know the precise role of particular proxies in the earlier portions of reconstruction it remains problematic to assign genuine confidence limits at multidecadal and longer timescales. I still contend that multiple regression against the recent very trendy global mean series is potentially dangerous. You could
calibrate the proxies to any number of seasons , regardless of their true optimum response . Not for a moment am I saying that the tree-ring, or any other proxy data, are better than Mike's series - indeed I am saying that the various reconstructions are not independent but that they likely contribute more information about reality together than they do alone. I do believe that it should not be taken as read that Mike's series (or Jone's et al. for that matter) is THE CORRECT ONE. I prefer a Figure that shows a multitude of reconstructions (e.g similar to that in my Science piece).

Incidently, arguing that any particular series is probably better on the basis of what we now about glaciers or solar output is flaky indeed. Glacier mass balance is driven by the difference mainly in winter accumulation and summer ablation, filtered in a complex non-linear way to give variously lagged tongue advance/retreat .Simple inference on the precidence of modern day snout positions does not translate easily into absolute (or relative) temperature levels now or in the past. Similarly, I don't see that we are able to substantiate the veracity of different temperature reconstructions through reference to Solar forcing theories without making assumptions on the effectiveness of (seasonally specific) long-term insolation changes in different parts of the globe and the contribution of solar forcing to the observed 20th century warming .
There is still a potential problem with non-linear responses in the very recent period of some biological proxies (or perhaps a fertilisation through high CO2 or nitrate input) . I know there is pressure to present a nice tidy story as regards 'apparent unprecedented warming in a thousand years or more in the proxy data' but in reality the situation is not quite so simple. We don't have a lot of proxies that come right up to date and those that do (at least a significant number of tree proxies) some unexpected changes in response that do not match the recent warming. I do not think it wise that this issue be ignored in the chapter.

For the record, I do believe that the proxy data do show unusually warm conditions in recent decades. I am not sure that this unusual warming is so clear in the summer responsive data. I believe that the recent warmth was probably matched about 1000 years ago. I do not believe that global mean annual temperatures have simply cooled progressively over thousands of years as Mike appears to and I contend that that there is strong evidence for major changes in climate over the Holocene (not Milankovich) that require explanation and that could represent part of the current or future
background variability of our climate. I think the Venice meeting will be a good place to air these issues. Finally I apologise for this rather self-indulgent ramble, but I thought I may as well voice these points to you. I too would be happy to go through the recent draft of the chapter when it becomes available.

cheers to all

Keith

From: "Michael E. Mann" <mann@xxxxxxxxx.xxx
To: Keith Briffa <k.briffa@xxxxxxxxx.xxx, "Folland, Chris" <ckfolland@xxxxxxxxx.xxx, 'Phil Jones' <p.jones@xxxxxxxxx.xxx
Subject: RE: IPCC revisions
Date: Wed, 22 Sep 1999 12:35:24 -0400
Cc: tkarl@xxxxxxxxx.xxx, mann@xxxxxxxxx.xxx

Thanks for your response Keith,

For all:

Walked into this hornet's nest this morning! Keith and Phil have both raised some very good points. And I should point out that Chris, through no fault of his own, but probably through ME not conveying my thoughts very clearly to the others, definitely overstates any singular confidence I have in my own (Mann et al) series. I believe strongly that the strength in our discussion will be the fact that certain key features of past climate estimates are robust among a number of quasi-independent and truly independent estimates, each of which is not without its own limitations and potential biases. And I certainly don't want to abuse my lead authorship by advocating my own work.

I am perfectly amenable to keeping Keith's series in the plot, and can ask Ian Macadam (Chris?) to add it to the plot he has been preparing (nobody liked my own color/plotting conventions so I've given up doing this myself). The key thing is making sure the series are vertically aligned in a reasonable way. I had been using the entire 20th century, but in the case of Keith's, we need to align the first half of the 20th century w/ the corresponding mean values of the other series, due to the late 20th century decline.

So if Chris and Tom (?) are ok with this, I would be happy to add Keith's series. That having been said, it does raise a conundrum: We demonstrate (through comparing an exatropical averaging of our northern hemisphere patterns with Phil's more extratropical series) that the major discrepancies between Phil's and our series can be explained in terms of spatial sampling/latitudinal emphasis (seasonality seems to be secondary here, but probably explains much of the residual differences). But that
explanation certainly can't rectify why Keith's series, which has similar
seasonality *and* latitudinal emphasis to Phil's series, differs in large part in
exactly the opposite direction that Phil's does from ours. This is the problem we all picked up on (everyone in the room at IPCC was in agreement that this was a problem and a potential distraction/detraction from the reasonably concensus viewpoint we'd like to show w/ the

Jones et al and Mann et al series.

So, if we show Keith's series in this plot, we have to comment that "something else" is responsible for the discrepancies in this case. Perhaps Keith can help us out a bit by explaining the processing that went into the series and the potential factors that might lead to it being "warmer" than the Jones et al and Mann et al series?? We would need to put in a few words in this regard. Otherwise, the skeptics have an field day casting
doubt on our ability to understand the factors that influence these estimates and, thus, can undermine faith in the paleoestimates. I don't think that doubt is scientifically justified, and I'd hate to be the one to have to give it fodder!

The recent Crowley and Lowery multiproxy estimate is an important additional piece of information which I have indeed incorporated into the revised draft. Tom actually estimates the same mean warming since the 17th century in his reconstruction, that we estimate in ours, so it is an added piece of information that Phil and I are probably in the ballpark (Tom has used a somewhat independent set of high and low-resolution proxy data and a very basic compositing methodology, similar to Bradley and Jones, so there is some independent new information in this estimate.

One other key result with respect to our own work is from a paper in the press in "Earth Interactions". An unofficial version is available here:
http://www.ngdc.noaa.gov/paleo/ei/ei_cover.html
The key point we emphasize in this paper is that the low-frequency variability in our hemispheric temperature reconstruction is basically the same if we don't use any dendroclimatic indicators at all (though we certainly resolve less variance, can't get a skillful reconstruction as far back, and there are notable discrepancies at the decadal and interannual timescales). A believe I need to add a sentence to the current discussion on this point, since there is an unsubstantiated knee-jerk belief that our low-frequency variability is suppressed by the use of tree ring data.

We have shown that this is not the case: (see here:
http://www.ngdc.noaa.gov/paleo/ei/ei_datarev.html and specifically, the plot and discussion here: http://www.ngdc.noaa.gov/paleo/ei/ei_nodendro.html
Ironically, you'll note that there is more low-frequency variability when
the tree ring data *are* used, then when only other proxy and historical/instrumental data are used!

SO I think we're in the position to say/resolve somewhat more than, frankly, than Keith does, about the temperature history of the past millennium. And the issues I've spelled out all have to be dealt with in the chapter.

One last point: We will (like it or not) have SUBSTANTIAL opportunity/requirement to revise much of this discussion after review, so we don't have to resolve everything now. Just the big picture and the important details...

I'm sure we can can up with an arrangement that is amenable to all, and I'm looking forward to hearing back from Keith, Phil, and Chris in particular about the above, so we can quickly move towards finalizing a first draft.

Looking forward to hearing back w/ comments,

mike

Source: East Anglia Confirmed Emails from the Climate Research Unit – Searchable
http://www.eastangliaemails.com/emails.php?eid=136&filename=938018124.txt

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1.2: Email from Tom Wigley to Phil Jones

From: Tom Wigley <wigley@xxxxxxxxx.xxx
To: Phil Jones <p.jones@xxxxxxxxx.xxx
Subject: [Fwd: CCNet Xtra: Climate Science Fraud at Albany University?]-FROM TOM W
Date: Mon, 04 May 2009 01:37:07 -0600
Cc: Ben Santer <santer1@xxxxxxxxx.xxx

Phil,

Do you know where this stands? The key things from the Peiser items are ...

"Wang had been claiming the existence of such exonerating documents for nearly a year, but he has not been able to produce them. Additionally, there was a report published in 1991 (with a second version in 1997) explicitly stating that no such documents exist. Moreover, the report was published as part of the Department of Energy Carbon Dioxide Research Program, and Wang was the Chief Scientist of that program."

and

"Wang had a co-worker in Britain. In Britain, the Freedom of Information Act requires that data from publicly-funded research be made available. I was able to get the data by requiring Wang’s co-worker to release it, under British law. It was only then that I was able to confirm that Wang had committed fraud."

You are the co-worker, so you must have done something like provide Keenan with the DOE report that shows that there are no station records for 49 of the 84 stations. I presume Keenan therefore thinks that it was not possible to select stations on the basis of ...

"... station histories: selected stations have relatively few, if any, changes in instrumentation, location, or observation times" [THIS IS ITEM "X"]

Of course, if the only stations used were ones from the 35 stations that *did* have station histories, then all could be OK. However, if some of the stations used were from the remaining 49, then the above selection method could not have been applied (but see below) -- unless there are other "hard copy" station history data not in the DOE report (but in China) that were used. From what Wang has said, if what he says
is true, the second possibility appears to be the case.

What is the answer here?

The next puzzle is why Wei-Chyung didn't make the hard copy information available. Either it does not exist, or he thought it was too much trouble to access and copy. My guess is that it does not exist -- if it did then why was it not in the DOE report? In support of this, it seems that there are other papers from 1991 and 1997 that show that the data do not exist. What are these papers? Do they really show this?

Now my views. (1) I have always thought W-C W was a rather sloppy scientist. I therefore would not be surprised if he screwed up here. But ITEM X is in both the W-C W and Jones et al. papers -- so where does it come from first? Were you taking W-C W on trust?

(2) It also seems to me that the University at Albany has screwed up. To accept a complaint from Keenan and not refer directly to the complaint and the complainant in its report really is asking for trouble.

(3) At the very start it seems this could have been easily dispatched.
ITEM X really should have been ...

"Where possible, stations were chosen on the basis of station histories and/or local knowledge: selected stations have relatively few, if any, changes in instrumentation, location, or observation times"

Of course the real get out is the final "or". A station could be selected if either it had relatively few "changes in instrumentation" OR "changes in location" OR "changes in observation times". Not all three, simply any one of the three. One could argue about the science here -- it would be better to have all three -- but this is not what
the statement says.

Why, why, why did you and W-C W not simply say this right at the start?
Perhaps it's not too late?

I realise that Keenan is just a trouble maker and out to waste time, so I apologize for continuing to waste your time on this, Phil. However, I *am* concerned because all this

happened under my watch as Director of CRU and, although this is unlikely, the buck eventually should stop with me.

Best wishes,
Tom

P.S. I am copying this to Ben. Seeing other peoples' troubles might make him happier about his own parallel experiences.

Source: East Anglia Confirmed Emails from the Climate Research Unit – Searchable http://www.eastangliaemails.com/emails.php?eid=972&filename=1241415427.txt

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1. 3: Emails between Jones, Trenberth and Mann regarding the Keenan fraud allegations

Phil Jones wrote:

Kevin,
Have a look at this web site. I see you're away. The websites can wait, but scroll down to the letter below from Keenan - the last sentence.

http://www.climateaudit.org/?p=1471#comments
and
http://www.climateaudit.org/?p=1479#more-1479

One is about data from a paper 17 years ago (Jones et al. 1990)

Also there is this email (below) sent to Wei-Chyung Wang, who was one of the co-authors on the 1990 paper. Wei-Chyung is in China, and may not yet have seen this. When he's back in Albany, I've suggested he talks to someone there. It is all malicious. I've cc'd this to Ben and Mike as well, to get any thoughts from their experiences.

If it gets worse I will bring Susan in as well, but I'm talking to some people at UEA first. Susan has enough to do with getting the AR4 WG1 volume out.

On the 1990 paper, I have put the locations and the data for the rural stations used in the paper on the CRU website. All the language is about me not being able to send them the station data used for the grids (as used in 1990!). I don't have this information, as we have much more data now (much more in Australia and China than then) and probably more stations in western USSR are as well.

As for the other request, I don't have the information on the sources of all the sites used in

the CRUTEM3 database.
We are adding in new datasets regularly (all of NZ from Jim Renwick recently), but we don't keep a source code for each station. Almost all sites have multiple sources and only a few sites have single sources. I know things roughly by country and could reconstruct it, but it would take a while.

GHCN and NCAR don't have source codes either. It does all come from the NMSs - well mostly, but some from scientists.

A lot of the issues are in various papers, but they never read these. Also certainly no use talking to them.

In Geneva all week. David Parker and Tom Peterson will be there. I can live with the web site abuse, but the Keenan letter knocked me back a bit.

I seem to be the marked man now !

Cheers
Phil

From: "D.J. Keenan" <doug.keenan@xxxxxxxxx.xxx
To: "Wei-Chyung Wang" <wang@xxxxxxxxx.xxx
Cc: "Phil Jones" <p.jones@xxxxxxxxx.xxx
Subject: retraction request
Date: Fri, 20 Apr 2007 13:31:15 +0100

Dear Dr. Wang,

Regarding the Chinese meteorological data analyzed by Wang et al. [GRL, 1990] and Jones et al. [Nature, 1990], it now seems clear that there are severe problems. In particular, the data was obtained from 84 meteorological stations that can be classified as follows.
49 have no histories 08 have inconsistent histories 18 have substantial relocations 02 have single-year relocations 07 have no relocations Furthermore, some of the relocations are very distant--over 20 km.
Others are to greatly different environments, as illustrated here:
http://www.climateaudit.org/?p=1323#comment-102970

The above contradicts the published claim to have considered the histories of the stations, especially for the 49 stations that have no histories. Yet the claim is crucial for the research conclusions.

I e-mailed you about this on April 11th. I also phoned you on April 13th: you said that you

were in a meeting and would get back to me. I have received no response.

I ask you to retract your GRL paper, in full, and to retract the claims made in Nature about the Chinese data. If you do not do so, I intend to publicly submit an allegation of research misconduct to your university at Albany.

Douglas J. Keenan

From: "Michael E. Mann" <mann@xxxxxxxxx.xxx
To: Phil Jones <p.jones@xxxxxxxxx.xxx
Subject: Re: FYI
Date: Sat, 21 Apr 2007 09:45:50 -0400
Reply-to: mann@xxxxxxxxx.xxx
Cc: trenbert@xxxxxxxxx.xxx, Ben Santer <santer1@xxxxxxxxx.xxx

Hi Phil,

This is all too predictable. This crowd of charlatans is always looking for one thing they can harp on, where people w/ little knowledge of the facts might be able to be convinced that there is a controversy. They can't take on the whole of the science, so they look for one little thing they can say is wrong, and thus generalize that the science is entirely compromised. Of course, as nicely shown in the SPM, every
landmass is independently warming, and much as the models predict. So they can harp all they want on one Chinese data set, it couldn't possibly change the big picture (let alone even the trends for China).

So they are simply hoping to blow this up to something that looks like a legitimate controversy. The last thing you want to do is help them by feeding the fire. Best thing is to ignore them completely. They no longer have their friends in power here in the U.S., and the media has become entirely unsympathetic to the rants of the contrarians at least in the U.S.--the Wall Street Journal editorial page are about the only place they can broadcast their disinformation. So in other words, for contrarians the environment appears to have become very unfavorable for development. I would advise Wang the same way. Keenan may or may not be bluffing, but if he tries this I believe that British law would make it easy for Wang to win a defamation suit against him (the burden is much tougher in the states),

mike

From: "Kevin Trenberth" <trenbert@xxxxxxxxx.xxx
To: mann@xxxxxxxxx.xxx
Subject: Re: FYI
Date: Sat, 21 Apr 2007 08:24:12 -0600 (MDT)

Reply-to: trenbert@xxxxxxxxx.xxx
Cc: "Phil Jones" <p.jones@xxxxxxxxx.xxx, "Ben Santer" <santer1@xxxxxxxxx.xxx

Hi Phil
I am sure you know that this is not about the science. It is an attack to undermine the science in some way. In that regard I don't think you can ignore it all, as Mike suggests as one option, but the response should try to somehow label these guys and lazy and incompetent and unable to do the huge amount of work it takes to construct such a database. Indeed technology and data handling capabilities have evolved and not everything was saved. So my feeble suggestion is to indeed cast aspersions on their motives and throw in some counter rhetoric. Labeling them as lazy with
nothing better to do seems like a good thing to do.

How about "I tried to get some data from McIntyre from his 1990 paper, but I was unable because he doesn't have such a paper because he has not done any constructive work!"

There is no basis for retracting a paper given in Keenan's message. One may have to offer a correction that a particular sentence was not correct if it claimed something that indeed was not so. But some old instrumental data are like paleo data, and can only be used with caution as the metadata do not exist. It doesn't mean they are worthless and can not be used. Offering to make a correction to a few words in a paper in a trivial manner will undermine his case.

Kevin

Source: East Anglia Confirmed Emails from the Climate Research Unit – Searchable
http://www.eastangliaemails.com/emails.php?eid=790&filename=1177158252.txt