



August 2008

## Emissions trading: 'Grip on reality' or just 'trust in numbers'?

Stephen Healy, University of New South Wales  
Declan Kuch, University of New South Wales

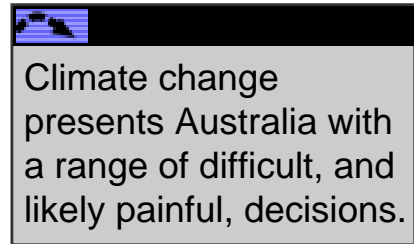
Something shifted in the political atmospherics surrounding climate change last year. In the wake of Al Gore's *An Inconvenient Truth* and the Stern Review, both the then Howard Government and the opposition proposed major initiatives to address climate change. Notable among these was the Shergold Report, written by Howard's Head of Department, and the Garnaut Climate Change Review, established by the States and Territories, both of which focused upon the potential for a domestic Emissions Trading Scheme (ETS). The Garnaut Review has since become a major input into the design of the ETS which the Rudd Government has committed to commence by 2010 and which is subject of the 'Carbon Pollution Reduction Scheme' Green Paper published in July (Department of Climate Change 2008).

Ross Garnaut is right to call climate change a 'diabolical' policy problem. Scientists predict climatic changes unparalleled since human civilisation first emerged during the relatively stable and benign climatic regime existing since the last ice age (approximately 12–10,000 BC). A key element of the current policy problem is how to stem these changes sufficiently rapidly to ensure that conditions amenable to human flourishing are maintained. This mitigation challenge requires a rapid global reduction in fossil fuel emissions, the major source of greenhouse gases,

and so a break with technologies that have underwritten industrial society since its emergence in the 18th century. The dynamic, volatile and contentious character of climate change politics should, then, come as no surprise. While discord may rule in climate change politics there is general agreement that mitigation is primarily a matter of economics and technology. Focusing on emissions trading, we ask is that all there is to it?

Climate change presents Australia with a range of difficult, and likely painful, decisions. Cheap coal, most recently reinforced by the Howard Government's allegiance to what Guy Pearse and Clive Hamilton termed the 'Greenhouse Mafia', a powerful coalition of major emitters bent on exerting influence in Canberra (Hamilton 2007; Pearse 2007), has left Australia with a per capita emissions level among the highest in the world and an underdeveloped low emissions energy sector. Howard's partiality for 'clean coal' and the related decision not to extend the Mandatory Renewable Energy Target (MRET) in 2004 (see Wahlin 2006), meant that rather than capitalising on an opportunity for Australia to become a renewable energy manufacturing hub, expertise and manufacturing in this area has moved offshore. Photovoltaic Engineers from the University of New South Wales for example, are deeply involved with offshore manufacturers in China and Germany. For Australia's renewables sector, the Rudd Government's Green Paper (Department of Climate Change 2008) continues the Howard era emphasis on 'clean coal' (which has a far from certain future) and marginalisation of renewable energy technologies. The consequences for both industrial activity and lifestyles from reducing Australia's emissions will likely be considerable, while the transition to low emissions sources of energy has many broader implications such as for energy security. Government inaction over recent years and increasingly strident scientific appeals for deep, rapid greenhouse gas emission cuts (see, for example, Pielke, Wigley & Green 2008) all, however, reinforce the urgency of these matters.

Against this background, emissions trading has risen to prominence as the industrial world's mitigation policy of choice. The 'idiosyncratic ... political features of the European



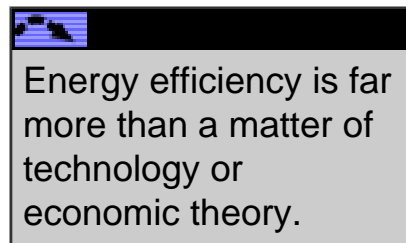
Union' (Mackenzie 2008, p. 8) played a large part in this because, although one EU country can veto a tax, emissions trading is, as an environmental matter, subject to 'qualified majority voting'. Interestingly, the Garnaut Review's mandate to develop 'medium to long-term policy options' (Garnaut Climate Change Review 2007) has also translated into an ETS becoming 'the centre piece of a domestic mitigation strategy' (Garnaut Climate Change Review 2008a, p. 5). In essence the 'cap and trade' ETS proposed involves mandating a 'cap' on national emissions, giving or selling emission permits, up to this cap, to emitters, and then facilitating trade in these permits. The idea is that emitters who find emission reductions expensive to achieve will buy permits from those able to make these cuts relatively cheaply. While more complex than an emissions tax, some economists believe that trading is both more economically efficient and effective in stimulating the development of low emission technologies.

The implicit assumption in current policy, then, is that mitigation is primarily a matter of effecting technological change by economic means. This assumption reproduces the naïve and apparently unshakable confidence in technological and market 'solutions' that brought about climate change and other, similarly 'diabolical', policy problems in the first place. Theorists such as Ulrich Beck (1992) and Bruno Latour (1993, 2004) have explained the link between this way of thinking and such problems in terms of deeply enculturated conceptual 'blinkers', notably those enforced by science and economics, that act to blind contemporary decision-making to contextual specifics critical to resolving particular policy challenges. We draw out the practical implications of this rather abstract

argument by examining one 'market failure' identified by Garnaut (Garnaut Climate Change Review 2008b, ch. 18).

Energy efficiency has long been a focus of mitigation policy, commonly called the 'no-regrets' option because the achievable cost effective energy savings (greater than 50 per cent, according to some authorities) have little or no effect upon the services derived from energy. From a technological perspective this is primarily a matter of facilitating best practice efficiencies, something amenable to legislative control, for example through industry policy, mandatory appliance standards and so on. Economic perspectives on energy efficiency are more interesting, and wide-ranging. Some economists have contested the existence of the 'no-regrets' option conflating economic and energy efficiency by arguing that markets settle upon the most 'efficient' level of energy efficiency of their own accord. So-called information deficits have become a major focus of attention because economic theory dictates that efficient markets require participants to have full information. This is a key motivation for the current enthusiasm for 'smart meters' that allow consumers, should they wish to, to alter their consumption patterns in line with the 'real-time' price of electricity flagged by these meters. Garnaut, in Chapter 18 of his Draft Report (Garnaut Climate Change Review 2008b), acknowledges another major tenet of economic theory in the form of 'principal agent issues', which occur when some, such as landlords, have control over decisions that affect the efficiency of the energy use of others.

Energy efficiency is, however, far more than a matter of technology and/or economic theory. Energy use, and the intensity of it, is structured into both the form and content of our material environments, our technologies, and our practices and behaviours. Automobility, among the most energy



intensive of contemporary practices is, for example, not only a matter of cars and associated infrastructure but also of urban form and governance. The mall and freeway patterned McSuburbs of Australia, which reproduce a pattern pioneered in the United States, structure long-term transport options and lifestyles more broadly. Not only do the single mothers of isolated outer suburbs face more significant constraints on their mobility than the matrons of the wealthy inner city, but shopping malls also provide a marked contrast with the street life characteristic of many Asian and European cities. Energy use more generally is like this. Air-conditioning, the rapid growth of which is putting Sydney's electricity infrastructure under considerable strain (Integral Energy 2003, p. 5), echoes automobility in shaping built environments, embodied dispositions and cultural norms (Healy 2008), while domestic practices such as heating, lighting, washing and cooking are also fundamentally culturally shaped (Shove 2003, 2004). Attempting to improve energy efficiency through economic and technical means alone, by ignoring these broader social factors, risks ensuring that the 'no-regrets' option remains merely an option. Current techno-economic approaches are fundamentally limited in other ways. For example, existing energy markets are configured to consistently increase energy sales and are embedded in a culture that values consumption as exemplarily rational behaviour.

The complexity and urgency of climate change means we must go beyond by our current economic and technological ways of thinking. Present developments are not, however, encouraging, with ethics a powerful case in point. While Hepburn and Stern (2008, p. 3) point out that '[c]limate change policy ... raises questions that are fundamentally and inescapably ethical', Garnaut begs to differ. When asked, at the 10 July Sydney Draft Report Forum, whether there was a moral dimension to the requirement for Australia to reduce its emissions Garnaut responded that it was a purely 'practical' matter (although his emphasis upon an imperative for Australian action appears to assume an element of moral suasion). We now focus upon the

'practicality' of Garnaut's recommendations, the current Rudd Government response, and emissions trading more generally.

## DO MARKETS HAVE A 'GRIP ON REALITY'?

Many, and most certainly economists such as Garnaut, take it for granted that markets, and economic theory more generally, have a secure 'grip on reality'. Some scholars, however, take a different view:

[t]he construction of numbers as resources ... cannot be treated as a question of providing superstructures securing untainted circulation (institutions, regulatory frameworks, standards etc.), but of generating, maintaining, ascertaining, adjusting, testing or manipulating expectations in social situations (Vollmer 2007, p. 596).

Garnaut, although he has declared himself to be a 'sceptical economist' (2008, p. 20), evidently does believe that markets secure the 'untainted circulation' of goods and services. The Draft Report, for example, argues that:


[o]ther policies operating alongside an emissions trading scheme can have no useful role in reducing emissions once the emissions trading scheme is in place. From that time, the only useful role for additional policies of this kind is to reduce the effect of market failures in adjustment to the emissions price, so as to reduce the cost of adjustment to the low-emissions economy. (Garnaut Climate Change Review 2008b, p. 351).

So for Garnaut, and economists like him, markets are perfectible entities (in the sense of 'securing untainted circulation'), except for one or two cases of 'market failure.' What, however, if the permits traded in an ETS did not

correlate to real emission reductions? That is what if the 'grip on reality' of the 'institutions, regulatory frameworks, standards etc' constituting an ETS were inadequate?

Recent theoretical work suggests that the 'grip on reality' of markets is problematic. The book *Do Economists Make Markets?* (Mackenzie, Muniesa & Siu, 2007) argues that, rather than reflecting reality, economics

*performs* markets. Pioneered by Michel Callon (1998), the argument is that rather than describing a pre-existing state of affairs, economic theory—or rather the practices it informs—(re)-makes the world in the image of its own formal structure and strictures. This perspective views the construction of new markets (Muniesa & Callon 2007) as experiments. In light of the current pervasiveness of 'market experiments', this suggests parallels with Ulrich Beck's now famous observation that because we treat our world as a laboratory, we now live in a 'risk society' (1992, 1995).



Economists such as Garnaut take it for granted that economic theory has a secure 'grip on reality'.

While Garnaut has devoted considerable recent attention to matters of risk and uncertainty (see, for example, 2008, pp. 5–7) his concern is with the quite substantial uncertainties of climate change science and not with those attaching to the proposed ETS his review informs. We contest the practicality of this perspective and contend that there is much to gain from viewing the ETS as an experiment. Experiments aspire to particular outcomes on the basis of the manipulation of relationships obtaining among experimental entities. These experimental entities do not, generally, simply reproduce real world ones but are rather refined and purified analogues of them. Undesirable influences are also usually removed from the contexts in which experiments are conducted. Failure can result for a variety of reasons including flawed experimental theory, insufficiently refined and purified experimental entities, or

insufficiently curbed external influences on the experiment. Many of these things are evident in our experience of emission trading schemes to date.

Carbon commodities are a very recent invention and decidedly experimental in the sense that significant uncertainties attach to the emission reductions they achieve. The experimental character of ETSs is also more broadly evident. There's now broad agreement, for example, that a key problem with Phase 1 of the European ETS was undue politicisation of the permit allocation process. Lobbying of EU governments by many of the largest emitters resulted in the over-allocation of permits with the result that the market failed and these emitters accrued windfall profits. Similar concerns have been expressed about the Green Paper's proposal to compensate large emitters (Keane 2008; MacGill & Betz 2008; Ramsay 2008). For many economists, including Garnaut, the solution is to auction the permits. However, experience of such auctions to date has been limited and, much of it, explicitly experimental (see, for example, Centre for Energy and Environmental Markets 2007).

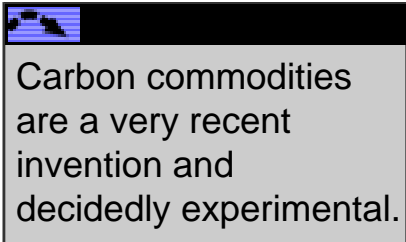
Mackenzie (2008, pp. 15–22) shows how the attempt, to date, to slot carbon emissions into existing commodity frameworks has been unsuccessful, and has resulted in the 'partial invisibility of carbon' with a variety of potential counter-constructive consequences. He (2008; forthcoming) and Lohmann (2005) also detail significant problems with the fundamentals of existing carbon markets. Among the most basic of these is the reliability of existing carbon commodities. For example, Global Warming Potentials (GWP), which relate the climate warming potential of different greenhouse gases back to that of carbon dioxide are, at best, of the order of  $\pm 35$  per cent accurate. This is a far from abstract consideration with projects intercepting emissions of trifluoromethane (HFC-23), a by-product of the manufacture of the refrigerant chlorodifluoromethane (HCFC-22), and very potent greenhouse gas, making up the bulk of the emission credits currently available under the



Clean Development Mechanism (CDM). (The CDM was established under Kyoto to allow developed countries to obtain credits to offset against their domestic emission reduction obligations via implementing projects in the developing world.) Currently such HFC-23 projects 'are now a major income stream for China's refrigerant plants, and for the Chinese Government' (Mackenzie 2008, p. 11), although the GWP of HFC-23 was revised from 11,700 to 14,800 in 2007, thereby significantly effecting the mitigation associated with CDM credits derived from these projects. Mackenzie (2008, p. 25) also notes how the World Wildlife Fund has sought recognition that some CDM credits are more reliable than others. These 'gold standard' credits are generated through more straightforwardly verifiable renewable energy and energy efficiency projects, which are priced by the market 10–20 per cent higher than other projects.

Matters such as these are almost invariably couched, deliberated, and debated in narrow technical terms. Yet they are, in many ways, best considered matters of governance. Effective

governance demands attention to detail, both technical and contextual; adequate cognisance of the inevitable tradeoffs involved in designing and implementing structures as complex as carbon markets, and the capacity to manage these things both in the near and longer terms. Currently, however, a naïve 'trust in numbers' restricts decision-making attention to a narrower range of technological and economic considerations.



Carbon commodities are a very recent invention and decidedly experimental.

## **MISPLACED 'TRUST IN NUMBERS'?**

Facilitating structural change to 'decarbonise' the economy by placing a price on carbon, through emissions trading or other means, is necessary but insufficient to achieve mitigation in market economies. Even on their own terms,

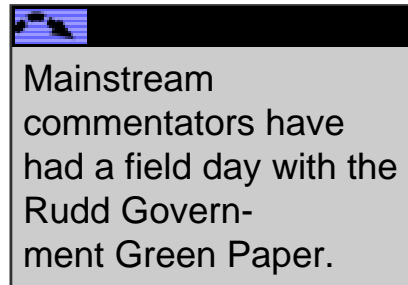
to succeed such schemes need to be well-designed and implemented, to trade reliable entities, and to ensure that market fundamentals (for example, emission monitoring frameworks at the level of firms) are in place. Yet even then, many further contextual considerations beg attention, as current debates around transport highlight.

Much of the recent debate on transport futures has been focused on purely technological solutions, envisaging a future populated by clean cars of one kind or another. There are also well-proven and developed economic tools, such as London's congestion charge. Yet these techno-economic responses miss fundamental determinants of why people travel the way they do. Public transport patronage in Zurich, Toronto, and Vienna is much higher than in Sydney and Melbourne not only because these cities have superior public transport systems but also because they have been planned over time with mass transit in mind. This is also why cycling is so popular in the Netherlands and so unpopular in Australia. Effective transport policy requires attention to a wide range of factors, in addition to technology and economics, notably land-use and urban planning (Newman & Kenworthy 1999). This, however, is only part of the story. Cities dominated by the car, with their malls and freeways, entail a particular 'form of life' that involves not only a specific form of transport but also significantly informs much of the content of lifestyles more generally. Compare, for example, the culturally vibrant street life typical of Asian and European cities with the intrinsically car centred character of many American cities (the parents of one of us were once threatened with arrest for walking in LA!). Attending to automobility effectively therefore, as with energy efficiency, involves taking on board a host of deeply contextual factors, in addition to matters of pricing, technology and planning. It is, thus, not incidental that transport and domestic energy use are a key focus of current mitigation efforts but widely viewed as resistant to conventional policy interventions.

The current tendency to frame and structure policy through

a restricted range of technological and economic considerations reflects a deeply institutionalised 'trust in numbers', which removes from the gaze of decision-makers the broader contextual dimensions of complex policy challenges, such as energy efficiency and automobility. While numbers have come to be seen as the exemplary means of ensuring objectivity, and of securing against arbitrariness and bias, this trust can sometimes be misplaced, as the evidence on the reliability of carbon commodities shows. In *Trust in Numbers*, Theodore Porter (1995) shows that the calculative mechanisms in which we invest so much trust today resulted from political efforts to circumscribe the power of expertise. Numbers can remove arbitrariness and bias, but they can also secure sectional interests, under the guise of objectivity, and blind us to critical contextualised particulars.

The current ETS debate illustrates this well. Although technical matters of market design, such as selling as against giving out permits, garner significant attention far less has been devoted to market fundamentals and implementation issues. For example, a recent Australian Institute of Management survey (ABC 2008) showed that a majority of company executives were unaware of the 2010 starting date, let alone had measures in place to deal with an ETS. Other vital matters are also dropping under the radar. While many renewable advocates hold out hope for a 2020 target analogous to that of the EU (20 per cent emission reductions coupled to a 20 per cent renewables target), this is unlikely to be practicable without major upgrades and extensions to our electricity grid, which currently take around a decade. As for governance, mainstream political commentators have had a field day with the Rudd Government Green Paper. Alan Ramsey (2008) was particularly scathing about the notion of granting Parliament annual oversight of the annual cap. He notes



Mainstream commentators have had a field day with the Rudd Government Green Paper.

that this invites large emitters, who are among Australia's most powerful companies, to bring annual pressure to bear on the process. By contrast, Garnaut's innovative proposal for an Independent Carbon Bank was intended to be informed by both scientific and market fundamentals.

## CONCLUSION

What, however, of the contextual particulars we have underscored in this article if and when all such considerations were addressed. First it's important to reiterate why it is important to attend to these. Dealing effectively with matters such as transport and energy efficiency relies on a good understanding of how energy is actually used. The technological and economic factors that current policy focuses on are important, but not nearly enough: it is only through a 'big-picture' perspective that we are likely to be able to tackle climate change, and other profoundly complex policy problems. Alongside technological and economic factors, a big-picture perspective is framed by broader, large-scale, longer-term strategic objectives. Urban consolidation is a good example. Proposed as a key means of countering automobility, it also has many synergies with broader urban sustainability imperatives such as waste management. Thus, urban consolidation should be seen as part of a portfolio of measures to address climate change. Urban consolidation also has the potential to build close knit and more vibrant communities, in addition to structuring less energy intensive lifestyles—although this requires far more sophisticated approaches to policy-making than currently prevail.

It may be unsurprising that decision-makers fall back on their 'trust in numbers' rather than address such challenges directly. Yet there is another, very traditional, method that is a key here—democracy. If we are to successfully build a lower emissions 'form of life', those—which is all of us—who are expected both to benefit and to bear the associated risks and costs will have to have our voices heard. Much of the commentariat have this very wrong. This is not a matter

of understanding how an ETS works; after all, how many people understand electricity? Rather, it is a matter of deliberating the relevant alternatives, in broad brush but adequate terms.

Hugh Mackay (2008) recently noted a 'window of opportunity' to engage the community in mitigation. This may, however, have passed the Government by; the Green Paper appears to place corporate interests above others and to flag a continuing 'trust in numbers'. If the government *were* to seize the window of opportunity Mackay identifies, and to facilitate community debate about what less carbon intensive 'forms of life' might entail, a potentially more sophisticated and contextually sensitive ETS, and broader complementary suite of policies, could result. In turn, if this process reinforced our 'grip on reality' by tempering our 'trust in numbers', we, and future generations, could only be better placed to manage both climate change and other similarly diabolical policy problems.

## REFERENCES

Australian Broadcasting Corporation 2008, 'Business unprepared for emission trading scheme: Survey', *ABC News*, 1 July [Online], Available: <http://www.abc.net.au/news/stories/2008/07/01/2290937.htm> [2008, Jul 24].

Beck, U. 1992, *Risk Society*, Sage, London.

Beck, U. 1995, 'The world as a laboratory' in *Ecological Enlightenment: Essays on the Politics of the Risk Society*, Humanities Press, New Jersey, pp. 101–110.

Callon, M. 1998, *The Laws of Markets*, Blackwell, London.

Centre for Energy and Environmental Markets 2007, 'Workshop: Auctioning greenhouse gas (GHG) permits in Australia', November 29, Centre for Energy and Environmental Markets, UNSW [Online], Available: <http://>

[www.ceem.unsw.edu.au/content/29thworkshop.cfm?ss=1](http://www.ceem.unsw.edu.au/content/29thworkshop.cfm?ss=1)  
[2008, Jul 5].

Department of Climate Change 2008, *Carbon Pollution Reduction Scheme Green Paper*, Commonwealth of Australia, Canberra, July.

Garnaut Climate Change Review 2007, *Terms of Reference*, The Garnaut Climate Change Review, Melbourne [Online], Available: <http://www.garnautreview.org.au/> [2008, Jul 1].

Garnaut Climate Change Review 2008a, *Interim Report to the Commonwealth, State and Territory Governments of Australia*, The Garnaut Climate Change Review, Melbourne [Online], Available: <http://www.garnautreview.org.au/> [2008, Jul 1].

Garnaut Climate Change Review 2008b, *Draft Report*, The Garnaut Climate Change Review, Melbourne [Online], Available: <http://www.garnautreview.org.au/> [2008, Jul 4].

Garnaut, R. 2008, 'Measuring the immeasurable: The costs and benefits of climate change mitigation', The Sixth H. W. Arndt Memorial Lecture, The Australian National University, 5 June [Online], Available: <http://www.garnautreview.org.au/> [2008, Jul 1].

Hamilton, C. 2007, *Scorcher: The Dirt Politics of Climate Change*, Black Inc., Melbourne.

Healy, S. 2008, 'Air-conditioning and the 'homogenisation' of people and built environments', *Building Research & Information* (Special Issue: Comfort in a Lower Carbon Society), vol. 36, no. 4, pp. 312–322.

Hepburn, C. and Stern, N. 2008 'Re: *Productivity Commission Staff Working Paper on the Stern Review*, Submission to Garnaut Review [Online], Available: <http://www.garnautreview.org.au/> [2008, Aug 4].

Keane, B. 2008, 'Wong's Green Paper: What it means', *crikey.com*, 16 July [Online], Available: <http://www.crikey.com.au/Garnaut-Report/20080716-Wongs-Green-paper-what-it-means.html> [2008, Aug 5].

Latour, B. 1993, *We Have Never Been Modern*, Harvester Wheatsheaf, Hemel Hempstead.

Latour, B. 2004, *Politics of Nature: How to Bring the Sciences into Democracy*, Harvard University Press, Cambridge, MA & London.

Lohmann, L. 2005, 'Marketing and making carbon dumps: Commodification, calculation and counterfactuals in climate change mitigation', *Science as Culture*, vol. 14, no. 3, pp 203–235.

MacGill, I. & Betz, R. 2008, 'A lost opportunity for leadership', *newMatilda.com*, 22 July [Online], Available: <http://www.newmatilda.com/2008/07/21/lost-opportunity-leadership> [2008, Aug 5].

Mackay, H. 2008, 'Rudd needs to display tough leadership', Transcript of interview with Kerry O'Brien, *7.30 Report*, ABC Television, 2 July [Online], Available: <http://www.abc.net.au/7.30/content/2008/s2292699.htm> [2008, Jul. 24].

Mackenzie, D. 2008, *Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets*, February [Online], Available: [http://www.sps.ed.ac.uk/staff/sociology/mackenzie\\_donald](http://www.sps.ed.ac.uk/staff/sociology/mackenzie_donald) [2008, Jun 5].

Mackenzie, D. *forthcoming*, 'Constructing emissions markets', in *Material Markets: Facts, Technologies, Politics*, Oxford University Press, Oxford.

Mackenzie, D., Muniesa, F. and Siu, L. (eds) 2007, *Do Economists Make Markets? On the Performativity of Economics*, Princeton University Press, Princeton and Oxford.



Muniesa, F. & Callon, M. 2007, 'Economic experiments and the construction of markets' in *Do Economists Make Markets? On the Performativity of Economics*, eds D. Mackenzie, F. Muniesa & L. Siu, Princeton University Press, Princeton and Oxford, pp. 163–189.

Miller, P. 2001, 'Governing by numbers: Why calculative practices matter', *Social Research*, vol. 68, no. 2, pp. 379–396.

Newman P. & Kenworthy, J. R. 1999, *Sustainability and Cities: Overcoming Automobile Dependence*, Island Press, Washington DC.

Integral Energy (2003) *Submission to the Legislative Standing Committee on Public Works—Inquiry into Energy Consumption in Residential Buildings*, Sydney.

Pearse, G. 2007, *High & Dry: John Howard, Climate Change and the Selling of Australia's Future*, Penguin, Camberwell, Vic.

Pielke, R., Wigley, T. & Green, C. 2008, 'Dangerous assumptions', *Nature*, vol. 452, no. 7187, pp. 531–532.

Porter, T.M. 1995, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*, Princeton University Press, Princeton.

Ramsay, A. 2008 'Buckle up for trouble on the green route', *The Sydney Morning Herald*, 19 July [Online], Available: <http://www.smh.com.au/news/alan-ramsey/buckle-up-for-trouble-on-the-green-route> [2008, Jul 19].

Shove, E. 2003, 'Converging conventions of comfort, cleanliness and convenience', *Journal of Consumer Policy*, vol. 26, no. 4, pp. 395–418.

Shove, E. 2004, 'Efficiency and consumption: Technology and practice', *Energy & Environment*, vol. 15, no. 6, pp. 1053–



1065.

Vollmer, H. 2007, 'How to do more with numbers: Elementary stakes, framing, keying, and the three-dimensional character of numerical signs', *Accounting, Organizations and Society*, vol. 32, no. 6, pp. 577–600.

Wahlin, W. 2006, 'Powering up a nation: Energy security in Japan and Australia', *Australian Review of Public Affairs*, 12 November [Online], Available: <http://www.australianreview.net/digest/2006/11/wahlin.html> [2008, July 2].

*Stephen Healy co-ordinates the History and Philosophy of Science and Environmental Studies Programs of UNSW's Faculty of Arts and Social Sciences (FASS). He is the FASS Research Co-ordinator of UNSW's Centre for Energy and Environmental Markets and a keen cyclist.*

*Declan Kuch is also a cyclist and currently researching the sociology of carbon markets under the supervision of Stephen Healy.*

ISSN 1832-1526  
*Australian Review of Public Affairs*  
© 2000–2008 [The University of Sydney](http://www.australianreview.net)