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GROWTH

A Taxing Debate:
Climate policy beyond Copenhagen

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CEDA – the Committee for Economic Development of Australia
Level 13, 440 Collins Street
Melbourne 3000 Australia
Telephone: +61 3 9662 3544
Fax: +61 3 9663 7271
Email: info@ceda.com.au
Web: ceda.com.au

Contents and contributors

David Byers is the Chief Executive of the Committee for Economic Development of Australia (CEDA), a position he took up in February 2007. Before heading CEDA, David worked in a variety of roles in Australian companies BHP, Evans Deakin Industries and Woodside Petroleum before joining law firm Morris Fletcher and Cross. Most recently he worked at Mobil Oil Australia and then ExxonMobil in a number of senior public policy roles in Singapore, Dallas (Texas) and Melbourne (Australia).

As the Australian Parliament considers the fate of the Government's Carbon Pollution Reduction Scheme, and the world looks to the forthcoming Copenhagen round of negotiations over an international agreement on climate change, CEDA is pleased to present *Growth 61: A Taxing Debate – Climate policy beyond Copenhagen.*

foreword

The report examines some of the major climate policy issues with which the world continues to grapple. As Warwick McKibbin and David Pearce argue in this volume, we have still not come to grips with the time scales involved in climate change and what this means for policy action. While there is general agreement among economists that market-based responses that raise the market price of carbon are more desirable than regulations and subsidies, there has been insufficient debate as to the best market-based mechanism. Should we raise the price of carbon through a quantity-type approach (such as a cap-and-trade emissions trading scheme [ETS]) or through a price-type approach (such as a carbon tax)?

ETS or carbon tax?

The Australian Government has settled on a form of cap-and-trade scheme as its primary policy response. Yet several papers in this report ask whether this is really the best and most durable approach. How did cap-and-trade become the policy of choice in the debate over how to reduce greenhouse gas emissions? Should it supplant the simpler idea of imposing a tax on energy consumption? The answer is not to be found in economics or science, but in the politics of climate change. Cap-and-trade is more politically acceptable than taxes. As authors in this volume argue, the political appeal of cap-and-trade emissions trading schemes is that they hide the true costs to consumers.

In addition, the 'trade' will not in fact be in greenhouse gas emissions; there can be no such market. What will be exchanged are derivatives of carbon credits and debits – financial commitments that need to be audited. These trades will sometimes be with jurisdictions that are not always financially reputable. Having suffered a global financial crisis – in large part because of poorly managed, excessive credits and swaps originating from excess housing finance – some authors in this volume worry about the integrity of the carbon credits trading down the track. Will there be a carbon bubble of the wrong kind?

Moreover recent data from the European Environmental Agency (EEA) suggests that the best known ETS – the European ETS – is failing to adequately reduce actual emissions. The policies and measures in place today are unlikely to be sufficient for the EU-15 to meet its Kyoto target of an 8 per cent reduction in emissions from 1990. The history of European trading prices for CO_2 has also illustrated the extreme price volatility induced by cap-and-trade quantity-based systems.

This volatility has led influential market participants to express concern that it is undermining incentives to channel long-term investment towards large-scale (often very capital-intensive) greenhouse gas reduction projects and technologies.

By contrast, several papers in this report argue that carbon taxes, by raising the price of carbon-based energy directly, predictably and in a constant manner, better enable firms to plan for investments in capital equipment and new emissions-reductions technologies. They are less vulnerable to manipulation and evasion. Carbon taxes would create greater certainty about prices, stronger and clearer signals to consumers and investors, and introduce some much needed simplicity and directness to climate policy.

Copenhagen

The report also highlights perspectives from major countries – the United States, China, India, Germany and Australia – on the Copenhagen process and what, if anything, is likely to emerge from it. Will there be a successor treaty to the Kyoto Protocol, due to expire in 2012? Or will it be impossible to overcome the doubts that persist about the ability of the Kyoto style 'targets and timetables' approach to deliver substantial quantitative greenhouse gas emissions reductions? Or, as Nordhaus suggests in this report, would the introduction of a scheme of globally harmonised taxes ultimately represent a more effective policy measure than the current emphasis on negotiating binding international or national emissions limits?

Challenges for policy making

In the lead-up to Copenhagen and beyond, there are clearly many difficult questions to resolve in the climate policy arena. Our failure to solve them is not for want of effort or determination to succeed. To understand why major questions persist, it is necessary to reflect on the difficulties inherent in designing a viable climate change policy. The source of these problems is as much in the science of climate change as it is in the economics – and the links between these two fields.

Firstly, the International Panel on Climate Change, in its 2007 Summary for Policymakers, found that most of the recent warming is likely due to man. It found the size of warming over the past 30 years was significantly greater than could be explained by natural variations. Only if human input of greenhouse gases was included, did the simulated climate agree with what had recently been observed. Despite this conclusion, serious and persistent doubts remain – many linked to the limitations of computer models in depicting the natural and anthropogenic factors that might lead to significant climate variations, as well as the inherent difficulties in projecting climate trends into the future over decades and even centuries. The CO_2-to-climate change link involves a long-term global stock–flow process. Models rely on assumptions about future emission levels and the impact of emissions on future CO_2 concentrations. How these concentrations affect the timing and extent of temperature change, climate variability, differences across regions, and the impacts of temperature changes on ecological systems are not fully understood – although knowledge is accumulating.

Secondly, greenhouse gas emissions arise from a large number of sources, yet a tonne of emissions from any point on the globe at any given time has the same effect on the atmospheric concentration of CO_2. Many individual countries have responsibility for a relatively small contribution to the flow of global greenhouse gas emissions (Australia's is about 1.5 per cent). Actions taken by individual countries to reduce emissions will only ever be a small proportion of global action, which in aggregate can only have less than a 1 per cent effect on the total stock; yet actions taken by 'first-movers' can have immediate negative effects on the competitiveness of their domestic industries.

Finally, uncertainties also persist in the economics. The costs and benefits of different mitigation and adaptation options, domestic and global policy reactions, the future path of technological change, and social attitudes to different policy options are conjectural. The time scales involved are immense – actions taken today may not have noticeable effect for 50 years or more. Judgements about the level of discount rate used are critical to the calculus of costs and benefits. For example, Stern and Garnaut use a very low discount rate to derive their conclusions on the costs of delay and the benefits of acting early. For Nordhaus and Porter (in this report), an artificially low discount rate distorts the nature of the trade-off between future and present generations. As future generations will experience much higher incomes, based on improved technologies and expanded knowledge, they argue it is difficult to sustain a case that current generations should endure a precipitous shutdown of greenhouse gas-emitting activities. A steady ramping-up of policies provides a better response to intertemporal and intergenerational equity considerations.

A risk management approach

It is against these characteristics and challenges that climate policy measures must be tested. We cannot wait for perfect knowledge before taking action. The prospect of climate change from greenhouse gas emissions calls for risk management strategies – to make the best decisions in the face of risk and uncertainty.

Firstly, the most cost-effective way to reduce greenhouse gas emissions would be to undertake the lowest-cost emissions reductions, regardless of where they were located. So any policy approach must be truly international to be effective.

Secondly, efficient emissions reductions follow a 'policy ramp' in which policies involving modest rates

of emissions reductions in the near-term are followed by sharper reductions in the medium and long term as competitive low-emissions technologies are deployed.

Thirdly, the best policy approach is one that can be applied flexibly (upwards or downwards) in response to new scientific evidence.

We hope that this report advances the development of sensible and measured policy responses to the risk of climate change. A carbon tax may not be the policy of choice now but the ETS bubble may burst and the world may, in the not too distant future, be looking for a viable "Plan B" to replace versions of the problematic cap-and-trade system. Similarly, while today it may be difficult to envisage an alternative to a Kyoto-style 'targets and timetables' international agreement, the day may soon come when the need to embrace a diversity of interests across all nations calls for more flexible approaches, built on a clear price signal, investment certainty, technologies and national action. Finally, as McKibbin and Pearce argue, the large time lag between mitigation policies and results means that increased understanding of adaptation and the need for effective policies in this area will be crucial over the next decade.

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We thank all our authors for their contribution to this project. As well as our Australian experts, it has been particularly pleasing to receive contributions from around the world. This includes two organisations with whom CEDA collaborates as part of the International Network of Private Business Associations – CIRD, the China Institute of Reform and Development and IDW, the Cologne Institute of German Economics. We also appreciate the efforts of our editor, Professor Ian Marsh, who has steered the project over many months and reached out to access the best from Australia and overseas. Finally, we appreciate the support of CEDA members and other individuals who contribute to our research Gift Fund. Without this support, it would not be possible for CEDA to deliver ideas and options into the public domain through its research and policy group.

Professor Ian Marsh is on the faculty of the Australian Innovation Research Centre at the University of Tasmania. He is also a research fellow at CEDA (the Committee for Economic Development of Australia). A graduate of the Kennedy School of Government, and the Graduate School of Arts and Sciences, Harvard University, Professor Marsh was formerly an Associate Professor of the Australian Graduate School of Management, Research Director of the Liberal Party of Australia, Associate of McKinsey & Co, and Private Secretary to the Minister for Defence. Professor Marsh has been a prolific contributor to public discussion about the role of government through his many books including Australian Political Parties in Transition (2006), and Democracy, Governance and Regionalism in East and Southeast Asia (2006).

In recognition of the economic, social, political and geo-political importance of climate change, this CEDA report revisits the theme of an earlier one, *Climate Change – Getting it Right* (2007), but within a new context.

executive summary

The issues have advanced rapidly since 2007. Back then, climate change was on the international agenda but domestic public opinion in Australia was just mobilising. The CEDA collection brought together papers from Australian and international experts including Dr Robert J Shapiro, Ronald Prinn (MIT) and Graham Pearman (Monash University). Some chapters dealt directly with climate science. Others reviewed economic perspectives, particularly in the context of the Stern report, and possible policy responses, including the role of technology.

At the time of writing, Australia is poised to make choices that may lock it in to a particular set of responses for a considerable period ahead. In addition, the UN Climate Change Conference in Copenhagen, scheduled for December this year, intends to craft a post-Kyoto international policy settlement.

Responding to this context, this collection addresses two specific issues, one domestic and one global:

- What is an appropriate policy response for Australia?
- What are the likely approaches of a variety of countries whose collaboration will be essential to any durable post-Kyoto arrangement?

For nearly 50 years CEDA has informed, influenced and raised the standard of discussion about the issues shaping Australia's economic development. It does this by providing forums and publishing independent research. In the former, politicians, policy makers, business leaders and experts explain and debate different perspectives. In the latter, alternative policy options are explored with more depth and analysis, exposing deeper complexities in ways that are not possible in shorter addresses.

The Economist magazine has described climate change as perhaps the most demanding issue of our time. It is not hard to see the reasons. Climate change invites us to imagine and anticipate developments that are of extraordinary duration. Mitigating action now is unlikely to deliver results until the end of this century. Not only are the scientific models used to forecast climate change extraordinarily complex, but technologies yet to be imagined will have substantial, maybe definitive, impacts. These uncertainties and possibilities need to figure in present deliberations and decisions.

Moreover, if pessimistic forecasts are half-correct, we may not be able to avoid climate change that is already

set to occur. This will require a program of adaptation that is quite separate from, and no less significant than, any mitigation effort.

Finally, this is a truly global issue. Ultimately, if concerted global action cannot be orchestrated, action by any single country or group of countries is futile. This is the general context in which choices of very long term significance for business, society and individuals are now being made.

Public deliberation about climate change in Australia occurred under the shadow of the 2007 election. By contrast, it is instructive to compare these processes (as described in the paper by David Pearce and Warwick McKibbin) with those that have been simultaneously occurring in the US (see the paper by Adele Morris).

In Australia, as the McKibbin/Pearce paper makes clear, these issues have engaged the bureaucratic system at least since the Kyoto Treaty in 1997. The Howard government established a Greenhouse Office in 1998 and initiated a variety of activities to evaluate climate change policy. But until 2006 it adopted a largely reactive approach, at least in relation to public opinion.

The Stern Report and Al Gore's documentary film, *An Inconvenient Truth*, were also released in 2006 and these events, and other developments, lifted climate change to a new level of public awareness.

Thereafter in Australia climate change became a federal election issue. This culminated in the establishment of a taskforce by the Howard government in November 2007. In early 2008, the taskforce recommended adoption of a 'cap and trade' scheme, which was accepted by the government. There was immediate bipartisan consensus around critical strategic questions. Just before the election, the Howard government took a further step, adopting a mandatory target for renewable energy, conceding another important policy choice to electoral pressure.

After the election in November 2007, the Rudd government elevated the Garnaut Climate Change Review to centre stage. Its substantial final report, published in September 2008, is 617 pages long. Writing in *Climate Change – Getting it Right* (CEDA 2007), Robert Mendelsohn of Yale University posed these challenges for the Garnaut Review:

1. It should compare plausible alternative policies so governments can see what their choices are.
2. The discount rate should be realistic – it should follow the same rate used for other public investment.
3. The representation of uncertainty needs to be carefully handled – citing the best case and the worst case do not advance understanding.
4. The Garnaut Review should discuss both adaptation and mitigation.
5. Australia has distinctive interests (eg in relation to coal) which need to be properly assessed.

While the Garnaut Report dealt in depth with the last two issues, its handling of the first three was arguably less than adequate.

After the release of the Garnaut Review's final report, there was no time or machinery in which conceptual or strategic issues could be exposed to wider scrutiny and engagement. Yet assessments of the significance, implications and choice of policy options should precede discussion of solutions for adapting to and mitigating against climate change.

The government released its White Paper in December 2008, only three months after Garnaut presented his final report. This shifted discussion to immediate choices and actions. It also locked the government into a particular position. It was soon followed by draft legislation in April 2009, which was introduced to parliament in May 2009. That debate is still proceeding.

As the McKibbin/Pearce paper in this collection argues, broader public understanding has not been cultivated sufficiently. Ultimately, policy choices and public consent are interdependent. A decision now that raises expectations inappropriately, that misleads the public about what can be achieved in the short term (or indeed achieved at all) and ultimately produces backlash, is arguably worse than no decision or a delayed decision.

A number of complex issues needed (and deserve) to be communicated clearly and broadly.

Informed public discussion would have exposed and encouraged understanding of issues such as:

- the right approach to intergenerational equity
- the discount rate appropriate to value longer term benefits and relate these to present costly actions
- the imperative of concerted international action
- the likely effectiveness of alternative incentives as means of influencing behaviour (eg taxes on production or consumption versus cap and trade versus a hybrid regime)
- the level of emissions needed to stabilise carbon in the atmosphere at tolerable levels (Prinn 2007)
- other actions necessary to facilitate interim adaptation (ie over the next 60 or so years).

As noted above, the stakes – not just for the business community but for everyone – are very large. Choices are now being made that, for good or ill, will bind actions for the next century. The public is owed a discussion on the stakes involved in these choices. This collection explores emerging policy choices. At one level, this involves Australia's response. But this cannot be separated from a second level, which involves international responses.

Chapter summaries

The report leads with a policy perspective from CEDA's Director of Research and Policy, Dr Michael Porter.

Part 1 of the report reviews issues currently being debated in the Australian parliament and broader perspectives relevant to domestic policy choices.

Part 2 contains international perspectives and experience relevant to Copenhagen deliberations and beyond.

Michael Porter

Michael Porter argues that a carbon tax is workable based around the GST. The revenue can cut taxes elsewhere, subsidise R&D and provide assistance to major polluting countries.

The 'carbon price' in an ETS comes from trade in emissions *debits and credits*. ETS prices in Europe are really *derivative* prices, based on political allocations. These prices are volatile, offer no guarantee of reduced emissions, and promote a potential carbon finance bubble.

Most people don't understand the complexities of an ETS. But a carbon tax, like the GST or a tobacco tax, is readily understood. The world's leaders have 'sold' a solution on the basis of no observable tax or price changes, and with 'negotiated' exemptions amounting to protectionism. Customers favouring reduced emissions deserve better than an ETS which hits exporters and import competitors.

This failure to focus on consumers and prices disregards increasing access to smart devices (eg phones) for monitoring prices and taxes on environmental products such as emissions, electricity, cars and water.

A carbon tax can deliver certainty, retention of competitive advantage, consumer engagement, and avoid the rent-seeking and corruption of an ETS. A carbon tax also avoids a carbon finance bubble. Jurisdictions attracted to issuance of tradeable credits and debits are far more financially vulnerable and open to corruption than those who gave us the current financial crisis.

Part 1: Policy perspectives

1.1 Warwick McKibbin and David Pearce

Warwick Mckibbin and David Pearce summarise domestic and international developments. They observe, "Australian climate policy is both well developed and still in its infancy. It's well developed in the sense that since negotiation of the Kyoto Protocol in 1997, a considerable amount of work has been done in designing policy alternatives." But engagement with the practical implications of the proposed ETS is in its infancy.

The chapter emphasises the important distinction between adaptation and mitigation. In essence, mitigation in the medium term will have no impact on climate change already foreshadowed. Adaptation, by contrast, is about learning to minimise the costs of any climate change that occurs. It brings benefits today (potentially benefits even if there is no further climate change. A price on carbon is essential.

But the proposed ETS has two problems. One concerns the potential for permit price volatility and the other short to medium-term adjustment costs. Australia's approach must also be aligned with that of other countries. Emphasising the long-term implications of the ETS, McKibbin and Pearce observe, "When Australia's climate policy starts to bear fruit, today's political leaders will be distinguished elder statespeople, and the prime minister will be someone who hasn't been born yet…. Based on the typical life cycle of large firms, the current big players in the market won't exist."

They conclude by suggesting any arrangement must be capable of assimilating nasty surprises, and should be based on more than best and worst scenarios.

1.2 Geoff Carmody

Geoff Carmody calls Australia's CPRS "the GST from hell" for several reasons: it affects exports, exempts imports and reduces competitiveness. It is more likely to drive emissions (and jobs) overseas than reduce emissions globally. It has also been poorly received across the board. He calls for a more globally acceptable policy model and notes that, crucially, China has signaled its support for a consumption-based approach.

He says the debate about climate policy design is not over, and three major issues are unresolved:

- whether an emissions trading scheme (ETS) is better than a carbon tax
- whether national emissions production or national emissions consumption is the best national emissions base for policy
- the setting of global emissions abatement targets and their allocation among countries.

A national emissions consumption-based carbon tax best delivers all of these outcomes and is a viable path to where we started: the original vision of a uniform global response.

1.3 Gary Sampson

Gary Sampson's background as the highest-placed Australian to have worked at the GATT and its successor, the WTO, provides a valuable perspective on the links between climate policy, trade and competitiveness.

The serious economic problem for countries adopting ambitious emissions reduction targets ahead of others is the adverse impact on their most emissions-intensive industries. With this in mind, Sampson's paper examines WTO provisions in order to gain an insight into concerns surrounding competitiveness.

WTO rules were conceived to create a stable and predictable rules-based trading system and promote the negotiated reduction of trade barriers. A coherent international agreement on climate change will need to address different concerns to the WTO, but in a mutually supportive and consistent manner. He also makes the point that WTO rules should not to be viewed as an "inconvenience" to be worked around in order to achieve emission reduction policies.

Sampson's conclusion is that the challenge at Copenhagen is to set in motion a process for the negotiation of a treaty that will permit a level playing field for countries wanting to move head at different speeds in enforcing their emission reduction targets. This will require international agreement on dealing with competitiveness in a manner that is rational, equitable and coherent.

1.4 William Nordhaus

In a reprint of a chapter from his well-known book, *A Question of Balance: Weighing the Options on Global Warming Policies* (2008), prominent Yale economist William D Nordhaus looks at the relative merits of quantity-based and price-based mechanisms. The ETS is a quantity based approach, while a carbon tax is a price-based approach. Nordhaus catalogues the difficulties, both practical and conceptual, associated with an ETS and illustrates the results by modeling the likely impacts of the alternatives on global emissions. He presents the case for a tax-based alternative.

1.5 W David Montgomery, Lee Lane and Anne Smith

W David Montgomery and his co-authors focus on R&D policy. The century-long lead times in tackling climate change and the chronic uncertainties create fundamental problems. Montgomery's chapter is written in a US context, but the analysis is applicable to Australia.

After making the case for extensive government engagement in R&D, Montgomery turns to appropriate policy design. The conception of research as linear – from boffins to practice – has long been discounted in innovation literatures. But translating this into a climate change context multiplies design problems. Not only must varied motivations be accommodated (commercial, scholarly, prestige, political), but positive network effects need to be realised:

> The difficulties may be especially acute for government-funded R&D intended for private sector adoption. In this case, government-funded basic research might have to address problems that arise at the "later" stages of the R&D process. These reverse flows may involve the private sector trying to get the attention of government funding and perhaps university researchers for basic research problems that arise in development or commercialisation phases…This feature of the process would appear to imply that support (subsidies, demand pull from carbon pricing) for technology demonstration is likely to be prone to failure, unless there are also mechanisms to provide adequate incentives for all the linked research efforts that may be needed to overcome obstacles.

The chapter continues to explore additional complexities arising from the international character of the problem and the need to encourage international technology transfer.

Part 2: Towards an international system

2.1 Alan Oxley and Bill Bowen

Alan Oxley and Bill Bowen summarise the overall challenge of climate change in the following way:

> Development of a successful global strategy to address climate change requires reflection of consensus among the major emitters, a common long-term aspirational goal, room to recognise different strategies to reduce emissions, a dynamic structure which can be reviewed and adjusted every decade as economic conditions adjust, technical understanding of the process of global warming improves and technologies to address it are developed and progressively deployed. Above all, the strategy must give the leading developing country economies confidence that the strategy will not impede their plans to raise living standards and reduce poverty… None of this is apparent in the work to date by negotiators on a successor instrument.

They argue there is no justification for rushing to negotiate to design a successor instrument to the Kyoto Protocol. They suggest that the Kyoto Protocol weaknesses must be addressed in the design of a successor instrument if it is to succeed. The authors state that unless the fundamental economic interests that currently divide attitudes on how to tackle climate change are recognised in an agreement, no global consensus is possible.

The paper suggests effective global strategy should:

- establish consensus among countries which account for a substantial majority of global greenhouse gas emissions
- set a common goal
- support national development objectives
- foster or recognise strategies to reduce emissions
- demonstrate tangible short-term results
- perceptibly spread costs equitably
- facilitate adaptation and mitigation
- provide for flexibility and revision.

Finally, the paper argues that the only way to build global consensus on climate change is to aim for a global EMG (a treaty which is Evolutionary, Multi-Track and reflects Global consensus) not a global ETS (a treaty which seeks to tackle climate change with a 'take it or leave it' global Emissions Trading System).

2.2 Adele Morris

Adele Morris of the Brookings Institution reviews the development of climate policy in the US. While the Obama administration has reversed the climate scepticism of its predecessor, the problems of progressing legislation through Congress remain. The interests of coal producing and manufacturing states need to be accommodated. Mid-term elections next year compound these pressures. She suggests that the challenge for the Obama administration is to promote an approach that solidifies and preserves the consensus for domestic action over the long term and leverages US action into greater greenhouse gas emissions abatement abroad.

Morris includes observations on the outlook for Copenhagen. Success needs to be defined "creatively and dynamically" and not yoked to agreement on an ETS. If US consideration of legislation is incomplete, Morris believes "it would be better to craft an agreement that recognises US energy spending from the stimulus package, crafts a technology cooperation agreement, for example, and promises further talks when US legislation is more developed." Morris outlines the ingredients for a successful conclusion at Copenhagen as:

- all parties sticking to commitments that are feasible and sustainable domestically
- creative and dynamic definitions of success
- allowing countries the flexibility to set price signals instead of hard caps
- using of commitments by major developing countries to avert protectionism.

2.3 Yin Zhongyi

Presenting a Chinese perspective, Yin Zhongyi from the China Institute for Reform and Development, suggests developed countries that are responsible for the bulk of emissions in the atmosphere now must take prime responsibility. He writes that the Chinese government has already introduced a variety of mitigation and adaptation measures and will not be party to any approach that diminishes its capacity to grow its economy. Any remedy that does not recognise this position will be unacceptable. The Chinese government also believes a tax-based solution may be preferable to quantity-based regimes, such as an ETS.

2.4 Prodipto Ghosh

Dr Prodipto Ghosh, former Indian Secretary to the Ministry of Environment and Forests, and distinguished fellow at The Energy and Resources Institute (TERI) in India, picks up similar themes in his discussion of India's approach to the UN Climate Change Conference in Copenhagen meeting. He notes the debate between developed and developing countries – notably India and China – has polarised. Western nations are responsible for the accumulation of GHG emissions and should bear the largest share of the burden of cuts to future emissions, as it will be impossible for developing countries to grow without expanded energy production.

Developing countries are nevertheless fully alive to the dangers of climate change and to their own responsibilities. Ghosh enumerates the various measures being taken by India to curb emissions.

He concludes that a global agreement is unlikely unless developed countries recognise their responsibilities and that mitigation actions need to be designed in the context of the needs of individual states. Adaptation also needs to be given higher priority. India also opposes sectoral targets which would privilege particular technologies. Rather, western countries need to finance the global R&D effort.

2.5 Hubertus Bardt

With the EU and individual European governments at the forefront of international advocacy of an ETS, Dr Hubertus Bardt from Germany's IDW provides a European perspective. Dr Bardt explores the essential features for a new international agreement. To include developing countries, Kyoto Protocol measures that allow offsets for investments in mitigation projects need to be extended. Any agreement must also include the 15 largest emitters of greenhouse gases.

Conclusion

This collection underlines the many uncertainties and complexities that surround the development of climate change policy but also raises the issue of how we can best deal with the long-term nature of the issue.

To manage on-going policy development in Australia, the Federal Government has announced the formation of an Australian Climate Change Regulatory Authority. As now conceived, this is purely a bureaucratic and technical body. Yet in the light of the many administrative complexities identified in these papers, climate change regulation will likely become a technical nightmare. Arrangements for appeals and for transparent dealing are unclear.

Moreover, the proposed authority is limited to a regulatory role. More is surely required. The complexities identified in this collection underline this. Emerging issues will concern the substance of policy, not just the administrative details. The development of bipartisanship and public opinion must also be considered.

Elsewhere, Warwick McKibbin has suggested the establishment of a standing body along the lines of the Reserve Bank. The autonomy and authority of the Reserve Bank rests on a consensus between the major parties and indeed in the community more broadly. This is its license to adjudicate monetary policy. A political consensus on climate change is still remote. In its absence, no forum can attain 'neutral' status. The Productivity Commission may represent another possibility. But it may also founder on a lack of political consensus. Is the structure surrounding the Auditor-General a better configuration? This involves a technical agency undertaking professional analysis and a political arm (perhaps in the form of a joint parliamentary committee) to provide a springboard for broader public and interest engagement.

Whatever the remedy, authoritative institutional capacity will be surely required. This is needed to host on-going resolution of major issues about targets or taxes, prices or tax levels, adaptation, mitigation aims and progress, the contribution of technology and needed research, international factors etc. Ideally, such an institution should also be able to mediate bipartisanship and inform public opinion.

Climate change remains a work-in-progress.

Dr Michael Porter is Director of CEDA Research and Policy. Dr Porter is founder and Executive Chairman, Tasman Asia Pacific Pty Ltd and Tasman Institute. He was Professor and founding Director of the Centre of Policy Studies (CoPS), Monash University, between 1979 and 1990. Dr Porter received a Commonwealth Research Centre of Excellence Award in 1982, one of 10 programs covering taxation, environment, resources and the financial sector. CoPS in the 1980s, and its successor the Tasman Institute in the 1990s, played a lead role in preparation of reform strategies for Victoria under the banner of Project Victoria in 1991–92. These strategies covered electricity and gas, ports, water, transport and general reform of state enterprises, environment policy and taxation. He has also taught economics at leading universities including Yale (where he was Irving Fisher Professor from 1978–79) and Stanford in the US, and Monash and the ANU in Australia.

Reforms in the greenhouse era: Who pays, and how?

A CEDA Research and Policy perspective on climate change

Summary

The accumulation of greenhouse gases (GHGs), and notably CO_2, is seen increasingly as a cause of global warming, volatile weather, changed rainfall patterns and much more. Although this paper makes no comment on the science and causes of global warming, it acknowledges there is broad-based community pressure to reduce carbon-emitting activities in Australia and to favour renewable energy sources (preferably those with a low GHG footprint).

The Australian government has responded to these pressures with the Carbon Pollution Reduction Scheme (CPRS), a variant of the 'cap-and-trade' emissions trading scheme (ETS) used, for example, in Europe. This has occurred despite the CPRS delivering negative protection when adopted unilaterally: it penalises the energy-intensive goods that dominate Australian exports and exempts imports that will compete with locally-produced output covered by the scheme. This has created understandable Australian pressure for 'compensation and carve-out' measures so those firms do not feel victimised. While the government, and even some members of the opposition, favour the CPRS, the problems of implementation are so substantial that there needs to be a far more efficient alternative 'in the wings'.

Along with other proponents of a consumer-based carbon tax (notably Carmody in this volume), this paper advances a system where a tax per tonne of emissions is imposed but that, as with other input costs under the GST, this cost is passed down the chain of production. Price quotes and invoicing enable consumers to see the carbon element of price – a relatively minor modification of the GST invoicing system. Goods and services that avoid using carbon at all stages of production will pay the pure 10 per cent GST; other goods and services will pay a premium in proportion to emissions intensity, weighted over all stages leading to the final sale. Exports from Australia would be 'zero-rated' (and taxed by the importing nation's carbon reduction policies). Imports to Australia would be subject to Border Tax Adjustments so they are treated the same way as substitute locally-produced items.

A further problem with the ETS is that the trade is in financial instruments, or GHG derivatives, not GHGs. The current global financial crisis – brought on by toxic financial derivatives and their misuse, trade and 'securitisation' of what should be secure housing finance

– should warn us off similar trade in GHG derivatives on a massive scale. Yet that is precisely what is entailed as the ETS ramps up to a worldwide scheme across many countries with poor financial governance and major emissions. The ASX is in print with no doubt disinterested but enthusiastic documents regarding carbon derivatives trading.[1] However, in the context of the current financial crisis, the prospect of promoting billions of dollars of trades in carbon derivatives (credits and debits by jurisdiction) is frightening and a potential source of yet another financial bubble ready to burst.

Introduction

No guarantee on emissions quantities via a CPRS

It is commonly asserted that an advantage of an ETS (or CPRS) over a carbon tax is that the former guarantees a *quantitative* emissions reduction outcome (by capping emissions) with no certain price outcome, while the latter guarantees a price outcome (by setting a price on carbon emissions) at the expense of emissions reduction uncertainty.

This 'quantity of emissions' argument for a CPRS is false because of the ability to import (cheaper) emissions permits that undermine the Australian cap. There is absolutely *no* certainty about whether or how much *Australian* emissions will be reduced, let alone what will happen to global emissions under an ETS. Additionally, setting quantity limits is particularly difficult when targets must adapt to differential economic growth, uncertain technological change and evolving science. Accordingly, the guarantee of quantitative emissions reductions may really be an illusory benefit. As Nordhaus notes (2008, p. 25):

> We do not know what emission levels would actually lead to dangerous interferences, or even if there are dangerous interferences. We might make a huge mistake – either on the low side or the high side – and impose much too rigid and too expensive or much too lax, quantitative limits.

While the ETS and CPRS currently have a political head of steam in the EU and Australasia, and possibly the US, there are many creaky bridges to cross. A particular source of vulnerability of an ETS arises from its reliance on the creation of another financial derivatives market, and the emissions debits and credits and packaged derivative instruments, this market will spawn.

The difference between the current financial crisis and a likely future 'carbon derivatives bubble' is the necessary involvement, in order to obtain a global ETS solution, of many more jurisdictions including the developing countries of Asia, Eastern Europe and South America. As new jurisdictions with high carbon emissions join the market, this raises a new layer of complexity around questions of financial governance, quality of carbon accounting, who should pay for adjustment and so forth. In contrast, a local carbon tax (based on national consumption of emissions) is something the world community can help developing countries to phase in, in tandem with reduced emissions schemes, and with no penalty to first movers in contrast to the ETS and CPRS. A carbon tax can replace more distorting taxes, fund R&D schemes, and provide aid for phasing in lower emissions technology for energy generation.

In summary, quite apart from the EU evidence of the past 12 years, there are many in-principle reasons to doubt the efficacy and durability of an ETS, given the continuing and necessary involvement of assessors, auditors and regulatory parties. There is scope for corruption and the real capacity for a financial bubble. As with the financial crisis, many question whether counterparties to the contracts – outside the OECD for example – will seek to exploit a major weakness of an ETS: whether there will be emissions reductions as per the issuance of credit instruments. The additional point of asymmetry raised here is that an ETS fails to engage the financial support of consumers, but attracts the financial community.

A tax in sync with consumers

A carbon-adjusted GST is a broad-based approach in sync with community pressures for clear incentives to reduce our carbon footprint. While politicians favour the ETS, there is widespread agreement among economists that there are threats to both its integrity and durability. In addition, sound economics suggests a strong case for a carbon consumption tax to be placed on the interchange bench and enter the field when the damage to and from the ETS calls for a better solution. Ross Garnaut's Final Report also agrees with the thrust of this paper when he says in his summary on policy:

> "A well-designed emissions trading scheme has important advantages over other forms of policy intervention. *However, a carbon tax would be better than a heavily compromised emissions trading scheme"* (emphasis added; Garnaut 2008, p. xxiv).

Qantas Chairman Leigh Clifford has also noted the impracticality of a CPRS relative to a carbon tax.[2]

A carbon tax integrated with the GST system also fits with the capacity of new technology and smart devices to inform us of costs in ways that have a low transactions cost. Increasingly techno-savvy consumers, using smart handheld devices or phones for example, will be able to price and buy products knowing just what the carbon element is (if they wish). The carbon-affected goods of greatest interest include electricity and water

by time of day, season and carbon content, as well as all other products to which those environmentally sensitive products are inputs.

Phasing in a carbon tax

A carbon tax can be set at values per tonne that escalate to the desired value over a period, making the phase-in element more politically manageable and economically sensible. A ramp-up of the tax fits with technical arguments; and notably that there is no case for precipitous action despite the current hype.

In support of the ramping model suggested by Nordhaus and others, three key points emerge from the scientific discussions:

- Whatever action we take, the global emissions stock will barely be affected over the next three-to-four decades.
- The contribution of Australian greenhouse gas emissions to this flow is about 1.4 per cent and falling. This measure – a flow – is in tonnes. The relevant stock measure is a concentration concept – measured in parts per million (ppm) by volume, with targets specified in the range of 450 to 550 ppm by 2050 for example.
- A tonne of emissions from any point on the globe at any given time has the same effect on the atmospheric concentration of CO_2.

The most cost-effective way to reach a specific atmospheric concentration is to undertake the lowest-cost emissions reductions regardless of where they are located. Closing down major power stations and aluminium smelters in Australia will increase, rather than reduce, emissions if this simply leads to expansion in more polluting environments.

While Australia does not wish to be a free rider in reforms aimed at creating a safer and better planet, we should not be forced into unsound agreements or well-meaning but ineffective measures that will undermine the economy in the short run for no certain long-run benefit. At a minimum, we should design a robust scheme for shifting to a low-carbon economy without large costs in transition. We need to get the incentives right and phase them in to adjust without trashing existing production and assets. We should also foster R&D, aid newly developing countries in their emissions and pollution reduction strategies, and generally keep a high standard of science, fairness and policy awareness in the debate.

The rhetoric on emissions trading schemes such as the CPRS in Australia includes references to the need to 'price carbon' but lacks the substance, simplicity, transparency and sense of an explicit price incentive. The government favours a heavily bureaucratic scheme that inevitably raises uncertainty regarding investment in Australia. Once the cost of somewhat arbitrarily assigned obligations to purchase credits starts to be felt, producers such as electricity generators, energy-intensive exporters and major manufacturers feel they will lose comparative advantage and cease to invest. Others, including investors in renewables, will also hold off, waiting to see whether the CPRS will be legislated, whether other countries will support such schemes at Copenhagen, or whether a different scheme might emerge.[3]

Efficiency and corruption

While tax systems are far from perfect, they have the advantage of involving two parties in a zero-sum game – and thus there are natural disincentives to abuse. On the other hand, a valuable quota (as in a cap-and-trade) can be issued by a bureaucracy without a clear sense of cost to other parties and with a chance for the issuer to be paid for the privilege – without the knowledge of others.

While there is a quoted European price for carbon via derivative 'securities' such as carbon credits, in reality the political marketing of the ETS is conducted as if it is creating new opportunities for rents and privileges. And of course it is *not* a trading of carbon, or even GHG emissions, but of financial instruments or commitments.

Treatment of imports

In the case of imports and a carbon tax, as covered by Sampson in this volume,[4] WTO rules allow Australia to apply a Border Tax Adjustment (BTA) to compensate for the effect of a carbon tax on domestically produced products. To quote Sampson (2009):

> In the case of a domestic carbon tax, a BTA would charge imported goods the equivalent of what would have been paid had they been produced domestically and rebate the tax paid by exporters. With a cap and trade scheme, a border adjustment would be doubly bureaucratic in that it would oblige domestic importers or foreign exporters to secure emission permits analogous to that faced by domestic producers. Exporters would need to apply for and receive emission permit rebates.

The sound economics of a carbon-adjusted GST

This paper, and others written for CEDA (Shapiro 2007; Nordhaus 2009; Carmody 2009), argue:

Why not target the same (ramped) emissions reduction goals through a properly assigned, broadly based and foreseeable tax on GHG emissions content?

A carbon tax follows sound and tested economic principles, using a price mechanism to change the relative prices of energy inputs and, consequently, the prices of goods and services. Emissions-intensive

goods become more expensive relative to those that are less emissions intensive. This provides an incentive for consumers and businesses to adjust their purchasing decisions in favour of lower-priced, less emissions-intensive goods and services. As well as driving emissions reductions by changing relative prices, the introduction of a carbon tax would provide a financial incentive for investment in low emissions technology research, development and commercialisation.

Just as importantly, it creates a sense that we are all paying for what is 'our' problem, and roughly in proportion to the GHG emissions intensity and level of national consumption.

Carbon leakage

The reason the climate policy problem is seen as so "diabolical" (to quote Ross Garnaut) is that global warming is a 'public good' – a public commons related to the existing *stock* of GHG in the atmosphere, where the flow in any year is modest in proportion to the stock, and where the annual Australian contribution to the flow is around 1.4 per cent. A policy problem is that reduced production or consumption by one country or consumer has no discernible effect on the total, and thus little can be achieved without international cooperation.

To complicate matters profoundly, the costs of acting come early and the benefits come very late, are uncertain, and can only be measured in the distant future – long after the policy initiators have left office. The good news is that the 'public good' aspects (ie no point in a country going first) can at least be minimised by eliminating trade competitiveness as a driver that encourages inaction. For this reason a consumption-based carbon tax is more helpful than an ETS, since a carbon tax does not penalise the exporters in early mover countries, whereas an ETS hurts exporters and creates a need to compensate or exclude from scheme coverage, as exemplified in the government and opposition contributions to the debate in Australia.

In terms of reducing the supply of such a public good (or 'bad' in this case) there is a need for concerted action. Many of the current 'solutions', such as reducing electricity or aluminium production in Australia, will make the matter worse as countries that produce more emissions per unit of output expand as Australia reduces its own emissions. This is called 'carbon leakage' in climate jargon. A related issue is that competitively priced electricity has been a source of competitive advantage for many Australian industries. The Australian power generation industry is characterised by a very high proportion (approximately 84 per cent) of coal-fired power generation capacity which is strongly affected by the introduction of a price on carbon emissions. Alternative low-emissions power generation technologies need technological development, cost reduction and time to transform the energy mix towards a lower emissions profile.

The problem is that concerted action to date is based on targeting national emissions production, not consumption, and cap-and-trade, with incentives at the end – and not the start – of the policy queue. If you delay charging your producers for generating GHG, you benefit, since they gain at the expense of the first movers. A carbon tax model targeted on consumption is attractive because it targets those pressuring for reform, who thereby pay, and does not penalise exporters or import-competing industries (see Carmody 2009).

An ETS is effectively a burden on the production of energy emissions. It penalises exporters and creates rent-seeking pressures, as an emissions quota may be negotiated along with a price exemption since the permits have value and are tradable. Worse, an ETS may actually increase emissions when more polluting countries take up the slack, since there is no easy mechanism by which other countries can be made to follow suite.[5] If a community (especially a relatively rich community like Australia) rejects an explicit tax on its own emissions consumption, then that community is not favouring a genuine and transparent response to carbon reduction.

On the other hand, 'favouring' the CPRS is playing the game of 'don't tax him, don't tax me, tax the fellow behind the tree'.

Consumer footprints – where should they lead?

Many environmental groups and other strong supporters of strategies to reduce carbon emissions in Australia are critical of the CPRS and favour an explicit tax. In large part this is because many in the community who want to reduce their 'carbon footprint' find they are not part of the scheme as it only focuses on the major wholesale emitters and that even some of these, including agriculture, have been exempted or 'carved out'. The ETS has no incentives that touch the community directly – in sharp distinction to a consumption tax model. There is no capacity under the quota model for customers to 'carbon-cost' their actions, or better, lower costs by varying their consumption of GHG embedded in commodities. On the other hand a carbon tax creates the incentive for individual reductions. People can monitor with new smart devices that report taxes and charges

of commodities such as electricity, water, gas, as well as variations by time of day. Environmental groups in Australia have been highlighting this flaw.

Why we need a 'new tax'

Taxes are relatively simple to administer. Even the Garnaut Review (2008, pp. 308–309) conceded this much:

> Carbon taxes are straightforward to apply and avoid the need for governments to take discretionary decisions about who ought to be allowed to emit. Carbon taxes also provide certainty about the marginal costs of mitigation.

The principle of sound (Pigovian) taxation generally suggests in the case of 'bads', such as carbon emissions, that the user or consumer should pay to offset the negative external effect of emissions. A virtue of a carbon consumption tax in a country such as Australia is that it automatically exempts goods that are exported, which then get taxed in the country that imports them, and ensures imports are treated the same way as local products. In contrast the CPRS obliges firms to buy permits and then penalises the 'first mover'.

For some reason this obvious application of targeted consumer taxes remains barely discussed. Instead, we have seen the uneven and hastily attempted introduction of emissions caps and trading arrangements, followed by attempts to carve out compensation arrangements or provide temporary assistance to energy intensive industries. The ground rules for these exemptions are neither consistent nor clear. Australia's largest export industry, the coal industry, is excluded from emissions-intensive trade-exposed (EITE) assistance despite the industry arguing that it meets the criteria for moderately intensive activities (1000 tonnes of carbon dioxide equivalent per million dollars of revenue) with an average emissions intensity of more than 1300 tonnes of carbon dioxide equivalent per million dollars of revenue. It also argues it will lose international competitiveness if it is not eligible for EITE assistance. In support of its argument it commissioned a report from ACIL-Tasman which backed its claim that most coal production is from mines above the threshold for moderately intensive activities and that higher costs, mine closures, job losses and reduced coal production would follow. Nonetheless, the government has excluded the coal industry arguing that coal is below the required threshold and unique in that the level of greenhouse gas emissions can vary so much from mine to mine. Its exclusion may equally reflect the standing of an industry politically out of favour on the climate change issue.

One reason the community appears to have endorsed ETS proposals around the world and in Kyoto is that it is easy to endorse a system that has no direct or immediate voter cost.

While there are clear concerns with implementation costs of an ETS, it is also true that implementing a carbon tax via the GST has its complications. If the tax is set by an average industry classification it may offer inadequate incentive for firms to individually reduce emissions, although they will benefit by using low emissions inputs with less tax to pass on. There will be a case for review and change of the carbon tax supplement within the GST schedule, and so the scheme is not free from bureaucratic dimensions and costs. It is just that these costs, rent-seeking and scope for corruption are far less than for an ETS – a system of credits and debits and tradeable instruments that require constant audit against actual emissions. One option to manage the costs of a carbon tax in the early stages is to zero-rate most very low emissions commodities, and to apply more frequent adjustment on emissions-intensive products.

There are some pluses to the CPRS in terms of incentives to cut emissions and sell the permits, and for rent seekers to search out benefits from emissions reduction possibilities. Finally, McKibbin and Wilcoxen's hybrid proposals address rent seeking and related issues in ways that can improve the likely outcomes of a carbon tax relative to an ETS (1997).

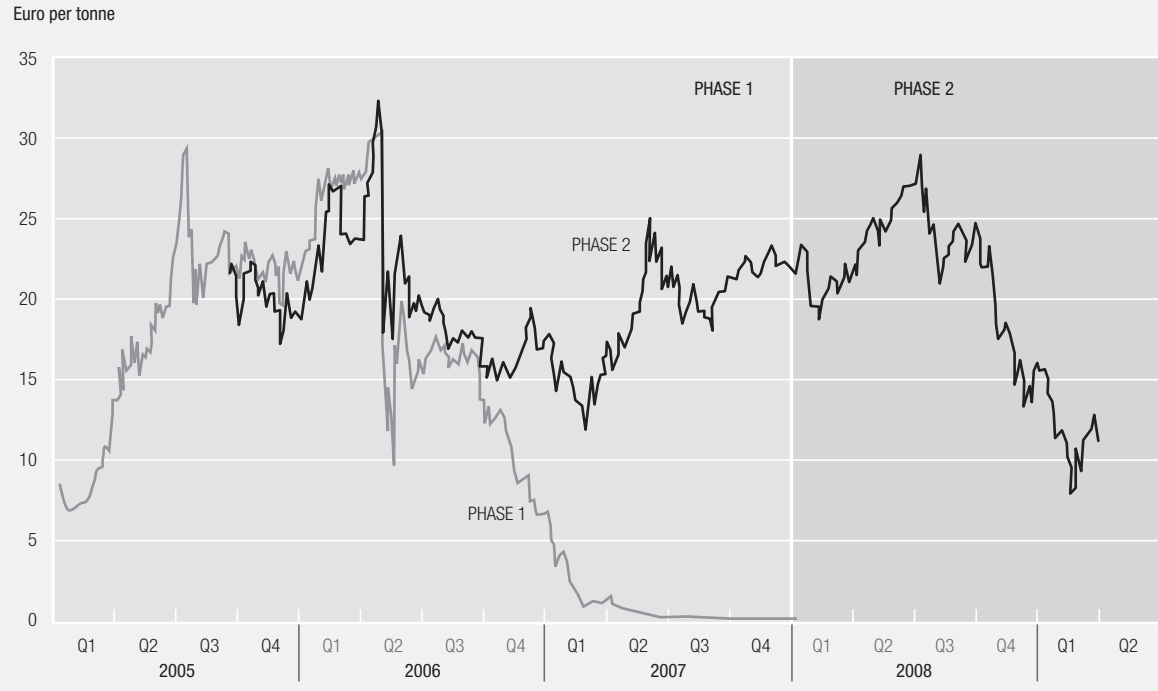
Facilitating business certainty

Benjamin Franklin (1706–90) remarked "In this world nothing can be said to be certain, except death and taxes". Had he lived today he might have added that nothing is more certain to kill investment than uncertainty itself. And a sure way of creating economic uncertainty is to intervene across the economy according to committee and bureaucracy-administered judgements on emissions of CO_2, company by company.

The industries affected most by taxes or obligations related to emissions of carbon are typically capital intensive, with long-term investments driven by a discounting calculus that extends over many decades. Energy-related industries seek taxing and regulatory regimes that create the least possible degree of uncertainty, since anything that raises the risk premium raises the discount rate that applies. Moving a discount rate from 9 per cent to 15 per cent, for example, demolishes the capacity of long-term income streams to drive investment.

Even more remarkable is the time chosen to try to implement a highly uncertain ETS. In 2009, the

FIGURE 1:
EUROPEAN ETS CARBON PRICE MOVEMENTS: EUAs



Source: www.pointcarbon.com

world is battling the greatest shock to the international economy since the Great Depression – one that resulted directly from misuse and poor understanding of financial derivatives. Yet the ETS has, at its heart, the creation of a new and far more questionable financial instrument than the credit default swaps and other synthetic derivatives behind the global financial crisis. The tradable emissions credits are to be issued by all countries – with the bulk of them eventually to come from a range of countries with relatively unsophisticated financial governance and trading regulation. If Wall Street's financial manipulations of debt and derivative instruments gave us the global financial crisis, the ETS seems certain to give us something far worse.

Volatile carbon derivative prices

The track record and nature of an ETS indicates no likelihood of predictable emissions reductions or carbon 'prices'. In contrast to a predictable consumer tax, data from the European ETS indicates the price of emissions credits is ultra volatile. Both supply and demand are ultimately political, and thus highly inelastic to the carbon price. Small changes in the supply of credits or debits can cause very large 'carbon credit' price variations. The largest producers of CO_2 emissions are likely to be power generation utilities, particularly coal-fired power stations. Under a strict cap-and-trade system, a cold winter or hot summer will cause CO_2 emissions to rise rapidly with electricity consumption. Since the quantity of emissions will be capped, their price will also rise sharply and be passed onto consumers as higher electricity prices.

Because the supply of carbon credits and debits is set politically, the resulting 'market' in emissions credits is destined to make a roller coaster look relatively flat. Figure 1 shows the volatility of the price of carbon credits with the slump in price reflecting, far more than liquidity factors, notably the changing willingness of European governments to issue new credits.

The price of EU emission allowances (EUAs) (the light grey line) climbed to 30 Euros per tonne in December 2005 and remained in the 20–30 Euro band for almost an entire year. However, in April 2006 the price of EUAs crashed by almost 20 Euros. By the end of 2007, it had fallen to an average of just 3 Euro cents as it became clear that actual emissions in the first commitment period (2005–07) would be lower than the proposed cap.

Less than a year ago, phase 2 permits were trading at almost 30 Euros per tonne before falling steeply to below 10 Euros per tonne. More recently, the price has risen again towards 15 Euros per tonne.

The volatility in price for EUAs has led influential market participants to express concern that it is undermining incentives to channel long-term investment towards large-scale (often very capital-intensive), carbon-saving projects and technologies. The Institutional Investors Group on Climate Change (IIGCC), for example, is worried that carbon markets have not provided investors with the strong, long-term price signals necessary to support large investments in low-carbon solutions (IIGCC 2009, p. 4):

> The EU Emissions Trading Scheme (EU ETS), for example, has not provided companies or investors with the robust price signal needed for them to make long-term capital commitments towards low carbon technologies. So far, the EU ETS has encouraged short-term emission reductions when prices are high (e.g. switching from coal to gas) but has not had an impact on investment decisions in new technologies. The EU ETS has suffered from price volatility, with higher-than-expected prices followed by sharp declines both in Phase I and Phase II.

Spikes, not gradual adjustment, are already a feature of the very limited trading across a few advanced countries.[6] Enter the supply of permits from less sound sources of governance and the graph of carbon prices will be reminiscent of the Himalayan skyline, not the dunes of Oman.

While emissions may not be priced explicitly under an ETS, the cash and opportunity costs of permits, or lack of permits, are large. Given that energy resources are distributed unevenly across countries, the allocation of carbon credits and debits is sure to be an endless source of international political jockeying and industrial rent-seeking.

While the incidence of an ETS is uncertain, it is very real. When a market disappears, or when a competing party is exempt from a permit requirement and gains market share regardless of its carbon emissions (carbon leakage), the world moves back to the jungle of trade based on politics, horse-trading, industry protection by fiat, and even corruption and cheating – not comparative advantage.

By contrast, carbon taxes raise the price of carbon-based energy directly, predictably and in a constant manner, imposing the greatest costs on those forms that produce the most emissions. In doing so, carbon taxes create direct incentives to reduce carbon-based energy use or substitute low-emissions sources of energy until the cost of doing so is greater than the tax.

The smoother price path offered by a carbon tax will enable firms to plan better for investments in capital equipment that reduces CO_2 emissions (eg by increasing efficiency or using low-carbon fuels). It will also provide a more certain price signal for firms considering investing in the development of new emissions-reduction technologies.

Efficiency and corruption, taxes and quotas

Quotas allocated by government – such as the rights to emit carbon in an ETS – are valuable. However, if they are largely given away in the first instance they create wealth for the beneficiary and a waste of rent-seeking effort on the part of parties seeking such benefits. By not raising revenue, there is no capacity to fund other reductions in tax, or R&D, carbon sequestration projects and the like. On the other hand, if taxes on emissions are used to fund reductions in other more distorting taxes, then a carbon tax is a win-win; it delivers environmental benefits and improved efficiency (reduced dead-weight losses elsewhere). On this score a carbon tax at the consumption level is advantageous relative to a quota system, which also brings the prospect of corruption.[7]

Along with public funding for technological development and adaptation, the Garnaut Climate Change Review saw the international trading of emissions entitlements emerging as the most important mechanism for the international collaboration needed to support national action (2008, p. 191):

> The only realistic chance of achieving the depth, speed and breadth of action now required from all major emitters is allocation of internationally tradable emissions rights across countries.

And (2008, p. 228):

> International trading in emission entitlements allows financial flows between countries. Such financial flows could offset abatement costs in developing countries, drawing them into an international policy framework.

The federal government appears to be of a similar view (Australian Government 2008):

> Growth in international carbon markets presents opportunities for Australia by broadening the abatement opportunities for liable parties and by extending the market for Australia's own abatement.

Others view this as, at best, naïve in the extreme and, at worst, an attitude that would undermine the integrity of the ETS.

In the early but rapid stages of national economic development, the standards of financial governance are generally less than ideal. Acceptance of the rule of law, property rights, a sound judiciary, a sound administration of competitive tendering, independent regulation and the capacity to prevent cronyism are all hard to achieve in this phase. Yet they are required for an ETS to work well. Many countries contributing substantially to the growth of GHGs are in the early stages of development with improving but less than ideal standards of financial governance. Although it must be said that Wall Street's recent performance suggests no country is immune from abuse of financial instruments and institutions.

When it comes to international trading of permits, or what are in fact carbon derivatives, the resulting impact on the entire system is clear. As the US Congressional Budget Office noted in a 2008 study (p. 20):

> Lax monitoring or enforcement in one country would undermine the effectiveness of the policy not only in that country but in other participating countries as well. The country with lax enforcement could become a supplier of fraudulent allowances (ones that did not correspond to actual reductions), diminishing the environmental integrity of the entire trading system.

Linking cap-and-trade programs also means that countries give up sovereignty over the price of allowances traded in their programs, as arbitrage transmits prices. This means the effectiveness of the national caps they set is reduced:

> Linking cap-and-trade programs…would change the price of allowances in each participating country, which would alter gains and losses and could create incentives for strategic behavior. A country with a relatively high allowance price (because of a more stringent cap, for example, or a greater dependence on high-carbon fuels) would experience a price decrease as a result of linking. In contrast, a country with a relatively low price before linking would see an increase. (Congressional Budget Office 2008, p. 20)

As Garnaut recognised, linking would also create net flows of allowances (and resulting revenues) into or out of countries. This creates the incentive for countries to choose their caps strategically to take advantage of these potential flows. A less stringent cap could result in a country becoming a net supplier of allowances and the recipient of a significant capital inflow – as happened with Russia under the EU scheme. As a result, an ETS is much more susceptible to corruption than a carbon tax. Limiting emissions creates scarcity where none previously existed and a valuable international asset. It invites corruption, evasion, false declarations and an audit framework that needs to apply in countries with poor records on economic governance.

To integrate the tax on emissions with the GST, or the VAT in Europe for example, is a process that we know can and will work. To quote Nordhaus (2007, pp. 30–31):

> "The tax approach also provides less opportunity for corruption and financial finagling than quantitative limits, because it creates no artificial scarcities to encourage rent-seeking behaviour".

While there is a quoted European price for carbon via derivative 'securities' such as carbon credits, in reality the political marketing of the ETS is conducted as if it is creating new opportunities for rents and privileges. And of course it is *not* a trading of carbon or even GHG emissions, but of financial instruments or commitments. We are already witnessing the capacity for shonky carbon credits to be issued by jurisdictions with poor governance. For example, the Papua New Guinean government has suspended the head of its Office of Climate Change and Carbon Trade pending a full-scale investigation into possible illegal carbon credit sales.

The Obama administration has forecast revenues of $650 billion over 10 years from the sale of carbon credits. The global carbon trading market is expected to grow to $700 billion annually by 2013 and $3 trillion by 2020. The global financial crisis has shown us that brilliant, highly-paid financial executives gearing trades around mortgages (as safe as houses!) are capable of creating toxic assets in the hundreds of billions of dollars. Yet the backing behind these transactions is far more credible than commitments by polluting countries to reduce emissions.

The lesson from the global financial crisis is that derivatives and other complex financial instruments issued in bulk can bring economies down. So too could an ETS.

Intergenerational effects of the ETS

An uncontroversial assumption about the objective of all current economic policies is that they leave future generations with a sound, healthy and productive environment, achieved by appropriate incentives. This should be delivered by a competitive economy that sustains an innovative technological and educational system through a growing capital stock.

The assumption by Stern and Garnaut of very low discount rates has been criticised by experts in that area (such as Nordhaus, Arrow, Varian, das Gupta – see Box 1). Assuming artificially low discount rates biases choices in favour of closing carbon-intensive activities now by failing to properly to discount future incomes. More reasonable assumptions of the intertemporal and intergenerational tradeoffs argue for a steady ramping up of policies to reduce carbon emissions, especially under conditions of uncertainty.

In many economists' views (notably Nordhaus in this volume), applying very low discount rates grossly distorts the trade-off between future and present generations. Given future generations will experience higher incomes based on improved technologies, fewer regulatory constraints than their predecessors, and the expansion of knowledge, it is hard to argue the case for acting early in terms of the needs and wellbeing of future generations.

Choosing policies that differentially affect current and future generations raises major ethical questions

BOX 1: The impact of artificially low discount rates

Recalculating the Costs of Global Climate Change
Hal R Varian, December 2006

The [Stern] report not only chooses to weigh all generations' welfare almost equally, it also makes an extreme choice when specifying the relationship between consumption and welfare. These choices together imply that a 1 per cent reduction in consumption today is desirable if it leads to slightly more than 1 per cent increase in the consumption of some future generation, even though, in the model, future generations will be much wealthier than the current generation.

Global Climate Change: A Challenge to Policy
Kenneth Arrow, Economists' Voice, June 2007

Critics of the Stern Report don't think serious action to limit carbon dioxide (CO_2) emissions is justified because there remains substantial uncertainty about the extent of the costs of global climate change and because these costs will be incurred far in the future. They think that Stern improperly fails to discount for either uncertainty or futurity.

I agree that both futurity and uncertainty require significant discounting. However, even with that, I believe the fundamental conclusion of Stern is justified: we are much better off to act to reduce CO_2 emissions substantially than to suffer and risk the consequences of failing to meet this challenge. As I explain here, this conclusion holds true even if, unlike Stern, one heavily discounts the future.

that go well beyond economics. Is it sufficient to leave future generations with a per capita capital stock no smaller than at present? Or growing at 1 per cent a year? If so, the criteria applied to policy choices by Stern and Garnaut are far too harsh. What is clear is that Stern, for example, assumes sustained growth over the next 200 years so that sacrifices now (when per capita world income is about US$6,000) will be to the benefit of future generations projected to be earning a large multiple of current per capita income ($87,000, projected by Stern's assumed growth rate of 1.3 per cent). Why should the financing of investments in future low-emissions technology be largely financed by current generations?

Most commentators, including this one, are in favour of assisting the development of low-emissions technologies and their extension into the polluting countries most likely to be dominant future sources of emissions. However, forcing major cuts in energy-intensive production in developed countries, and Australia in particular, seems unnecessary and likely to increase emissions as more polluting countries take up the slack.

The current debate on this issue is not one we can resolve in this volume. However, it is false to assume there is a strong ethical obligation to burden current versus future generations for investments in low emissions technology. More seriously, there are already clear signs that investment – including in renewable and carbon-free activities – will be killed by the uncertainties of the ETS. The best legacy we can leave future generations is a sound and growing capital stock, strong economic institutions, durable and fair models of governance, systems of taxation based on sound incentives, and other examples of best or better practice economic policy.

Graduated responses: a ramping up of carbon tax

It would be far better to have a well-targeted and explicit consumer-based tax that reflects emissions content (as set out by Carmody), than a rent-seeking, politically-convenient CPRS (that only seems 'free' to voters). An extension of the GST would be paid by everyone who benefits from the consumption of goods and services and from a low carbon environment. The carbon element in the tax formula will skew consumption patterns away from carbon-intensive products, enable other taxes to be lowered, and finance other ways of improving the environment.

The level of the tax can be phased to appropriate levels, adjusting gradually for a problem that has emerged over the 250 years since the start of the Industrial Revolution, and where the stock of emissions can only be reduced by a little over 1 per cent a year at best. Emissions in any given year are only a small portion of that total. Limiting the risk of climate change requires substantial reductions in emissions over many years. As the Congressional Budget Office noted (2008, p. ix):

> …ensuring that any particular limit was met in any particular year would result in little, if any, additional benefit. In contrast, the cost of cutting emissions by a particular amount in a given year could vary significantly depending on a host of factors.

Just as the buildup has been slow and uncertain, the response should favour a gradual 'ramp up' of disincentives to emit carbon. While Stern and Garnaut have grossly distorted the discounting arguments for the alleged tradeoffs between current and future generations, that does not mean they are wrong in seeking policy reforms now, as Arrow stresses in Box 1. But there is a need to avoid change for the sake of change, to maintain competitive producers of goods and services, and to phase out high-emitters over time with a new and gradual escalation of carbon-penalising taxes.

Less developed economies that rationally seek their own industrial revolutions should phase in their carbon taxes more slowly, helped by the 'carrot' of aid-funded technology, R&D and other low emissions technologies.

If AusAID, for example, was funded through such a carbon tax and devoted largely to assisting developing countries to implement state-of-the-art technologies, this might be far more effective than a plethora of conferences attempting to implement a system with fundamental flaws – an ETS.

Conclusion

The point of this paper is consistent with the views of most leading economists – that tax and price-based solutions can most effectively encourage countries to shift production away from carbon usage. A carbon tax – a means of genuinely pricing carbon to encourage substitution to lower carbon technologies – is the obvious and tried model. It raises revenue which can be used in part to foster solutions to other underlying problems. Taxes are the tried and tested system in which governments and the private sector can interact for community and environmental benefit.

The 'carbon price' emerging from trading in emissions debits and credits (eg in Europe) is a derivative price, or financial instrument price, based on a set of allocation principles, transactions and securities trade that is potentially far worse than the worst financial arrangements of Wall Street. If we have learned anything in the last two years it is the need for transparency in financial instruments and their regulation. We need tight governance on the very issuance process and packaging of securities. Yet when the issuance processes for carbon credits are examined, and the national markets analysed, it is hard to seriously believe the world understands what is being sold to them by their respective governments.

The majority of political and business leaders, as well as ordinary people, do not understand the complexities of an emissions trading scheme. But a carbon tax – like the GST, or an alcohol or tobacco tax – is readily understood. The policy dilemma faced by the world's leaders is that they have 'sold' a solution to their constituents on the basis of no tax or price changes. Rather, they have invented a system whereby the largest carbon-emitting firms in each country are allowed to continue to emit up to an aggregate cap on emissions, relative to a benchmark year (1990 – a convenient year for most Europeans coming out of polluting structures). Firms have a right to buy and sell these permits to achieve their desired level of production, *inter alia* creating a 'price' for those emissions credits and debits.

Yet there is increasing access to smart devices for engaging consumers in arrangements for pricing and taxing environmentally sensitive products, such as emissions, electricity consumption and water. Products such as the Google Power Meter, for example, can present information in user-friendly ways so that consumers can see immediately what they are being charged for any commodity in terms of access, amount, time of day and tax – including carbon tax.

If governments are serious about urgent action on carbon emissions, they would impose taxes on the use of carbon now, and use the funds to transform our countries into low-carbon economies. But of course to date no country is applying such across-the-board carbon taxes. Instead, an international game of charades is taking place where there is talk, but not taxing of emissions. The good news is that low-emissions technologies are emerging with the potential to reduce carbon usage over time – solar, other renewables and indeed nuclear. A more honest complementary policy is to do the things which encourage substitution *away* from carbon – and use aid and R&D budgets to help those countries that are late to economic development to also make the transition.

A carbon tax comes from a sound economic standpoint and delivers relative simplicity, investment certainty, retention of competitive advantage, consumer engagement, as well as avoiding large measures of rent-seeking and corruption. Finally and potentially quite critically, a carbon tax avoids the prospect of a major financial carbon bubble that will inevitably burst. This near certainty arises because of the mass of carbon credits and derivatives that will need to be traded across jurisdictions for a meaningful optimisation of emissions generation and production worldwide. These jurisdictions attracted to the issuance of tradeable credits and debits are far more financially vulnerable and open to corruption than those who gave us the current financial crisis.

Endnotes

1 See, for example, http://carbonfinance.ws/2007/12/12/asx-carbon-emissions-futures-trading/.

2 In a speech to a CEDA Forum in Perth on 8 July 2009, Qantas Chairman Leigh Clifford said "…it would be better to have the certainty provided by a carbon tax -- easier to implement, simpler for everyone to manage, and much more flexible. The tax can be targeted quite specifically and raised or lowered as its impact is assessed." (The Australian, 9/7/2009).

3 As an example of the intrinsic uncertainty and shifting debate regarding emissions trading schemes, and the need for a tax driven approach, consider this quote from Point Carbon (20 July 2009), which illustrates how there is no real consensus on what emissions trading systems will cover, and how a wide range of derivatives is in prospect:

> Carbon trading could cut the cost of emission reductions by 70 per cent, a report today said. Markets themselves, however, are not sufficient and additional domestic action is required, according to a new report commissioned by UK Prime Minister Gordon Brown. "Cap-and-trade should be combined with targeted regulation, taxation and public finance for comprehensive action," said Mark Lazarowicz MP, the prime minister's special representative on carbon trading and author of the report. Lazarowicz reckons this combination would make it easier to keep global temperatures from rising above 2C, the level UN scientists believe is necessary to prevent runaway climate change. It would also enable an extra 40-50 per cent of emission cuts to be made at the same cost as could be achieved by using only domestic policies, he said.

4 See Chapter 1.3 in this volume by Sampson: "What is clear is that Australia is free to impose: "on the importation of any product…a charge equivalent to an internal tax…in respect of the like domestic product".

5 The Garnaut Review's Final Report (2008) confirmed just how problematic a CPRS would be for the energy intensive exporters: "Until sectoral or global agreements are reached, the Government should assist trade-exposed, emissions-intensive industries (TEEIIs), to account for material distortions arising from major trading competitors not adopting commensurate emissions constraints".

6 See data on www.pointcarbon.com

7 To quote Nordhaus (2007): "An additional question concerns administration of programs in a world where governments vary in terms of honesty, transparency, and effective administration. These issues arise with particular force in international environmental agreements, where countries have little domestic incentive to comply, and weak governments may extend corrupt practices to international trading. Quantity-type systems are such more susceptible to corruption than price-type regimes. An emissions-trading system creates valuable international assets in the form of tradable emissions permits and allocates these to countries. Limiting emissions creates a scarcity where none previously existed. It is a rent creating program. The dangers of quantity as compared to price approaches have been demonstrated frequently when quotas are compared with tariffs in international trade interventions. Rents lead to rent-seeking behaviour. Additionally, resource rents may increase unproductive activity, civil and international".

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Policy perspectives

part 1

Warwick McKibbin is Professor and Director of the Centre for Applied Macro-economic Analysis at the Australian National University and a Professorial Fellow at the Lowy Institute for International Policy in Sydney. He is also a non-resident Senior Fellow at the Brookings Institution in Washington DC. Professor McKibbin received his BCom (Honours 1) and University Medal from University of NSW (1980) and his AM (1984) and a PhD (1986) from Harvard University. He is a Fellow of the Australian Academy of Social Sciences and was awarded the Centenary medal in 2003 'For Service to Australian Society through Economic Policy and Tertiary Education'. Professor McKibbin is internationally renowned for his contributions to global economic modelling.

David Pearce is Executive Director of the Centre for International Economics. He has over 20 years experience in a variety of areas of economic analysis, including economy-wide modelling and other quantitative techniques. He has worked on a variety of issues in a range of industries including sugar, grains, transport, education (domestic and international), energy, greenhouse, water, and other aspects of the environment and health. David has international experience including projects in Indonesia, Sri Lanka, Bulgaria, the Central Pacific, Vietnam, China, Laos and India. He has been involved in greenhouse and related issues for the past 15 years where his work has included providing advice and analysis to Australian and foreign governments, a range of industry groups as well as international organisations.

Climate policy: Outlook and challenges

1.1

This is a revised version of "Climate policy in the year to come in the context of the century to follow", published in *CEDA Economic and Political Overview*, 2009.

A very busy time

The period of 2008 and into early 2009 was an extraordinary time for the development of climate policy in Australia. It started with the first outputs from the comprehensive Garnaut Climate Change Review (Garnaut 2008), followed by a detailed (800-page) design for an Australian emissions trading scheme, the Carbon Pollution Reduction Scheme (CPRS) (Department of Climate Change 2008) and ended with three separate Senate Committees[1] considering the CPRS and climate policy in general. In between was a flurry of submissions, lobbying, the media struggling with climate and economic concepts, and widespread attempts to understand the short- and long-term implications of a substantive policy project.

The remainder of 2009 will see intensified policy debate, particularly as the legislation is introduced to Parliament and all political parties continue to disagree about some of the fundamentals of climate policy. While the government seeks to put its CPRS into law, increased understanding of the implications of Australia's climate policy in the context of international developments will be essential if the policies adopted are to be robust and capable of delivering their promised long-term benefits. Broad and bipartisan support must emerge to ensure the policy's stability in the years to come.

In considering the outlook for climate policy in the year to come, several themes emerge:

- Despite many emissions trading designs over the past decade, practical implementation of mitigation policy and a robust understanding of what it really means have turned out to be in their infancy.
- Discussion of Australia's mitigation policy has not fully come to grips with the time scales involved, in particular the large differences in timing between the costs and benefits of mitigation.
- Most public analysis of emissions trading has not yet accounted for the short-term costs and risks inherent in emissions trading – both at a domestic and international level.
- International negotiations will remain a major challenge, with the recent global financial crisis providing some essential lessons for the design of an international response.
- The large time lag between mitigation and results, combined with the amount of climate change 'locked in' means that adaptation policy must take a front seat. The rationale for government intervention here is not as clear, and this needs to be elucidated.

The long design

Australian climate policy is both well developed and still in its infancy. It's well developed in the sense that since negotiation of the Kyoto Protocol in 1997, a considerable amount of work has been done in designing policy alternatives, and in particular emissions trading schemes, for Australia.

In 1999, the Australian Greenhouse Office led the serious development of an Australian emissions trading scheme with a series of detailed discussion papers, each considering one aspect of scheme design, and each involving submissions and consultations with industry.[2] This process canvassed all the major design issues in setting up an emissions trading scheme for Australia.

In 2002, the Department of Environment commissioned a number of modelling studies to explore various global scenarios on emissions mitigation frameworks including major studies by ABARE and McKibbin Software Group.[3]

Following this design and modelling analysis, interest in emissions trading waned at the federal level, but developments continued among states. In early 2003, the NSW government established its Greenhouse Gas Reduction Scheme. This amounted to one of the first mandatory greenhouse gas emissions trading schemes in the world.

In early 2004, the First Ministers of State and Territory Governments established a working group (subsequently called the National Emissions Trading Taskforce) to develop a model for a national emissions trading scheme. The Taskforce undertook consultations in 2005 and presented (and modelled) a proposed scheme in 2006.

Public interest in climate policy was significantly enhanced throughout 2006 with the release of Al Gore's 'An Inconvenient Truth' (which premiered in May) and the British Stern Review of Climate Change (which produced its final report in October) (Stern 2006).

In December 2006, then Prime Minister Howard established a Task Group on Emissions Trading which considered how to develop an emissions trading policy for Australia. The Task Group reported in May 2007, and while subsequent political events overtook this particular line of policy development, some important policy principles were established (and have flowed through into more recent policy proposals). The idea of emissions trading continued to receive public attention.

With the election of the Rudd Labour Government in late 2007, the development of climate policy and emissions trading accelerated. The Garnaut Climate Change Review (initially commissioned in April 2007) began producing reports in February 2008 and in September 2008 presented its final report (Garnaut 2008).

Throughout 2008 the Rudd Government produced a series of design and analysis reports on emissions trading, starting with a Green Paper in July (Department of Climate Change 2008a), followed by Treasury modelling in October (Commonwealth Treasury 2008), a White Paper in December (Department of Climate Change 2008b) and draft legislation in early 2009.

In short, 2008–09 saw the production of an enormous amount of climate-related material including a detailed scheme design. The major challenge for the remainder of 2009 and up to when the CPRS is scheduled to start, is to absorb this and come to grips fully with its practical implications.

Indeed, it is in this practical sense that the development of emissions trading policy is in its infancy. Despite the number of designs produced in the past several years, understanding of the practical workings and implications of emissions trading is advancing more slowly.

While most players in the practical climate policy debate appear to agree about the ends (avoiding dangerous climate change) there is not general agreement about the means. The proposed targets set out in the government's White Paper were criticised on many fronts. While understanding that there is inevitably a balancing act in setting Australian policy, as yet, no-one on either side of the debate is totally convinced that the balance is right.

Indeed, evidence presented in hearings at the three separate Senate Committees indicated considerable concern about most aspects of climate policy. At the time of writing this paper, all non-government parties in the Senate had indicated they would not support the CPRS in its present form.

There are a variety of reasons for this broad disquiet and ultimately, they are related to the very mixed levels of understanding of the economics of mitigation policy.

Today, knowledge of the cost of mitigation is not significantly advanced from the understanding of the past decade. It remains largely based on simulations with a variety of models that have been in use for many years. Despite Australia's solid base of modelling, the models have explored relatively few future worlds. Generally, they have been used to argue that in the long term, mitigation policies are low cost, and worth it.

But there has been relatively little exploration of short-term outcomes and risks, and in particular the problems of designing a robust framework that can deal with the wide range of uncertainty about the future for the Australian economy. Further, the analysis presented by the government to date has not convinced everyone that the CRPS is in fact the lowest cost way of reducing emissions (Centre for International Economics 2009).

Recap: what was the point again?

There are essentially two objectives for climate policy: mitigation and adaptation.

Mitigation is the reduction of greenhouse gas emissions *today* in order to avoid further climate change in the *future*. With mitigation, there are costs today with benefits in the future.

Mitigation is often expressed as a particular target or rate of emissions in a particular year, or as a particular long-term emissions concentration target. The policy challenge is often seen as specifying the emissions rate in a particular year. However, recent scientific research suggests that '…policy targets based on limiting cumulative emissions of carbon dioxide are likely to be more robust to scientific uncertainty than emission-rate or concentration targets' (Allen *et al* 2009).

Adaptation is about learning to minimise the costs of any climate change that occurs. It brings benefits today (potentially benefits even if there is no further climate change). These two policy fronts are complementary and not mutually exclusive (McKibbin and Wilcoxen 2004). They are recognised as separate 'pillars' in the government's climate policy.

Putting a price on carbon

The fundamental economic requirement for efficient mitigation is to put a price on carbon. Emissions are costless individually, but costly in aggregate. This 'global commons' problem means that individual emitters will not necessarily account for the future climate cost of their emissions. An appropriate price on carbon closes this gap, internalising the future climate costs of emissions today.

A price on carbon encourages abatement which needs to be done in an economically efficient manner. This in turn requires 'where' efficiency – finding who can abate at lowest cost – and 'when' efficiency, finding the most appropriate time to abate.

There are a range of ways to establish a carbon price. At one end are direct pricing mechanisms such as a carbon tax. At the other end are indirect mechanisms such as emissions trading. In between are hybrid approaches that adopt features of both these mechanisms. Under a tax, the price is set and the amount of abatement is determined as a consequence of that price. It is not necessarily known in advance. Under emissions trading, abatement is set (ie the total cap on allowable emissions is set) and the price of those emissions (the permit price) is determined in the permit market. The price of emissions is not known in advance and may fluctuate considerably over time.

To achieve global 'where' efficiency it is necessary to either have a globally coordinated carbon tax, or a global emissions trading scheme. To achieve 'when' efficiency, it is necessary over time to adjust the carbon tax or the permit market must allow an intertemporal trade in permits (banking and borrowing).

In a world where expectations about the future matter for the types (and expected return) of investment undertaken today, it is important to also have very clear and credible expected prices for carbon that stimulate current investment in carbon reducing and mitigation activities.

Both international negotiations and Australian policy have moved very much towards the indirect pricing mechanism through the establishment of fixed emissions targets, domestic emissions trading and the expectation of some form of international emissions trading.

Even with the development and subsidisation of new technologies, it remains essential to put a price on carbon.

Emissions can be reduced through a number of means ranging from changed practices (eg design of buildings, changing individual consumption patterns and so on) to fundamental changes in energy production technology. Technological solutions are well recognised as forming a major part of any measure to reduce emissions. It is also recognised that there are market failures in undertaking research and development (R&D) to generate new ideas.

From this, a conclusion commonly drawn is because of the need for a technical solution and the need for R&D subsidies of various kinds, the appropriate policy response is to subsidise low emitting technologies of various kinds, and carbon pricing based policies are not needed.

That this conclusion is incorrect can be seen by considering the general principle that different policy targets often require different policy instruments. The target for an R&D subsidy is the development of a new technology and the correction of a 'market failure'; the generation of new knowledge. But there is a second set of targets – the *adoption* of (new or existing) technologies that reduce emissions, or the *discouragement* of increased use of high emitting technologies. None of these second targets are addressed by technology or R&D subsidies. This second target requires a second instrument, which essentially amounts to some form of carbon price.

A carbon price must be established along with new technologies for a variety of reasons.

- As many energy investments are long lived, while new technologies are being developed, it is important that firms are given a clear price signal (over a long period) discouraging or limiting new investments in carbon intensive activities.
- Related to this is the idea that firms need clear price signals when planning future activities and making judgements about what production methods, technologies and products will be profitable in the future.

Clear price signals enhance this planning process considerably.

- Even with the development of new low emitting technology, without a price signal there is unlikely to be any incentive to actually adopt that new technology. A price signal provides firms with a definite indication of the tradeoffs involved in using new technologies and will allow them to choose their appropriate level of use.
- While R&D spending on new technologies is a very important component of any response to climate change, clearly, there are bounds on how much is sensible to spend. All R&D spending has an opportunity cost, that is, the same funds could be spent elsewhere and the resources used for R&D (eg talented researchers) deployed elsewhere. Without a carbon price signal, it is extremely difficult to make judgments about the appropriate amount for R&D spending.
- Even with low emitting technologies forming part of the energy mix, without a carbon price signal there is no guarantee that emissions will actually decline. To the extent that a new technology lowers the price of energy, a subsequent expansion in economic activity may lead to an increase in total energy use, including emitting energy sources. A carbon price signal will ensure that this expansion effect does not outweigh the substitution effect of shifting to lower emitting sources.

The balancing of costs and benefits

Mitigation policy is a balancing act. Costs are incurred today in the expectation of future benefits in the form of costly climate change avoidance. The appropriate amount of mitigation today depends on how expensive it will be (today), the magnitude of climate costs avoided (in the future) and views on how the future benefits should be 'discounted' (if at all) to make them comparable with costs today.

For Australia, this balancing act must take place in the context of international action on climate change. Australian actions that do not ultimately lead to better climate outcomes are futile.

Putting a price on carbon: issues in the proposed Australian scheme

Australia's proposed approach to putting a price on carbon is through a cap-and-trade emissions trading scheme, the CPRS. The government's mid-December White Paper contains all the details of this, and there are a lot of them (Department of Climate Change 2008b).

The proposed scheme is complex, but behind this complexity are two essential concerns about the implications of its operation:

- the possibility of permit price volatility in the early years of the CPRS, particularly if there are limited possibilities for Australia to buy permits from overseas or if access to borrowing permits is limited due to financing constraints; and
- the extent of the short-term adjustment costs that will result from the CPRS.

To date, neither of these short-term aspects of the CPRS have been explicitly modelled in any of the government's published analysis.

The permit price path

The government's intent in the White Paper is for abatement to essentially follow what is modelled as 'CPRS -5' in the Treasury's modelling analysis. This is a 5 per cent reduction in emissions relative to 2000 levels by 2020 (with a 2050 target of 60 per cent below 2000 emissions). Targets in the years before 2020 essentially move in a 'straight line' towards the 2020 target.

Treasury's estimates suggest that the permit price under this scenario will start at AU$20.40 per tonne and smoothly increase to AU$35.20 per tonne (see Figure 1).

Several points should be noted about this price path, however.

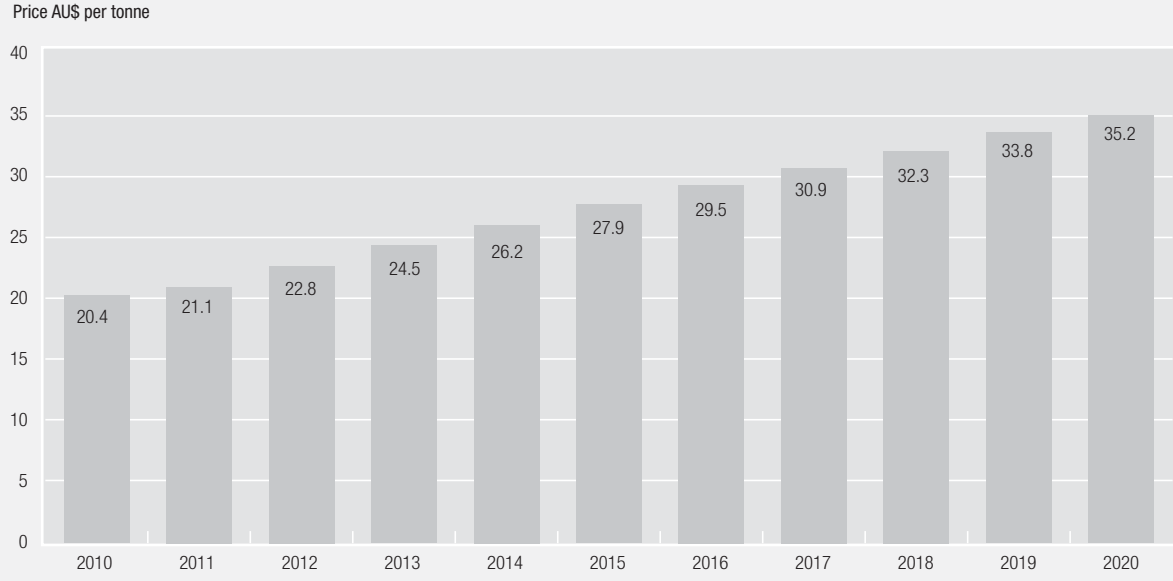
- Prices smoothly increase by assumption. The methodology adopted by Treasury essentially excludes the possibility of any price volatility in the short term (Commonwealth Treasury 2008). Put another way, the analysis assumes that there is established an efficient intertemporal market for permits.
- The simulations underlying these price estimates assume that developed economies also start abatement (with similar policies) in 2010 (at the same time Australia starts). That is, the relatively low permit price essentially assumes a solid agreement at Copenhagen. Put another way, a significant amount of global abatement is assumed to commence under this scenario (see Figure 2).

The White Paper accounts for the possibility of price volatility by suggesting a cap on the price of emissions of AU$40 per tonne. This approach truncates extreme price fluctuations and is quite distinct from alternatives such as the McKibbin and Wilcoxen's hybrid approach which completely eliminates short-term price volatility (McKibbin *et al* 2002a, 2002b).

How large will the adjustment costs be?

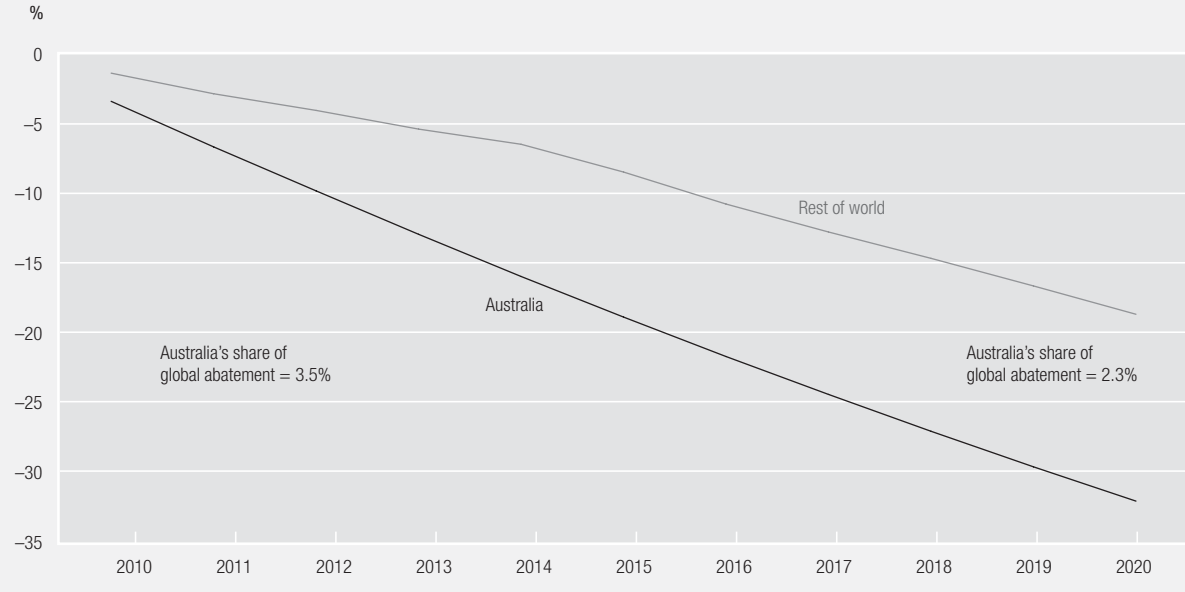
Analysis of the CPRS published to date essentially assumes away adjustment costs in the move towards the 'long run equilibrium' following the introduction of the CPRS. It is likely, however, that there will be some very significant adjustment costs.

FIGURE 1:
PROJECTED PERMIT PRICES



Source: Commonwealth Treasury 2008.

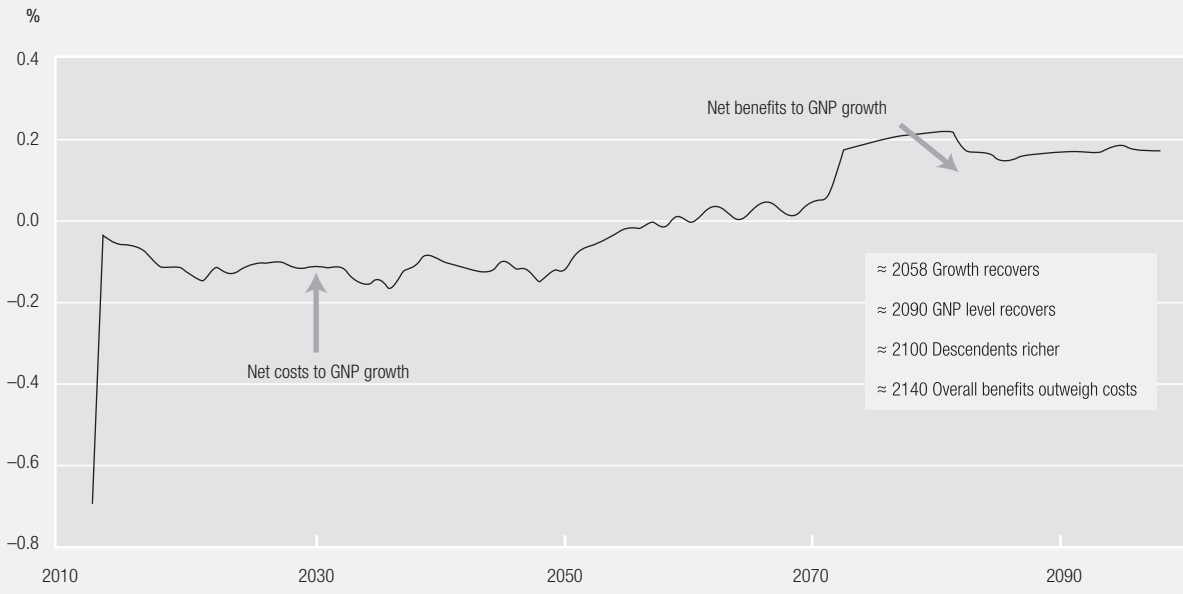
FIGURE 2:
AUSTRALIAN AND GLOBAL ABATEMENT (PERCENTAGE CHANGE IN EMISSIONS RELATIVE TO BUSINESS AS USUAL)



Source: Authors' estimates based on Treasury numbers.

The results published by Treasury show a very large divergence in output changes for the 53 industry groups reported from the modelling. While a significant number of changes are between –5 and 5 per cent, there is a significant proportion of industries with changes of plus or minus 40 per cent or greater. Indeed, 60 per cent of industries have a change in output greater than (plus or minus) 5 per cent, while around 10 per cent of industries have a change in output of greater than (plus or minus) 35 per cent (Commonwealth Treasury 2008).

FIGURE 3:
A LONG TIME TO PAYOFF (CHANGE IN GNP GROWTH RELATIVE TO REFERENCE CASE)



Sources: Chart taken from Garnaut Climate Change Review Final Report, page 265. Text based on authors calculations.

Coming to grips with the timing issue

Sometimes politicians give the unintended impression that if Australia starts an emissions trading scheme today, the climate problem will be solved. This is untrue. The public debate does not quite comprehend the nature of the time scales involved. The same science that tells us about global warming also tells us that even a very successful mitigation program will not change the climate for many decades to come. This does not mean do nothing. But it does mean we need to think about the problems slightly differently.

Garnaut's numbers: an illustration

A sense of the time scales involved in climate policy can be obtained by looking closely at some of the analysis reported by the Garnaut Climate Change Review. That analysis considers both the cost of mitigation (reduction in GNP compared with what it would otherwise have been) and the benefits of mitigation (the avoided, substantial, costs of climate change) (Garnaut 2008).

As illustrated in Figure 3, in the early years following the implementation of climate policy, economic growth is about 0.1 percentage points *below* what it would otherwise have been, but after about 2058 growth moves *above* what it would otherwise have been. This is not the breakeven point though (these results are in growth rates) – the level of gross national product (GNP) doesn't get to where we would otherwise have been until about 2090. But by 2100, having slowed climate change, we (or our descendants) will be richer than we (they) would otherwise have been.

By 2100 the Garnaut Climate Change Review suggests a net cost of 3 to 4 per cent of GNP. Even with very low discount rates, benefits in the future don't outweigh costs until somewhere between 2120 and 2140.

There are, of course, many caveats to this illustration.[4] What it shows, however, are the very long time frames involved before the policy begins to yield benefits.

When Australia's climate policy starts to bear fruit, today's political leaders will be distinguished elder states-people, and the Prime Minister will be someone yet to be born.

Based on the typical life-cycle of large firms, the current big players in the market won't exist, they'll be absorbed or scattered, effectively replaced by people we've never heard of; probably with a weird name like 'google'. An entire generation will take the price of carbon completely for granted. A permit price will still exist, but it will be mundane amongst a set of considerably more exotic financial instruments.

A policy without short term benefits

But in the short term, mitigation most likely has no net benefits. It involves costs and transitional uncertainties. This is where the policy will be most vulnerable. The fact that mitigation policy must stay around for at least 50 years (the span of a minimum of 10 parliaments)

means that to be successful, the policy must garner widespread support. Australia can't afford to chop and change policy because of disagreements about how it should work (eg the disagreements over recent workplace reform). Of course, policy may need to evolve and be flexible, but the flexibility needs to be built into an agreed framework so that key stakeholders can make plans.

A second implication of these long time frames is that mitigation can't be justified by current climate events. To do so is counterproductive as it creates an expectation of immediate results; an expectation that climate problems will immediately go away. This expectation, when inevitably disappointed, runs the risk of undermining mitigation action today, therefore undermining the benefits in the future.

Bringing the world along

Mitigation is, of course, a global problem. Australia's own abatement can only ever be a very small proportion of global abatement. Under all the scenarios recently modelled by Treasury, Australia's share of global abatement to 2050 is only around 1.5 per cent (Commonwealth Treasury 2008).

This creates two fundamental policy challenges: the coordination of Australian policies with global ones – in particular the need to choose targets when global actions are not known – and, the process of negotiation in international fora.

Coordination of Australian policies

Australia's own abatement will have a negligible effect on the environment but Australia must be part of the global response. Australia may even have limited scope for providing some leadership. But Australian abatement without international action, particularly if that leads to increased emissions elsewhere, is wasted effort. It amounts to costs without any corresponding benefits.

Actions taken by Australia ahead of global abatement creates one of the most important 'distortions' in climate policy: the effect on the competitiveness of export industries that face a carbon cost when their competitors do not.

The current response to this is to use permits and permit revenue to compensate exporters. This seems a natural response, but it does not solve the problem fully. First, this form of compensation is inevitably a transfer from one group of Australians to another. Second, and related, this action inevitably involves an opportunity cost. The funds used for compensation could have been used elsewhere in the economy.

More work is needed to understand the full implications of these choices. Why not, for example, look at permit revenue at the same time as reviewing Australia's taxation system, that is, using permit revenue to reform and remove distorting taxes?

The international negotiating challenge

The ongoing global financial crisis has brought home some stark lessons about setting targets for abatement. While one response has been to say that abatement should be delayed until it is more affordable, the true lesson of the crisis is more subtle.

Recent analysis indicates that a global cap-and-trade regime changes the way growth shocks would otherwise be transmitted between regions while price-based systems such as a global carbon tax or a hybrid policy do not (McKibbin *et al* 2008). In the case of a financial crisis, a price-based system enables significant emissions reductions at low economic cost whereas a quantity target system loses the opportunity for low-cost emissions reductions because the target is fixed.

This finding brings home a fundamental feature of the global negotiating problem. For a climate policy (either domestic or international) to survive future shocks it needs to have *dynamic consistency*, that is, following the shock it must remain optimal for each government to continue to enforce the agreed policy even when confronted with sharp departures from the conditions expected when the government first undertook its commitments.

A policy that does not have this dynamic consistency brings with it a number of problems.

- First, the collapse of the policy because of unexpected shocks could set back progress on emissions reductions for many years.
- Second, decisions by economic actors depend on their expectations of future policy, and this dependency affects the performance of the policy itself. A system that is more robust to shocks would increase the expected payoffs of investments in new technologies and emissions reductions relative to a system that is less robust.

Paradoxically, a system of rigid and ambitious targets that seems an environmentally rigorous approach may be ineffective if the rigidity decreases the probability of the agreement being ratified, or reduces compliance and long-term participation. Households and firms would take this into account in their investment decisions and they will invest too little in abatement and alternative energy technologies, causing the system to be less effective in practice than one with more flexibility. If governments try to compensate for this low credibility by imposing a more stringent target, they could inadvertently worsen the incentives for investment by further reducing the program's credibility.

Can a fixed targets and timetables system survive over the long term? A number of authors in the influential Harvard Project on International Climate Agreements think not.[5]

Managing nasty surprises

Any mitigation scheme needs to be structured to avoid nasty surprises – particularly the sort of surprises delivery by financial markets in the last few months of 2008.

The need for long-term credibility in setting targets so as to drive a future carbon price profile has to be carefully balanced with the need to have control over short-term economic costs. The approach of the McKibbin-Wilcoxen Hybrid is very explicit in delineating this tradeoff (McKibbin *et al* 2002a, 2002b). Long-term pre-committed carbon permits limit the ability for future governments to cheat on commitments by having a clear contingency plan available if it turns out that the future path needs to be adjusted. An independent central bank of carbon provides that clear contingency for adjusting the long-term costs at the same time as completely eliminating short-term carbon price volatility.

So far, the debate in Australia has not taken this issue of clear institutional independence and the management of short-term volatility sufficiently seriously, given the enormous uncertainty about possible economic futures.

Have we peered enough at alternate futures?

In designing a robust mitigation scheme for Australia, there is no substitute for carefully thinking ahead, probably in the form of extended simulation modelling, to work through the implications of the world developing in different and unexpected ways. But even if we have a wide variety of possible future scenarios in hand, the system that is implemented has to be flexible enough to adjust as events unfold but in a way which maintains the systemic credibility of the framework.

The adaptation imperative

In the scientific discussion of climate change, there is a very important notion of 'committed climate change'. While precise definitions of this vary, the essential idea is of the amount of climate change that will continue to take place, even if greenhouse gas emissions are immediately reduced to zero.

Put simply, some – and possibly a lot – of climate change is already 'locked in' and will not be at all influenced by mitigation actions in the short and medium term. Indeed, some recent commentators have argued that 'even the most prompt and stringent action still risks overshooting a target of 2 degrees C, and it will require centuries to achieve a roughly stable climate with tolerably low amounts of warming' (Parry *et al* 2009).

Adaptation to climate change is therefore inevitable and essential. Increased understanding of the need for adaptation, and the careful delineation of policy to deal with it, will be crucial developments over the next few years.

Fortunately, some progress has been made on the adaptation front. Adaptation is recognised as pillar of climate policy in the government's White Paper, and a number of Australian-based organisations are undertaking comprehensive work on frameworks for adaptation (Department of Climate Change 2008).

Recent work by Howden and others sets out some general principles for effective adaptive responses to take place. While initially expressed in the context of agricultural adaptation, these principles are very general and point out that for effective adaptation (Howden *et al* 2007):

- Managers and decisions makers must be convinced that projected climate changes are real and are likely to continue. This will be facilitated by policies maintaining effective climate monitoring and effectively communicating this to the community;
- Individuals and decision makers need to be confident that the projected changes will be significant for their own activities. Again, this can be facilitated through effective scientific research and sound communication; and
- Decision makers need to have, and be aware of, effective options for response in the light of climate change. Again, sound underlying research and development will be essential in delivering options for adaptation.

Most importantly, domestic economic management must maintain a flexible economy, capable of responding to changed circumstances. The effective working of markets (particularly natural resource markets such as for water) should be a priority for policy development.

Effective action on adaptation will prove to be a very important test for the Australian community. Polls suggest that Australians are mostly in favour of mitigation policies (such as emissions trading). Because the same science that suggests the need for mitigation also demonstrates the crucial need for adaptation, to be consistent, the Australian community must also move seriously to adapt.

Endnotes

1 These are: the Senate Economics Committee, the Senate Select Committee on Fuel and Energy, and the Senate Select Committee on Climate Policy. Links to each of these can be found at http://www.aph.gov.au/Senate/committee/com-list.htm. Each committee received a large number of submissions covering a vast array of issues.

2 These discussion papers are still available in the Department of Climate Change archive at http://www.climatechange.gov.au/publications/archive.html.

3 The papers are still available in the Department of Climate Change archive at http://www.climatechange.gov.au/archive/international/kyoto/modeling.html.

4 Most importantly this quantitative analysis only takes into account Garnaut's first two types of costs of climate change (market impacts with good data, and market impacts with poor data). The other two (low probability high impact costs, and the values of things we know we like, but don't value on markets) are not quantified here.

5 See Harvard Project on International Climate Agreements (2008), available at http://belfercenter.ksg.harvard.edu/project/56/harvard_project_on_international_climate_agreements.html?page_id=209.

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Geoff Carmody is an economist and Director, Geoff Carmody & Associates. He was a co-founder of Access Economics in 1988 and was an employee of that firm until recently. Before that, he worked for 15 years in the Commonwealth Treasury. Geoff gratefully acknowledges constructive criticism and advice from many people, notably Russell Higgins, Ed Shann, Greg Taylor, John Daley and, at the outset, Andy Stoeckel (whose simple question about policy design at a lunch early in 2008 'got Geoff going' on this topic).

Consumption-based emissions policy: A vaccine for the CPRS 'trade flu'?

1.2

Introduction

Australia's Carbon Pollution Reduction Scheme (CPRS) is 'the GST from hell'. It hits exports, exempts imports and cuts Australia's competitiveness. It's more likely to drive emissions (and jobs) overseas than reduce emissions globally. Naturally, it's been poorly received across-the-board. Its national 'trade flu' effect explains why the Kyoto Protocol has failed. We need a more globally acceptable policy model. Crucially, China has pointed the way.

The debate about climate policy design isn't over. At least three issues are unresolved.

First, is an emissions trading scheme (ETS) better than a carbon tax? I favour a carbon tax. It delivers emissions reductions with less (or no) 'wastage' via 'emissions shuffling' (more politely called 'emissions trading'). It is better at delivering predictable carbon price increases, clearly and consistently signalling the need to shift investment towards lower emissions technologies. This signal is required for a switch to a low-emissions economy.

Second, the most important debate by far is about the **best national emissions base for policy**.

The contenders are **national emissions production** and **national emissions consumption**. Either works under the very first policy idea leading up to the 1992 United Nations Framework Convention on Climate Change (UNFCCC): a globally applied carbon tax. Sadly, this idea didn't survive the 1992 UNFCCC. Worse, under the 1997 Kyoto Protocol, non-harmonised national action was formally approved. A national emissions production base will fail under this differentiated approach. 'First movers' suffer competitiveness losses compared with 'late movers'; effectively taxing their exports and subsidising their imports. This negative protection generates activity and job losses for little or no net reduction in global emissions. That's what the global hullabaloo about 'trade-exposed' industries is all about. That's why the Kyoto Protocol has failed.

An emissions consumption policy base neutralises adverse trade competitiveness effects, and is World Trade Organization (WTO) compliant. The prisoner's dilemma – the 'I'll cut my emissions after you cut yours' syndrome – is no longer an impediment to a

global deal. Such a deal should be the 'main game' in Copenhagen in December 2009. Australia's main role there should be to present a policy model that all countries can adopt as soon as possible. Anything else would be irresponsible. The CPRS doesn't qualify as a solution to 'trade exposed' industry concerns. A national consumption-based model does. It would greatly improve odds for a global deal. Australia should champion this tweaking of the CPRS to get others on board. China has already signalled broad support for a consumption-based approach.

The third debate is about global emissions abatement targets and their allocation amongst countries. Carbon taxes and emissions trading schemes rely on the price of carbon as the instrument to deliver abatement outcomes. National carbon prices are the true measure of national emissions abatement efforts and deliver appropriate burden sharing. Under a uniform global carbon price, countries with large, high-emissions energy sources, and high-income countries with high per capita consumption (and carbon footprints to match) face the largest adjustment burdens. This seems fair. It's also reasonably easy to monitor.

A national emissions consumption-based carbon tax best delivers all these outcomes. This is a viable path to where the global community started: the original vision of a uniform global response.

1. Australia's CPRS: what's the problem?

Suppose the Australian government actually told voters it would introduce a new GST, but with a really nasty twist. Unlike all other GST systems, this new GST:

- would apply to Australia's exports
- would fully exempt Australia's imports
- would be introduced unilaterally, that is, regardless of what other countries do.

You might think this would be crazy. It would. The Howard Government introduced a GST, but it exempted exports and taxed imports. The 'nasty' GST outlined above amounts to negative protection – 'the GST from hell'.

The Australian government's CPRS will operate just like that. It will affect Australian exports and exempt its imports, rather than the other way around. Naturally, this reality is not highlighted in government information on the CPRS, but it is the reality. This is also the reason for all the deals for (an arbitrarily select group of) emissions-intensive trade exposed (and other) industries. The CPRS entrenches a culture of business lobbying for distorting, efficiency sapping 'special deals'.

Smart countries won't adopt policies delivering negative protection. In the 12 years since the Kyoto Protocol policy model was 'agreed', the evidence supports this conclusion. Australia shouldn't, either.

Negative protection is the reason why the CPRS – and the European model on which it is loosely based – are not well received. This paper explores more globally acceptable policy alternatives.

2. Focus: a policy model where the economics actually *work*

This paper leaves the debate about the physics of climate change to professional scientists, but it does assume:

- global warming is happening and that man-made contributions are significant
- emissions can be measured
- policy action can reduce the severity of this problem.

Given these assumptions, a global policy response is needed, something so far lacking. Indeed, securing a genuinely global, comprehensive policy deal should be the 'main game'.

This paper focuses on climate change policy design, having particular regard to the real-world context in which it must be applied, and paying particular attention to incentive effects associated with different policy models.

At the outset, it should be emphasised that I no longer accept the hand-wringing summarised in what Ross Garnaut labelled the 'prisoner's dilemma' (Garnaut 2008, xviii). This notion – more accurately summarised as the 'I'll cut my emissions after you cut yours' syndrome – is largely if not wholly a product of poor government choices about the appropriate policy model under the 1997 Kyoto Protocol. It is not, as some would have you believe, some sort of global 'market failure'.[1]

The main themes are as follows:

- The policy model chosen must reflect the context in which it will be applied. In particular, a model suitable if all nations act together may well fail if they do not.
- Economic incentives associated with the policy model chosen, also determined by the context in which it is applied, can have powerful effects hampering the securing of a global deal. Indeed, in my opinion these incentive effects are central to an understanding of the failure of the 1997 Kyoto Protocol to date (and, probably, in future).

3. The vision leading up to the 1992 UNFCCC: a consistent policy model

What are the lessons of history?

One of the very first climate change policy models envisaged in the lead-up to the 1992 UNFCCC made sense. That model:

- focused on national production
- was applied by all countries at the same time
- was a globally harmonised carbon tax.[2]

In this context, a national production-based model was fine.

Because all nations applied the same carbon tax at the same time, there were no adverse national incentive effects, even using a national production model. By definition, the 'I'll cut my emissions after you cut yours' syndrome did not apply.

4. The 1997 Kyoto Protocol: a really dodgy detour or just the son of UNFCCC?

The 1997 Kyoto Protocol white-anted the internal consistency of the pre-UNFCCC vision in two ways:

- An ETS mechanism for putting a price on carbon emissions replaced the carbon tax (at the insistence of the United States (US) which, under George W Bush, then 'jumped ship'). The ETS, per se, was no great disaster. It was just messier and reliant on governments having the courage to limit emissions permits enough to impose a significant carbon price. But combined with the other change (see below), it helped secure policy failure.
- More important by far was the formal agreement that different countries could implement climate change policies at different times (ie the rich developed countries were to act first and others, some time later).

In particular, this second change to the original vision set the Kyoto Protocol up for failure because the original national production-based policy focus was retained under Kyoto. The internal consistency of the original pre-UNFCCC policy model was shredded. The combination of a national production-based model and non-harmonised national action produced the 'I'll cut my emissions after you cut yours' syndrome. Ross Garnaut's prisoner's dilemma is really a government policy failure, not so much a market failure. The policy failure was choosing the wrong policy model.

The rest of the story is well known. Efforts to secure a global climate policy deal under the terms set out in the Kyoto Protocol in 1997 have since foundered. They have:

- degenerated into national posturing and moralising, including at international fora; plus
- fruitless and unresolved arguments about national burden-sharing (see below); plus
- ad hominem attacks, bordering on quasi-religious frenzy in some cases; plus
- non-transparent, tendentious policy analysis (including by governments and in Australia); and
- adoption by some of targets set in the far distant future without credible measures to deliver them.

The Kyoto Protocol has been a cynical politician's dream. Promise the earth beyond your term of office and never be held accountable for delivery.[3] The now-delayed CPRS is a good example.

5. Some basic emissions accounting relationships

The sorry history just summarised is more easily understood if we grasp some basic emissions accounting relationships.

First, anthropogenic greenhouse gas emissions are associated with, and embedded in, economic activity.

Second, economic activity can be measured in three ways under national accounting systems. It can be measured via national production (GDP), via national expenditure (GNE), or via national income. The first two of these, especially, provide industry and product-specific measures of economic activity. Combined with good carbon accounting frameworks (still a global work-in-progress), they can be used to measure national production of, or expenditure on (consumption of), greenhouse gas emissions.

Third, by definition, globally, national production and expenditure (and income) add up to the same thing. (If they don't, a 'statistical discrepancy' is added to make sure they do.) Figure 1 illustrates this global equivalence between GDP and GNE.

Note also that globally, exports must equal imports (absent interplanetary trade and helped by a 'statistical discrepancy' as needed). It follows, by definition, that there are at least two paths to reducing global emissions: by targeting national production of emissions via a GDP-based policy, or by targeting national consumption of emissions via a GNE-based policy. Globally applied policies targeting either path can produce the same global emissions abatement result.

The 1992 UNFCCC model chose national production as the target. It could have chosen national consumption (emissions embedded in GNE) as the target. Either would be equally effective if all countries acted at the

FIGURE 1:
EMISSIONS EMBEDDED IN GLOBAL GDP = EMISSIONS EMBEDDED IN GLOBAL GNE

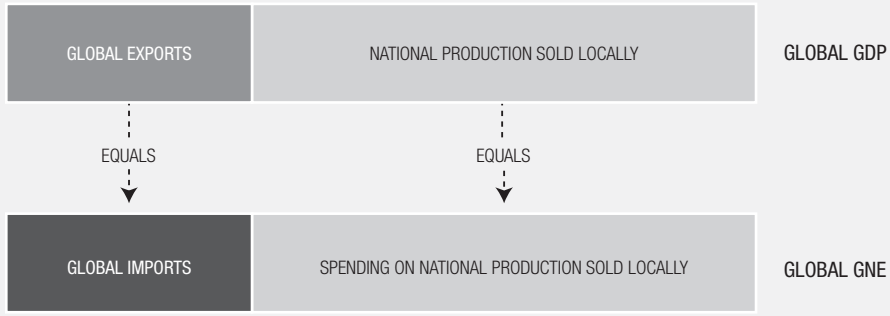

FIGURE 2:
EMISSIONS EMBEDDED IN NATIONAL GDP ≠ EMISSIONS EMBEDDED IN NATIONAL GNE

same time using the same policy instrument (eg a globally harmonised carbon tax.) Under the pre-UNFCCC global carbon tax model, choosing production or consumption as the policy target didn't matter.

But Kyoto (and before it, the UNFCCC) allowed for non-harmonised national action. From 1992, and especially from 1997, the choice was crucial. The wrong choice – national production – was made.

Figure 2 illustrates the problem thrown up by the Kyoto Protocol (eg for Australia).

Under a national production approach, a carbon tax (price) applies to a country's exports, not to its imports. Any country acting unilaterally effectively imposes a carbon export tax and offers a carbon import subsidy. This is a policy imposing negative protection on its national production. Its trade competiveness is undermined compared with countries not taking the same action.

Under a consumption approach, a carbon tax (price) does not apply to a country's exports and border tax adjustments (BTAs) apply to its imports. Any country acting unilaterally effectively leaves its export pricing and competitiveness unchanged and, if properly designed, imposes a carbon tax on its imports that is the same percentage of value as that imposed on the competing locally-produced substitutes.[4] This is a policy imposing zero protection on its national production. Its trade competiveness is unaffected compared with countries not taking the same action.

This is at the heart of the problem with the Kyoto Protocol.

Non-harmonised national policy action based on a production model is the real-world policy context. It sets up 'first movers' for losses of trade competitiveness. It gives 'late movers' a trade competitiveness 'free kick' and in so doing, positively encourages them not to follow suit. Worse, the loss of competitiveness shifts activity and jobs – and embedded emissions – to countries not acting, at least at the margin. This 'carbon leakage' means that the net reduction in global emissions resulting from 'first mover' action might be very small, zero, or even negative.

These 'incentive effects', derived from the policy context, will likely kill prospects for a global deal.

Why should individual countries act under a Kyoto-type production model? There's no guarantee such action will reduce *global* emissions. It could do the opposite. The only certainty is a loss of trade competitiveness and a leakage of economic activity, jobs and emissions to those countries not acting.

This is the genesis of the 'I'll cut my emissions after you cut yours' syndrome. Applied globally, it means nothing gets done.

This is the result expected from 'first principles', and is the result in practice (see below).

6. The importance of incentive effects in policy design

Incentive effects associated with policy design are the bread and butter of applied economists. They also underpin economic theory (most if not all of which can only work by making assumptions about human behaviour), even though some suggest 'behavioural economics' is a new, untrodden field.

Sometimes allowance for these incentive effects seems not to be well incorporated into policy decisions. For example, suddenly imposing a large tax increase on one from a long list of close substitutes to reduce its consumption, but not on the others, seems likely to produce poor outcomes. Using a recent Australian example to illustrate, selecting the alcohol included in so-called 'alcopops' for heavier taxation, but excluding other alcoholic beverages, is simply a way of generating increased incentives to consume alcohol through products other than 'alcopops'.

This is not the policy's intent (which is to reduce alcohol consumption and 'binge drinking'). The incentive effect embedded in the policy design undermines its purpose.

Getting the design wrong in the climate change policy field can be much more serious than this.[5]

In the climate policy field, broad-based carbon price instruments necessarily entail perhaps the largest and most complex single government policy intervention in economic activity outside wartime. It will be costly to administer and to comply with effective policies of this type.

Even so-called 'market determined' carbon prices under an ETS require substantial government involvement in monitoring and policing compliance with emissions permits (plus, of course, tough decisions on emissions caps if serious carbon prices are to be established). It is therefore crucial to design such policies with full attention to their policy context and associated incentive effects.

7. The policy design reason for the failure of Kyoto

Stripped to its core, the policy design reason for expecting the Kyoto Protocol model to fail is disturbingly simple and obvious:

> As soon as non-harmonised national action became the agreed policy context, policy design should have been adjusted to neutralise the resulting adverse incentive effects associated with the initial national production-based focus.
>
> Specifically, international trade-neutrality should have been immediately restored by switching the policy design to target national consumption of emissions.[6]
>
> Governments failed to make this essential adjustment to policy design in 1992 and again in 1997.

8. Evidence-based policy: the real-world proof that Kyoto is a failed policy model

The Kyoto production-based climate model has been tested for 12 years since the Protocol was established in 1997. Evidence of its failure to date is summarised in the broad indicators outlined in Box 1.

Box 1: Indicators of poor policy performance under the Kyoto Protocol since 1997

- Only in early 2005 did enough countries 'ratify' the Protocol officially for it to 'enter into force'.
- Major emitting countries have taken little or no broad-based climate policy action.
- Most of those countries that have accepted national emissions targets are likely to miss them by a mile.[7]
- Countries adopting an ETS (notably Europe) have not effectively capped their emissions.
- Those same countries have either over-allocated permits or accepted volatile/low carbon prices.
- The current carbon price in Europe is very low. The initial Australian price – AU$10 – will be lower.
- Those countries adopting ETS policies have 'carved out' large portions of national emissions production.
- Concerns about loss of trade competitiveness in trade-exposed industries have been the cause.
- These have led to threats of BTAs on imports from countries without an ETS.

This sorry history gives little confidence that the situation will be improved if the same model is pursued in Copenhagen in December 2009.

Is there a practical 'Plan B'?

9. Is a national emissions consumption approach practical?

Opponents of the proposed national emissions consumption-based policy have argued that such an approach is both unrealistic and inconsistent with WTO rules. The second objection is dealt with in the next section. The first is dealt with here.

The basis for the assertion of impracticality is that countries cannot know the emissions intensity of imports and therefore cannot know what BTA to make to them. If that objection were valid, it would be a heavy blow against a consumption approach.

However:

- This criticism is irrelevant.
- The only data needed to calculate the appropriate Australian border tax adjustment (BTA) for a specific import are (i) the Australian carbon price (or tax), expressed in AU$/tonne, and (ii) the Australian emissions intensity of the locally-produced version of the imported product concerned (measured in tonnes per unit of product).
- No overseas information is required. The same Australian information will be required or available (eg for monitoring) under an Australian production-based approach anyway.
- These two pieces of information, multiplied together, deliver a carbon cost in Australian dollars per unit of the product concerned.
- Dividing that carbon cost by the carbon cost-exclusive price of the Australian-produced product delivers an ad valorem equivalent carbon cost adjustment (as a percentage rate based on the carbon cost-exclusive price).
- This same derived percentage rate is then applied to the imported substitute as an ad valorem equivalent BTA, just like a GST.
- Attempts to tax imports at *different* ad valorem equivalent rates than locally produced substitutes (especially if higher) would indeed run foul of current WTO rules.
- More generally, carbon costs are recorded as a one-item addition to Australian Tax Invoices. These entitle GST-registered businesses to input tax credits (ITCs) on such costs, as they pass them down the supply chain. At the export point, the carbon cost is also rebated, thereby 'zero-rating' exports. Imports attract an appropriate BTA as described above. In turn, this provides an ITC for business purchases and a rebate when imports feed into exports.
- Ultimately, therefore, the cost passes on to final consumption, just like the GST.[8]

10. Is an emissions consumption approach WTO-compliant?

Designed properly, a national emissions consumption-based climate policy is both trade competitiveness-neutral and WTO-compliant.

The simplest explanation is that the national emissions consumption model should operate in precisely the same way as a product-differentiated Value-Added Tax (VAT) or, as these are labelled in Australia and New Zealand, a GST. See the section above.

Here, the product differentiation solely reflects differing *Australian* emissions intensities in production.

Both VAT and GST systems are trade competitiveness-neutral and WTO-compliant.[9]

11. A qualitative evaluation of policy alternatives: broad policy design principles

In order to evaluate alternative policy options, it's useful to set out some principles to provide a framework for such an assessment. This framework could also describe a road map for a more successful outcome in Copenhagen in December 2009 than now seems likely.

The 1992 UNFCCC goal: *Stabilising greenhouse gases at levels that would prevent dangerous anthropogenic interference with the climate system* should be the Preamble for any analytical framework (and any Copenhagen deal). We need to know where we are going.

Acceptance that countries probably won't act simultaneously should also appear in the Preamble. We should recognise reality, not be mugged by it.

An agreed framework of principles to guide policy design comes next. The following seven principles might seem like obvious 'motherhood' statements. That's good. It means there's a good chance countries can agree to them.

National policies should:

1. Raise relative prices for carbon, but minimise effects on real national incomes.

2. Make the same contribution to lower emissions globally as they do nationally.
3. Minimise 'free rider' impediments to a global deal.
4. Be comprehensive to minimise avoidance and internal 'carbon leakage'.
5. Be trade competitiveness-neutral.
6. Allow countries freedom to choose between approaches, subject to principles 1 to 5.
7. Minimise national compliance and administration costs.

Some brief comments on these principles follow:

- The first principle addresses the *instrument* through which broad-based climate change policies must operate: a price on carbon. Emissions must be made costly. The target is an increase in the relative price of carbon emissions, not a reduction in real living standards. The intent, as far as possible, is to deliver similar living standards at less longer-term environmental cost.
- The second principle seems obvious, but is worth stating explicitly. Every country must make a net contribution to lower emissions relative to business-as-usual (BAU). There is no point in adopting policies that simply shift the same level of emissions from one country to another. Such 'churning' does nothing to deal with the problem to which climate change policy is directed.
- The third principle goes to the heart of the design defects reflected in the failure of climate change policy efforts to date. If 'first mover' countries are condemned to suffer competitive disadvantage relative to 'late mover' ('free rider') countries because of the policy model chosen, a truly comprehensive, global, climate change policy deal will not be consummated. We know this from the evidence of the last decade or so. Global recession won't improve the odds in future. Policy design must root out 'free rider' or 'late mover' trade advantages as far as possible.
- The fourth principle underlines the need to minimise 'escape clauses' that weaken intra-national policy effectiveness, undermine a principled approach, and invite interminable 'rent seeking' for special 'carve outs' (eg as in Australia and Europe at present).
- The fifth principle is another way of expressing the third and fourth principles combined, but added for clarity. Climate change policy should not be protectionist, either between or within countries. But it should be trade competitiveness-neutral. 'First movers' should not suffer job losses and 'carbon leakage' because they are 'first movers'. Policy must be WTO-compliant, but 'first movers' should not be asked to give a trade 'free kick' to 'late movers'.
- The sixth principle seeks to give individual countries the maximum discretion, subject to these broad principles, in choosing the precise modalities that best suit them in dealing with climate change.
- The seventh principle is self-explanatory. Effective climate change policy, almost by definition, will be one of the most interventionist and detailed engagements undertaken by governments in the operation of their economies ever seen. Policies that secure the largest benefit at the lowest administrative and compliance costs are needed. These costs, at best, will be significant anyway.

This framework allows evaluation of alternative policies.

An ETS-only, production-based model won't comply with principles 1–6 (or, quite likely, even principle 7).

A consumption-model (allowing a choice between a carbon tax or an ETS approach) would comply with the first six of these seven principles, and in the case of principle 7, be superior to an ETS-only, production-based model.

12. A quantitative evaluation of policy alternatives: a proper, transparent review

Qualitative evaluations are fine as far as they go.

However, for practical policy-making, the best possible *quantitative* assessment of alternative policy options is essential for evidence-based decisions delivering the best benefit-cost outcomes.

In Australia, and elsewhere, the official quantitative assessments that have been published seem to be to some extent tendentious and incomplete:

- Treasury modelling (at least that which has been published) seems to have focused on long-term 'equilibrium' outcomes, and had little if anything to say about transition or adjustment paths.
- Treasury modelling seems mainly (only?) to have looked at the effects of a loose approximation to the CPRS and not at alternative policy options. This precludes the required ranking of benefit-cost outcomes across different policy options.
- Certainly, such an official benefit-cost ranking has not been published.

That said, Treasury made the following observation in its modelling report (Commonwealth of Australia 2008):

> '[Emission] Allocations based on production are likely to result in higher welfare costs for Australia than allocations based on consumption.'

If this is correct – even in long-term equilibrium – what are its full implications? Could it imply likely modelling support for a national consumption base? Is

it consistent with Minister Wong's repeated assertions that the production-based CPRS is the lowest-cost policy option for Australia?

We do not need to labour under uncertainty in this area. Rather, we should follow the Centre for International Economics (CIE) Managing Director, David Pearce's recommendation for a comprehensive quantitative review of all feasible policy options (CIE 2009).

13. Conclusion

At present, there are at least three unresolved public debates about the design and objectives of broad-based, price-oriented climate change policies – the debate is *not* over.[10] These debates are as follows:

1. A debate about the best policy instrument, with a carbon tax and an ETS (or some hybrid of the two) as the focus.
2. A debate about the most appropriate policy base, with national emissions production or national emissions consumption as the contenders.
3. A debate about appropriate global greenhouse gas concentration targets and national burden sharing of abatement to achieve those targets.

On the first of these debates, on balance, a (relatively) simple global carbon tax is favoured as the most cost-effective instrument for putting a highly visible price on carbon emissions along the entire supply chain to final demand. One of its major advantages is that when imposed as a predictable, increasing cost on emissions over time, it delivers the closest thing to achieving certainty in this area of climate change policy, plus a clear signal to reduce emissions. This is crucial, especially for longer-term investment decisions.[11] An ETS could be made to work but probably at higher cost. The history of the European ETS is not at all encouraging.

On the second of these debates (far more important than that about policy instruments), and as this paper makes clear, a national emissions consumption base is favoured.[12] This base improves chances of securing a comprehensive global agreement. Surely, this must be the 'main game', not least for a relatively exposed, relatively small total emitter like Australia. It also has equity advantages (for those wishing to pursue such matters) relevant to the burden sharing debate (see below).

There seems to be broad support for the national emissions consumption base, at least in principle, and albeit sometimes only implicitly. Consider the following:

- Gao Li, Director of China's Department of Climate change, recently noted that, '… about 15 per cent to 25 per cent of China's emissions come from the products which we make for the world. … This share of emissions should be taken by the consumers, not the producers.' Gao Li believes that this is a '… very important item to make a fair agreement.'[13] Here, naturally I think he is right. Moreover, his arguments apply to all countries exporting goods and services, not just to China. This is the essence of the national emissions consumption approach.
- Recently, Sir Nicholas Stern has indicated he agrees with China's position.[14]
- The US has indicated it will provide exemptions for its exports and impose BTAs on imports from countries not adopting climate change policies, in order to ensure its trade competitiveness is not undermined. Again, this reflects concern about the negative protection inherent in unilateral adoption of a national emissions production model, and is an attempt to neutralise that effect. In this sense, the US is quite close to a national emissions consumption model as proposed in this paper.
- Both Europe and Australasia have incorporated more or less arbitrary 'carve outs' into their ETS policy designs, based on concerns about the so-called 'emissions-intensive, trade exposed' sectors. These have constituted a poorly targeted and administratively cumbersome attempt to deal with some – but not all – of the trade competitiveness problems inherent in a national emissions production model. They constitute a very inefficient and ineffective option for dealing with those problems, but are a stumbling move towards a national emissions consumption model, nevertheless.

The attempts to 'band-aid' over the problems with production models, rather than deal with them in a principled, objective and systematic way, have introduced additional problems for the countries involved. For example:

- The CPRS has generated a frenzy of business lobbying for 'special deals' to insulate them from concerns about the costs of the CPRS on their operations. Not all these concerns relate to international trade competitiveness. The government has encouraged this frenzy because it announced its intention to do such deals (eg with the largest 1000 Australian companies etc).
- Some of the 'behind the border' industry assistance might be close to, if not actually being, protectionist in nature. (However, if so, Australia certainly will not be alone in this regard.)
- The 'carve outs' proposed under the CPRS reduce the national production target base at both ends. Some exports are 'carved out'. Some (fewer?) import-competing products are carved out. These 'carve outs' substantially shrink the total production base actually exposed to the CPRS. Further 'carve outs' – for example, the effective insulation of petrol used in Australia – shrink the target base even further. As a result, any given emissions reduction target is imposed upon a much smaller production

base, therefore requiring a much higher carbon price to deliver the same emissions reduction outcome (and increasing the chances that some of this will shift offshore as 'carbon leakage' and job losses). In this context, note that the effective coverage of the European ETS is about 50 per cent of CO_2 emissions and about 40 per cent of total greenhouse gas emissions.

These problems do not arise under a properly designed national emissions consumption-based policy:

- Lobbying for export 'carve outs' is not required. Exports automatically are 'zero-rated'. Lobbying by import-competing businesses is not required either. BTAs on competing imports match (in percentage terms) the emissions abatement costs faced by the domestic producers of those products. (Note, incidentally, that this does not mean Australia's emissions intensive exports, such as coal, are exempt from the coverage of the climate policy. They are covered under the policies of the consumers (importers) of those products via BTAs in the importing countries.)
- As noted earlier, the consumption model is trade-neutral and WTO-compliant, just like the GST.
- A national consumption (GNE) policy base will be roughly as large as a fully inclusive production (GDP) base. Indeed, especially for large developed economies running large current account deficits, the GNE base can be even larger than the GDP base.

On the third of these debates, accepting the science pointing to specific maximum global atmospheric concentrations as the target (eg 550ppm, 450ppm, 350ppm, or less), it is worth making some brief observations about national burden sharing.

Any translation of a given global emissions abatement task relative to business-as-usual (BAU) into 'slices of the abatement cake' to be allocated to specific countries has not been helpful. The alternative proposal (eg by Garnaut) for convergence to equal per capita emissions is also unhelpful. These attempts at national distribution of the adjustment burden are zero-sum games about which agreement is almost certain to be impossible – and impractical. There's a better way.

Broad-based climate change policies – carbon taxes, cap and trade measures like the ETS, or hybrids – are all specifically designed to put a price on carbon emissions. Price is the policy weapon intended actually to deliver the targeted emissions abatement outcome.

It is therefore sensible to focus on price measures (eg the carbon price or tax in each country) when assessing 'comparability of effort' (and burden sharing).[16] In this sense, separate apportionment of emissions shares is not required. Moving to a uniform global carbon price does this job reasonably fairly (see below).

A focus on national emissions abatement relative to BAU is a difficult practical exercise at best. Measuring and agreeing on the national BAU 'counterfactual' will be problematic, for a start. Current debates about arbitrary historical 'baselines' or starting points from which emissions abatement will be measured are sterile, often self-serving and probably unproductive. Carbon prices and taxes, in contrast, should be relatively easy to discover as policies are implemented.

Even if such national abatement shares could be decided and measured, there is virtually no chance whatsoever that they would lead to similar carbon price levels across countries if they were pursued. Countries differ substantially in their resource endowments, including endowments of high- and low-emissions energy sources. Large carbon price differences between countries will lead markets to shift resources in an effort to eliminate such price differences (carbon cost arbitrage). Indeed, under Australia's proposed CPRS, international trading in emissions permits is encouraged, and 'carbon leakage' will be another mechanism leading to a similar outcome. (Advocates of absolute or per capita emissions abatement targets and shares seem to have ignored such basic incentive effects in this important area as well.) This incentive-based market response will tend to undermine national absolute or per capita abatement shares, even if these can be agreed, which seems highly unlikely.

For Australia, a global deal on climate change, signified by a substantial and rising global price for carbon, will in any case change global comparative advantage currently enjoyed by some relatively low-cost (as measured) high-emissions energy sources. Selective application of similar carbon prices – as proposed under Australia's CPRS – will not have this effect. Rather, it will simply shift competitive advantage in relation to such resources to other countries not acting on climate change.

For those worried about equity, a global carbon price, applied to a national emissions consumption base by each country, delivers the following results:

- First, countries with relatively high endowments of high emissions energy sources (eg coal) will incur above-average adjustment burdens, because their competitive trade advantages based on the (hitherto) low cost of such energy sources will be reduced or eliminated, even when there is no 'carbon leakage'. Australia will probably incur an above-average adjustment burden in this context.
- Second, under an emissions consumption base, relatively wealthy, high-income countries with high per capita expenditures on goods and services (and a high per capita consumption of embedded emissions to match), will pay much more in per capita terms than poorer countries. Australia will probably incur an above-average adjustment burden in this respect as well.
- A uniform global carbon price is the practical option for effective policy, for practical measurement and assessment of national emissions abatement effort,

and for delivery of a tolerable distribution of burden sharing.

- Finally, a global deal based on a common global carbon price applied to a national consumption base achieves a very important end-result.

Through the consumption path, this deal would take the global community back to where it started: the original policy vision – a globally harmonised carbon tax to reduce emissions.[17]

Endnotes

1 That said, dealing with climate change *is* a diabolical problem, as Garnaut and others have said. The costs of policy responses come early, and the benefits accrue only over a long period of time, and are at best uncertain.

2 Unfortunately, in the end, the 1992 UNFCCC itself (see Article 4 – Commitments) already envisaged national timing and policy instrument differences, and referred to developing economies acting only after developed economies. So the 1992 UNFCCC itself got off on the wrong foot by sticking with a national production-based policy model under a non-harmonised response. The UNFCCC vision *was* for a globally harmonised response to climate change, ultimately, but it set up broad provisions that led to the failed Kyoto Protocol in 1997. By concentrating on the global end-point, but not thinking enough about feasible paths to it, arguably both the 1992 UNFCCC and the 1997 Kyoto Protocol have actually delayed national policy responses.

3 Recently, the ACT government announced its 'support' for a zero emissions target for the ACT. No timetable is indicated. No listing of measures to achieve this result is available. The government concedes it will be hard to achieve. The announcement was easily made, but the government's credibility will be exposed after it is long gone.

4 A detailed analysis of the consumption-based approach is presented in three policy notes by Geoff Carmody & Associates. Copies of these papers, and related opinion pieces, can be downloaded from http://www.onlineopinion.com.au/author.asp?id=5613.

5 The 'alcopops' and CPRS policies have important similarities. For alcopops, the substitutes are all other alcoholic beverages. For the CPRS, the substitutes are all of Australia's trading partners not adopting a CPRS-type policy, plus all of the Australian industries 'carved out' from the CPRS coverage. The incentives to shift away from 'alcopops' to other alcoholic beverages are akin to the incentives, under the CPRS, to shift away from affected industries to offshore competitor sources of supply, and to Australian industries 'carved out' from CPRS coverage.

6 Some will continue to argue that, ' … if we can only close a global deal, the problems of the production-based model will disappear because this achievement will deliver the harmonised global policy response we are seeking'. This is true. The practical problem is in the word 'if'. Moreover, the world is now well aware of the trade competitiveness problems with the production model. After all, most of the debate is about the trade exposed sector and seeking to insulate it from such adverse effects. Incentives to cheat in the light of this knowledge cannot be ignored. If this delusion about a global deal based on targeting national production of emissions continues as the basis for negotiations leading up to Copenhagen in December 2009, it is surely a triumph of hope over 12 years of very clear contrary policy experience.

7 The current global recession may well greatly reduce global emissions relative to a more 'normal' growth path by 2012. If so, and to that extent, this will have nothing to do with the effectiveness of the Kyoto Protocol.

8 For more details on this reasoning, see *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, especially section 4 and attachments A and B.

9 For more details on this reasoning, see *Effective climate change policy – the seven Cs: Implementing effective climate change policy – ETS or carbon tax?* Policy note no. 3, Geoff Carmody & Associates, October 2008, especially section 2 and attachment A.

10 A critical fourth issue is how to objectively measure greenhouse gas emissions associated with anthropogenic activity. 'Carbon accounting' is still a global work-in-progress. Without good carbon accounting, measuring emissions, and compliance with emissions abatement policies, are impossible. This issue must be resolved regardless of how governments choose to deal with climate change. In that sense, it is a given, and a matter for scientific research, development and debate.

11 For more information about my reasoning see *Effective climate change policy – the seven Cs: Implementing effective climate change policy – ETS or carbon tax?* Policy note no. 3, Geoff Carmody & Associates, October 2008, especially section 6.

12 For more information about my reasoning *Effective climate change policy – the seven Cs: Some design principles for evaluating greenhouse gas abatement policies*. Policy note no. 1, Geoff Carmody & Associates, July 2008, especially section 5.3. See also *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, especially section 4 and attachments A and B. On WTO compliance issues see *Effective climate change policy – the seven Cs: Implementing effective climate change policy – ETS or carbon tax?* Policy note no. 3, Geoff Carmody & Associates, October 2008, especially section 2 and attachment A.

13 "Consuming nations should pay for carbon dioxide emissions, not manufacturing countries, says China", *Guardian*, 17 March 2009.

14 See "Nicholas Stern's heresy: Conceding the West's Climate Burden", Geoffrey Lean, *Letter from Europe*, 2 June 2009, http://www.grist.org/article/2009-06-02-nicholas-stern-climate-china/.

15 See *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, attachment D.

16 See *Effective climate change policy – the seven Cs: Some design principles for evaluating greenhouse gas abatement policies*. Policy note no. 1, Geoff Carmody & Associates, July 2008, especially section 5.4. See also *Effective climate change policy – the seven Cs: Implementing design principles for effective climate change policy*. Policy note no. 2, Geoff Carmody & Associates, September 2008, especially section 5 and attachment C.

17 This is where William Nordhaus concludes we should be, too. See, for example, *Economic Issues in Designing a Global Agreement on Global Warming*, William D Nordhaus, Keynote address prepared for the Climate Change: Global Risks, Challenges, and Decisions conference in Copenhagen, March 10–12, 2009.

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Garry Sampson holds the John Gough Chair in the Practice of International Trade at Melbourne Business School (MBS). He also teaches in the TRIUM Executive Masters of Business Administration which is a combined degree of the Stern School of Business in New York, London School of Economics, and HEC School of Management in Paris. He is the Chair in International Economic Governance at the Institute of Advanced Studies at the United Nations University in Tokyo.

Gary is the most highly placed Australian to have worked at both the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO). After completing a Doctor of Philosophy at Monash, he undertook post-doctoral research at Cambridge. He subsequently worked with the United Nations and was a Senior Fellow with the Reserve Bank of Australia and Monash. He also held advisory positions with the Australian Industries Commission and the Economic Policy Advisory Committee in the Office of the Prime Minister.

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Greenhouse gas emissions and the trade regime

1.3

Introduction

The problem of climate change is a collective action problem that requires a global solution. The Garnaut Review has rightly described it as a diabolical problem, harder than any other policy issue in living memory, principally on account of the scope for free riding (Garnaut 2008, xvii). In economic terms, an institutional solution to limiting greenhouse gas (GHG) emissions faces a participation constraint (how to get all countries to commit to reductions) and a compliance constraint (how to get them to stick to their commitments).

The participation problem is best illustrated by recent history. Developing countries accepted the provisions of the Kyoto Protocol largely on the basis that they were exempt from binding commitments. In response, developed countries adopted weak or no commitments at all. Most vividly, in December 1997 the US Senate, on a vote of 95-0, unanimously passed the Byrd-Hagel Resolution and instructed the US administration not to sign on to the Kyoto Protocol unless it mandated 'new specific scheduled commitments or reduce greenhouse gas emissions for developing country parties within the same compliance period'. The agreement emerging from Kyoto did not meet that test and was never submitted to the US Senate for ratification.

It is generally recognised that the only tenable way to break the prisoner's dilemma deadlock is for developed countries to undertake deeper and earlier action than developing countries in terms of reduction commitments. But doing so will require the early movers to deal with issues of carbon leakage and competitiveness that have thus far been a significant factor in undermining domestic support for reduction commitments.

Competitiveness is an economic problem for countries adopting ambitious targets ahead of others. Their traded industries will face higher carbon costs than those of their international competitors. This could impact adversely on the most emissions-intensive industries. If they are trade exposed, they may be constrained in their ability to pass through carbon costs to consumers, potentially reducing their profitability. With a global GHG regime we would expect that the level of any activity would be determined by standard principles of comparative advantage, taking into account the relative GHG intensities of a country's factor endowments and technology. Against that benchmark, a situation where patterns of activity are determined by policy asymmetries – in the way a particular externality is dealt

with – would be inefficient. Added to these economic costs are the obvious political economy costs that would come with rapid adjustment in emissions intensive sectors and in regions dependent on them. These costs would compromise the ability of early mover countries to sustain their policy domestically.

Carbon leakage is a further issue of concern. It reflects the danger that activities in more stringent environments might be displaced by activities in less stringent ones, leading to a net increase in global emissions. The result would be an inefficient outcome with deep adjustment costs and no environmental gains.

All these concerns are raised in the Australian government's White Paper on its proposed Carbon Pollution Reduction Scheme (2008) and the Garnaut Climate Change Review's final report (Garnaut 2008).

As mentioned, a global agreement needs to meet a compliance constraint as well as a participation constraint. Some governments already believe others are not 'doing enough' to reduce carbon emissions. To 'encourage' these countries to make greater efforts, they propose acting unilaterally to apply trade sanctions. More generally, any global agreement – if is to be meaningful – will need a mechanism to punish parties that breach commitments. Trade sanctions are one such mechanism. Sanctions and measures to deal with competitiveness are trade measures.[1] They fall within the purview of the World Trade Organization (WTO). The WTO's objective is to bring predictability and stability to world trade through adherence to multilaterally agreed rules, to progressively liberalise trade, and to avoid measures that unnecessarily restrict trade. There are no WTO rights or obligations that address the environment directly, much less climate change and emission reduction.

To have a coherent international system, global emission reduction schemes should be consistent with WTO rules. This paper addresses issues arising from trade-related measures used to address competitiveness concerns.[2]

The timeliness of this issue is underscored by the fact that at the G8 Summit in Italy, leaders committed to working towards a global agreement that would limit increases in global temperatures to 2 degrees Celsius relative to pre-industrial levels. This in effect implies that atmospheric concentrations of GHGs need to be stabilised at 450 ppm (and probably lower). Further, parties to the United Nations (UN) Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol are now preparing for talks in Copenhagen that will shape the climate change regime to follow the protocol's first period. This ends in 2012. At this point, the nature of that regime and the commitments it will entail are still to be negotiated.

The conclusion of this paper is straight forward. Resorting to the WTO to level the playing field or apply sanctions is not a viable option. What is needed is a multilateral understanding negotiated outside the WTO, with the WTO playing an important secondary role.

It is instructive to examine WTO provisions in order to gain an insight into the relevant issues surrounding competitiveness concerns. Also, WTO rules are not to be viewed as an inconvenience to be circumvented in order to pursue desirable emission reduction policies. WTO rules were conceived to create a stable and predictable rules-based trading system and promote the negotiated reduction of trade barriers. What are needed are coherent international treaties that address quite different concerns in a mutually supportive and consistent manner.

With respect to an international understanding, unfortunately, the practical reality is that it is nowhere on the horizon. Certainly it will not be concluded in time for the Copenhagen Summit, and not for some time after. So what should governments do in the meantime, and what can they learn from the present?

Two regimes: Climate and trade

The WTO is the international organisation which oversees the multilateral trading system. It was created in 1995 as a result of the Uruguay Round of trade negotiations and replaced the General Agreement on Tariffs and Trade (GATT). It is an intergovernmental organisation with more than 150 member countries accounting for over 90 per cent of world trade. As most of the key countries in the climate change regime are WTO Members, or candidates to join the WTO (such as Russia), most governments in the climate regime will be bound by WTO rules.

The WTO's core responsibilities are the progressive liberalisation of trade and the conduct of trade according to agreed rules. The objective is to maintain a liberal rules-based trading regime to ensure predictability and stability in trading transactions.

Trade liberalisation is achieved through 'rounds' of negotiations where tariffs and other obstacles to trade are reduced and 'bound' against future increases. The Doha Development Agenda launched in 2001 is the ninth such round since the creation of GATT in 1947. WTO rules are agreed to by consensus and serve to ensure that liberalisation commitments are not undermined through new trade restrictions. Unlike other international agreements which are best endeavours in nature, WTO rules are legally binding. They are enforced through the most powerful compliance mechanism of any international organisation. The dispute settlement system provides for retaliation and compensation if WTO rules are not respected.

While the trade and climate change regimes both prescribe a pattern of behaviour for governments, there

are a number of important differences between them.

The objective of the trade regime is to remove government restrictions that impede countries maximising their comparative advantage. Each country acts at the national level, in its own interests, and within its own timeframe. On the other hand, the climate change regime requires the introduction of new measures that can have very considerable effects on comparative advantage. What could be seen as a progressive measure in the climate change regime (a discriminatory tax on carbon intensive imports or a requirement to buy emission permits) could be viewed as a trade distortion and disguised protection by the trade regime.

Further, as governments are addressing a global problem, international cooperation is needed in the climate regime to meet an agreed target within a common timeframe. As far as compliance is concerned, non-compliance in the climate regime creates a global problem, whereas non-compliance in the trade regime results in a bilateral dispute.

These differences do not necessarily mean that the two regimes are inherently incompatible. What it does mean is that the two regimes can not be dealt with in isolation. WTO rules are well known and if, as the climate regime evolves, it is apparent that governments wish to introduce measures that are WTO-incompatible, this need not be a problem. The problem arises when WTO rules are breached, and the conditions for government intervention are not agreed to by parties to both the trade and climate change regime. Coherence in global policy making should be the objective of all governments, perhaps more so with respect to climate change and trade policy than elsewhere.

The concerns

In practice, mitigation will require a wide range of instruments. The central element though will be a carbon price. There are a variety of ways in which a country might set such a price – through emissions trading or through a tax. Different countries will have different reduction commitments, but with international trade in permits, mitigation will be encouraged where it can be undertaken at least cost (meaning that, in principle, countries that find it particularly costly to cut emissions but still undertake ambitious reduction commitments will probably end up paying others to reduce emissions on their behalf).

From a global perspective, once there is global coverage and global trade in carbon permits, the potential distortions to trade should be reduced. As already mentioned, the issues lie in the interim when the commitments made by different countries are markedly asymmetric in nature.

The Australian government's White Paper reads:

> The Australian government has committed to a minimum 5 per cent reduction in national emissions from 2000 levels by 2020. Adopting such a target ahead of some other countries will mean that Australia's traded industries face higher carbon costs than some of their international competitors, which may have a significant impact on the most emissions-intensive trade-exposed (EITE) industries. (2008, p.12–21)

Similarly, without a level playing field, there is a concern that carbon 'leakage' may distort production and investment decisions, unfairly penalise countries working to reduce their emissions, and undermine global efforts to do the same. It would be a misallocation of resources at the global level, where resources moved internationally in response to very different government reactions to a common problem.

According to the White Paper:

> The ultimate objective of the introduction of a carbon constraint in Australia is to contribute to reductions in global emissions. If the introduction of a carbon constraint in Australia ahead of key international competitors simply results in EITE industries contracting in Australia and relocating offshore and using similar or worse emissions-intensive fuels or technologies, it will weaken Australia's effective contribution to the global emissions reduction effort. (2008, p.12–14)

There is both an economic and environmental case for quarantining 'carbon leakage'.

As Australia grapples with these issues, so do other countries. A variety of measures have been proposed or adopted by different governments. In July 2009, the Waxman-Markey Bill – named after its authors – passed in the US House of Representatives and provides for a cap and trade scheme coupled with institutional arrangements to address issues relating to competitiveness and leakage. The primary mechanism – permit rebates – is largely the same as proposed in Australia.

However, the draft Bill also contains provisions that give the President the right to impose tariffs, as of 2020, on competitors that have not undertaken commitments.

Similarly, senior European politicians have called for penalty taxes or sanctions on imports from countries 'not doing enough'. In France, Former Prime Minister Dominique de Villepin, Former President Jacques Chirac and incumbent President Nicolas Sarkozy have proposed trade restricting measures to urge China – among others – to reduce carbon emissions.

As far as sanctions are concerned, both the White Paper and the Garnaut Review wisely counsel against their use. They propose rebates for the cost of permits in order to shield trade exposed emissions intensive activities from the full carbon price. This is discussed in detail later.

Why worry about the WTO?

Many WTO agreements raise questions with respect to climate change policy:

- Can free emission permits be challenged under the Subsidies Agreement?
- Are 'cheap' imports from polluting countries candidates for anti-dumping duties?
- Do patents and the WTO Trade Related Intellectual Property Agreement restrict access to emission reduction technology?
- Do labelling, technical regulations, and standards meet the requirements of the Technical Barriers to Trade Agreement?
- Will the prioritised liberalisation of environmental goods and services in the Doha Development Agenda eventuate?
- Is the cross-border movement of technical expertise in emission reduction facilitated by the General Agreement on Trade and Services?

In all these agreements, negotiations and other instruments, WTO governments undertake binding commitments which clearly limit national sovereignty and policy options.

However, if governments breach their WTO commitments, does it really matter? Surely regulations to reduce global warming can take priority over WTO rules. Not meeting international commitments is common for many governments, so why not the WTO?

Binding trade rules are necessary to sustain the global public good of liberal trade – or at least contain the global public bad of protectionism. The past six decades – or the life time of the GATT/WTO trading system – have been marked by an unprecedented expansion of international trade. In terms of volume, world trade is nearly 32 times greater now than it was in 1950, and its share of global GDP has risen from 5.5 per cent in 1950 to 21 per cent in 2007. This enormous expansion has much to do with the adoption of more open and liberal trade and investment policies and the binding nature of obligations at the GATT and WTO. The number of countries participating in international trade has increased. Developing countries, for instance, now account for 34 per cent of merchandise trade – about double their share in the early 1960s. There were 22 members of GATT and there are now over 150 members of the WTO.

Moreover, as trade – and by extension the WTO – has a crucial role in world economic recovery, it is important not to undermine its role through incoherent measures to deal with climate change. As always in times of recession, the pressure of protectionism is on the rise. While G-20 leaders committed to avoiding protectionist measures in 2008, the World Bank documented (in March 2009) that since then 47 protectionist measures were enacted by different governments (of which 17 belong to the G-20) (Gamberoni & Newfarmer 2009). Moreover, the current round of multilateral trade negotiations launched in 2001 made little progress during the boom years between 2001 and 2007. It has little prospect of reaching a conclusion; evident from the lack of any substantial commitment at the April G-20 summit in London and the G-8 meeting in Italy. Instead, the focus has shifted to managing emerging protectionist pressures to minimise their harm, and maximise the scrutiny to which they are subject.[3]

In this current context, what is not needed are ill-conceived measures that deal with the adjustment effects of greenhouse mitigation policies. Given Australia's dependence on trade, it has much to gain from a system in which discriminatory practices are outlawed.

A further reason why it is worth worrying about the WTO relates to its enforcement powers. Many international agreements are 'best endeavours' in nature without an effective compliance mechanism. Non-compliance is not 'paid for'. This is certainly not the case for the WTO.

Any WTO member that believes benefits accruing to it under the WTO agreements are impaired by another member can invoke the dispute settlement system. In most cases, a WTO member will claim a measure enacted by another violates one or more of the provisions contained in a WTO agreement.

The dispute settlement process favours mutually acceptable solutions with the withdrawal of the inconsistent measure. If this cannot be achieved, the dispute will be adjudicated by panels composed of trade officials and may be subject to appeal to the Appellate Body.

When a panel or the Appellate Body concludes a measure is inconsistent with WTO law, it recommends the member concerned bring the measure into conformity with that agreement. There are very considerable incentives for doing so.

If the measure is not brought into conformity with WTO rules, the defending government is obliged to pay compensation or face retaliation by the complaining member. The sums involved can run into billions of dollars.

The costs of ill-conceived and WTO-inconsistent measures to address the transitional effects of GHG mitigation policies could be high. They would add further complications to negotiating a climate agreement if China, India, Brazil and other developing countries felt their trade prospects were undermined through disguised protectionism. Against this backdrop, why would they undertake reduction commitments?

If WTO rules obstruct governments in invoking their preferred measures, and if breaching obligations is a problem, why not simply change the rules of the WTO?

The reality is that this will not happen. WTO rules can only be changed on the basis of consensus. Two-thirds of WTO governments currently have no binding emission reduction obligations, so why agree to trade measures which could reduce their exports? Moreover, poorer countries are reluctant to undertake abatement commitments precisely because they are poor. Cutting off their growth prospects by legitimising what could turn into protection seems a peculiar way of getting them to take action.

Over and above these general issues, Australia has its own specific concerns. While border measures were rejected by the Australian government, this certainly does not preclude other countries from applying them to Australian exports. Australia is not operating in a vacuum and may well need to resort to the WTO to protect its interests. The Garnaut Review remarks:

> The Europeans, Americans, Chinese, and Japanese, among others, are all watching Australia with acute interest to see how we handle the treatment of our trade-exposed, emissions-intensive industries … (they) may find ways partially and expensively to protect their own industries in a mad scramble for preferment in a world of deep and differentiated government intervention over the dreadful problem. (2008, p.344)

Resorting to trade measures

The Garnaut Review cautions against the use of WTO-inconsistent measures in the absence of a global agreement:

> Pending such a global agreement, it would be undesirable for border adjustments to be imposed unilaterally by any country, because of the risks that they would pose to global trade. Rather, if there were a need for unilateral adjustment (due to an absence of global agreements), it would be better to provide domestic payments in WTO-consistent forms to firms. (2008, p.234)

While this is good advice, it begs a number of questions:

- What 'WTO-consistent' measures could be resorted to?
- How far do they go in meeting needs of governments, business and public interest groups?
- Why should the WTO legitimise emission reduction measures?

The fact is that WTO rules do severely constrain some governments from implementing their preferred policies. Unilateral sanctions on imports originating in non-parties to the Kyoto Protocol, for example, would mean payment of compensation or retaliatory action under the rules of the WTO. So what are the available policy options?

According to the Garnaut Review:

> …the choice of options available to countries prepared to act to reduce their emissions ahead of a comprehensive global agreement is dreadful… Indeed, the dilemma created for individual governments is so great that it has the capacity to destabilise public support and pervert individual domestic schemes to the point of non-viability. The sum consequence of the compromising of individual schemes could leave the world with little chance of avoiding dangerous climate change. (2008, p.342)

The practical (and 'dreadful') reality is that levelling the playing field through use of trade measures raises some of the most important and unresolved issues in WTO law. As the legality of such measures would surely be tested in the WTO dispute settlement process, important climate change decisions would be in the hands of the WTO panels and Appellate Body. This grants these bodies a great deal of commercial and political importance in an area where they have no special expertise. As their rulings cannot satisfy all – by definition there are complaining and responding countries in every dispute – even more criticisms will be directed at the WTO irrespective of the outcome. Claims that the WTO is meddling in affairs that do not concern it will multiply. This will undermine its credibility when public support is required to conclude the Doha Development Agenda.

The main point of contention is the friction between the need to manage transitional effects of mitigation policies in a world of asymmetric commitments, and the need to preserve the mechanisms that underpin a liberal global trading regime. The question is how best to manage that tension.

WTO rights and obligations are established and well known. For example, there is a general rule against levying quantitative restrictions on imports; WTO rules prohibit their use. Imports of carbon-intensive goods cannot be banned if the importing country wishes to do so. This is clear. What is equally clear is that additional tariffs cannot be imposed on imported carbon intensive goods. Most tariffs are legally 'bound' through half a century of multilateral tariff negotiations. A 'binding' of tariffs means that they cannot be increased unless renegotiated, ensuring the predictability of prices in trading transactions. Like other OECD countries, 97 per cent of Australian tariffs are bound.

However, competitiveness concerns relate very much to internal measures such as carbon or energy taxes, emission permit requirements and other domestic regulations. In this respect there is considerable scope for WTO members to adjust the impact of national measures on international competitiveness. Unfortunately, the question as to which measures can be legally adjusted is a very murky area of trade law.

WTO rules, for example, provide for Border Tax Adjustments (BTAs) – taxes on imports and rebates for exports – to ensure traded goods receive treatment equal to nationally produced goods. It is common to use WTO terminology – border tax adjustment – for the whole class of border measures directed to ensuring competitiveness. In the case of a domestic carbon tax, a BTA would charge imported goods the equivalent of what would have been paid had they been produced domestically and rebate the tax paid by exporters. With a cap and trade scheme, a border adjustment would oblige domestic importers or foreign exporters to secure emission permits in the same way as domestic producers. Exporters would receive emission permit rebates.

From a WTO perspective, the problem in 'levelling the playing field' and adjusting for carbon content through BTAs is that it is not at all clear which taxes can be rebated or imposed.

What is clear is that Australia is free to impose "on the importation of any product…a charge equivalent to an internal tax…in respect of the like domestic product…" (GATT Article II:2(a), WTO 1994b). Domestic taxes on the final product (aluminium) can be rebated for exports or imposed on imports. The controversy surrounds taxes on the imbedded carbon content of a good. Can taxes paid on the energy consumed in a production process be adjusted at the border? This question is far from resolved in WTO law, and should a case be brought to the WTO, it would be resolved through the 'interpretation' of some key legal concepts by the Appellate Body.

From a practical perspective, determining the carbon content of a traded good is not easy. If the BTA scheme covered not only basic goods but also the carbon embedded in the final product – such as the imported steel and the energy used to produce it, or aluminium and the aluminium in a bicycle frame this would require an enormous amount of data and a highly convoluted system of accounting. Manufactured goods are typically assembled from a host of raw materials and semi-finished intermediate goods, often sourced from different countries. Chasing down the full carbon footprint of the supply chains would be daunting enough even if the necessary data existed. For the most part it does not (Cosbey 2008).

This is one reason the Australian government's White Paper did not opt for BTA measures. Such measures would:

> …require accurate tracking of all inputs used in the production of a 'landed' good to determine both the amount of embedded emissions in that good and the effective carbon price that has been applied to the inputs. Accessing reliable and robust data from other jurisdictions is not straightforward, and the complexity of the task significantly increases when multiple jurisdictions contribute to the production of the good. (2008, pp.12–15)

This is a fundamental issue. BTAs would be based on estimates of unobserved (and probably unobservable) emissions from production processes overseas, and a counterfactual price of what the price of the overseas goods should have been if externalities were internalised. The history of WTO disputes dealing with policies that are ultimately predicated on some counterfactual construction of the price of competing goods is not particularly encouraging. It is unsurprising that many anti-dumping actions (based on construed prices) end in the dispute settlement process of the WTO.

Controversy also surrounds the requirement to adjust border taxes to imports of 'like products'; the question of what is a 'like product' is crucial. From a domestic perspective, a ream of paper produced from carbon inefficient coal is not the same as a ream of paper produced with solar energy. The two products may well be taxed differently in the domestic market or require different emission permits. However, if different taxes are applied domestically, which tax should apply to imported paper? According to WTO rules, 'like' products should be taxed the same.

Consider a tax on gasoline at the retail level. If the tax is imposed equally on gasoline produced from domestic and imported oil, then it should be in accord with national treatment, and the policy will be WTO-legal. Some difficulty arises, however, if competing substitute products are taxed differently. If a domestic gasoline substitute (eg ethanol) is taxed lower than imported gasoline, and if the two products are deemed 'like', then a WTO panel would rule the less favourable treatment a violation of national treatment (Charnovitz 2003). Based on WTO case law, 'likeness' is determined by a number of factors but, most importantly, if the products compete with each other in the market place they are considered alike. Gasoline and ethanol compete in the domestic market as do reams of paper produced by coal burning and solar energy.

The WTO 'most favoured nation treatment' (MFN) provision requires that "any advantage…granted by any Member to any product originating in…any other country shall be accorded immediately and unconditionally to the like product originating in…all other [WTO] Members" (GATT Article I, WTO 1994). There are no WTO legal grounds for applying more severe BTA measures to 'like products' from China or India, even if the importing country considers the domestic regulations of the exporting country unsatisfactory. A tonne of cement produced with solar energy in one country must be taxed at the same rate as a tonne of cement produced in a coal burning country.

Most favoured nation treatment is probably the most fundamental of WTO rules and goes a long way to constraining government discrimination in trade. For example, it rules out the discrimination envisaged by the US Senate, President Sarkozy and others against countries 'not doing enough'. Its interpretation also

goes a long way to explaining the animosity towards the WTO on the part of many public interest groups. The WTO perspective is that should any country wish to influence the manner in which products are produced in other countries – however appropriate this may be thought by the importing country – it should not be translated into discriminatory trade measures.

The reality is that some governments do wish to breach their non-discrimination obligations. The question then arises as to whether the possibility exists for them to do so. Can an exception be made for governments (eg France, the US) to use trade measures to penalise countries (eg China, India) because of their polluting production processes?

The answer is yes; there is a WTO 'exception provision' which is designed to permit governments to regulate as they wish to "protect the lives of people, flora, fauna and exhaustible natural resources" (GATT Article XX(g), WTO 1994). However, strict conditions have to be met to take 'exceptional' measures; the relevant procedure was never successfully invoked in half a century of GATT experience and only twice in the history of the WTO.

Broadly speaking, there are two key questions a panel or Appellate Body must address.

First, is the measure eligible for treatment as a WTO exception: it is *necessary* to "protect human, animal or plant life or health or relate to the conservation of an exhaustible natural resource". In practice, "exhaustible natural resources" are normally thought of as physical deposits such as iron ore or petroleum. Is the planet's atmosphere an exhaustible natural resource? Considering the international importance of climate change it would be surprising if the WTO panels and Appellate Body would not accept that the planet's atmosphere (that is, the layer of gases around the earth that regulates the climate) is an "exhaustible natural resource".

Second, what conditions prevail in the exporting country? This means a country cannot be discriminated against just because it does not have the same emission reduction scheme as the importing country. It may not apply carbon taxes, for example, but may have a cap and trade scheme. It may have neither, and use only clean technology with no carbon emissions. China has, for example, introduced a domestic target to improve energy intensity by 20 per cent by 2010 and imposed an export tax of 5 to 15 per cent on energy-intensive exports such as iron and steel, cement, aluminium and certain chemicals. It has neither carbon taxes as such nor a cap and trade regime. Determining if another country has an equivalent scheme will not be an easy task.

It will also require deciding on whether developing countries (eg India or China) should carry the same burden as other countries. Under the UNFCC, protection of the climate system must be pursued "on the basis of equity and in accordance with [the parties'] common but differentiated responsibilities and respective capabilities" (Article 34, UNFCC 1998). Under the Kyoto Protocol, developing countries do not have to commit to any emission reductions. The WTO panel process and Appellate Body would certainly refer to the UNFCCC and Kyoto Protocol. To discriminate against imports from a developing country when another international treaty has exonerated them from obligations would put the two agreements on a collision course. Avoiding this outcome has much to do with the Doha Development Agenda calling for "negotiations on clarifying the relationship between Multilateral Environment Agreements (MEAs) and WTO rules" (par. 31(i) Doha Declaration 2001).

The bottom line is that invoking the WTO exceptions provision to enable discrimination between supplying countries would call into question some of the most fundamental principles of the WTO. Authorising discrimination according to production processes raises questions such as whether hand-knotted rugs made by children are 'like' those made by adults, whether products manufactured from genetically modified organisms are 'like' those that are not, and whether shrimp caught in nets that incidentally kill endangered turtles are 'like' other shrimp. This places the WTO squarely on a slippery slope. Some public interest groups care as much about child labour, GMOs and endangered species as others care about climate change. If an exception was invoked to discriminate in trade for climate change purposes on the basis of production methods, why not for the other production processes? This touches on questions relating to the role of the WTO in global governance.[4]

The Australian approach

The Garnaut Review and the Carbon Pollution Reduction Scheme (CPRS) advocate dealing with competitiveness and carbon leakage issues through assistance to emission intensive trade exposed industries:

> There is a clear distinction between compensation and payments to correct for distortions in the efficiency with which resources are used. Providing assistance to address the failure of our global competitors to act on limiting their carbon emissions is not the same as compensating domestic firms for the government's decision to implement a domestic emissions trading scheme. (Garnaut 2008, p.345)

The CPRS does not propose BTAs. While it recognises the economic 'efficiency' of BTAs, it rejects

them mainly on the grounds that they would be nigh impossible to implement (for reasons discussed above) (Garnaut 2008, p.12–160).

The White Paper proposes a system of shielding those industries which are both emission 'intensive' and heavily exposed to international trade. The logic is that if the industry is emission intensive, it will have higher cost to bear under the Carbon Pollution Reduction Scheme, and if it is heavily exposed to trade, it will be difficult to pass on additional costs to consumers because of international competition.

The shielding is to be conducted on the basis of an allocation of permits, contingent on output and based on an emissions benchmark. The emissions benchmark specifies the extent to which activities would be shielded from the price of a unit of emissions.[5]

This approach is usually described as an 'intensity-based approach' or an 'output-based allocation'. It is in effect a particular type of emissions trading scheme tacked on to the end of the cap and trade mechanism that is at the core of the CPRS.

The White Paper flags the need for consistency with WTO obligations and mentions the WTO Subsidy Agreement specifically in this context:

> The Government is committed to delivering the EITE assistance program in a manner consistent with Australia's international trade obligations. These include obligations under the World Trade Organisation, in particular the Agreement on Subsidies and Countervailing Measures (SCM)... If a compliance issue were to arise, the Government may adjust the relevant aspect of the assistance program to ensure that Australia remains compliant with its international obligations… (2008, p.12)

The important question then is whether the EITE Scheme is consistent with Australia's obligations under the WTO, in particular, the SCM Agreement.

The first step is to consider whether the approach to EITEs qualifies as a subsidy within the meaning of the SCM and that the provisions of the SCM are applicable. This involves determining if:

- a financial contribution has been provided
- the contribution was made by a government or a public body within the territory of a WTO member
- the contribution confers a benefit.

It is fairly clear that the approach to EITEs satisfies these provisions. There is a financial contribution, the system is analogous to a flat subsidy in the form of production payments, it is provided by government, and it confers a benefit in the way it is understood in WTO jurisprudence (ie what a beneficiary would have received in the market).[6]

The second step is to determine whether the subsidies envisioned are specific to an industry or groups of enterprises and industries.

The provisions governing specificity are quite broad and include a range of factors. There are good grounds for thinking the approach to EITEs satisfy these provisions – the Green Paper is quite clear on the industries it expects to be covered; and indeed, debate on the structure of various eligibility criteria for EITEs has largely been carried out on the basis of who is in and who is out.

If granting free permits is found to be a specific subsidy within the meaning of the SCM Agreement, it is either prohibited or 'actionable' under various conditions. Subsidies contingent on export performance or the substitution of foreign inputs by local ones are prohibited. The CPRS proposals seem free of this problem because the 10 per cent cutoff threshold for trade exposure is fairly low in an open economy such as Australia's. The granting of production subsidies is not conditional on export orientation or the use of local imports – in practice a wide range of industries would fall into this category. Also, the main criterion for eligibility would be the emissions cutoff threshold, not export orientation.

The remaining issue is whether the extent to which the EITE approach could be actionable or subject to countervailing duties. An important point here is subsidies are actionable only if one country complains to the WTO that its own industries are 'materially injured' by the subsidy. First, there must be a 'complaining' government. Second, countervailing measures can only be imposed if three conditions are met:

i. the imported are shown to be subsidised
ii. there is injury to the domestic industry in the importing country
iii. there is a causal link between the subsidised imports and the injury.

This is difficult to determine a priori. How much a sector or industry benefits from a scheme relative to counterparts in other countries depends on how the scheme compares to similar schemes in other countries, and the abatement options for EITE industries (the greater they are, the greater the implicit subsidy). It is difficult to see how a country not implementing carbon reduction schemes may bring a complaint against an EITE-based approach to the WTO. It is more likely that countries with stringent reduction commitments and measures to deal with transitional concerns may have cause for complaint.

There are also important differences in impacts on trade and actual abatement depending on whether the economy in which it is implemented is small (a price taker on global markets) or large (it has an influence on prices). Because Australia falls in the former category, the use of an intensity-based approach should have limited adverse consequences on trade and abatement. Globally speaking, the pursuit of these options is likely to require increased surveillance. There is also scope for negotiated sector reductions in emissions intensity in many of the trade exposed sectors (such as aluminium, cement).

A global understanding

According to the Director-General of the WTO, Pascal Lamy:

> …imposing taxes on imports to penalise countries with looser emissions controls would be a 'distant second-best to an international solution' on climate change. The global community has a strong interest in pressures for border taxes by moving sooner rather than later to the international agreements that avoid distortions in investment and production in trade-exposed, emissions-intensive industries. Nevertheless, if an international solution is not forthcoming, the pressure, and indeed the case, for border adjustments will grow. (Lamy 2008)

From an institutional perspective (Sampson 2009) the importance of coherent global regimes for trade and climate change has not been lost on ministers for the environment. The Climate Change Convention addresses the trade regime directly by noting that parties should:

> …cooperate to promote a supportive and open international economic system…thus enabling them better to address the problems of climate change. Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. (Article 3, UNFCC 1998).

Similarly, the Kyoto Protocol's objective is the use of "market-based mechanisms" to achieve the "progressive phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run contrary to the objective of the Convention and application of market instruments" (Article 1.8, UNFCC 1998). This is very much in line with the WTO objective of the progressive removal trade restrictions and distortions. The Kyoto Protocol also states that the parties shall strive to implement policies and measures "in such a way to minimize adverse effects…on international trade" (Article 2.3, UNFCC 1998).

The potential tension between trade and emission reduction objectives is evident to trade ministers also. With the Climate Change Convention and Kyoto Protocol certainly in mind, they agreed at the launch of the Doha Development Agenda in 2001 to "…negotiate the relationship between WTO rules and specific trade obligations set out in multilateral environmental agreements" (WTO 2001).

The potential conflict comes from the enforcement powers of the WTO, which have unfortunately made it home for an increasing number of non-traditional trade disputes. In the absence of international agreements elsewhere, disputes have gravitated towards the WTO. The subject matter dealt with by WTO panels and Appellate Body now includes endangered species, hormone treated beef, genetically modified organisms and internet gambling.

This is not appreciated by everyone:

> Purists want environmental regulations left to (UN) specialised agencies, whereas many environmentalists want them enforced by the WTO. The argument for using the WTO is simple, for unlike most other international organisations, the WTO has a mechanism for enforcing its rulings: trade sanctions. The WTO convenes panels of experts to rule on trade disputes among member governments. If the losing government refuses to comply with the ruling, the panel authorizes the winning government to impose trade sanctions. (Weinstein & Charnovitz 2001, p.149)

Policy conclusions

Resorting to the WTO does not provide a long-term – or even a transitional – solution to the competitiveness concerns raised above. Adding the responsibility of ruling on the legitimacy of national climate change regulation to the WTO agenda would provide more ammunition to arguments that the WTO is operating beyond its reach. Indeed, WTO member governments and the Appellate Body have made clear, on numerous occasions, that they do not wish the WTO to be responsible for the setting and enforcing of measures where it does not have the skill, expertise or mandate.

Turning to the WTO to resolve differences, even on an interim basis, is not an option. It would surely involve 'testing' some of its most fundamental premises. These include:

- not using trade measures to force other countries to adopt the preferred production policies in the importing country
- not using environmental or other measures as disguised restrictions on trade
- not discriminating between the same imported goods because of the country of origin of the goods
- not discriminating between products produced domestically and imported goods
- not subsidising the domestic production of goods if it causes injury to the exports of other countries.

The current state of play is that while emission reduction objectives have been agreed to by signatories of the UNFCCC and the Kyoto Protocol, the measures to achieve those reductions have not. WTO rules are well known. An understanding on how to deal with competitiveness and related issues should emerge from the UN Climate Change Summit in Copenhagen. The realisation by both trade and environment ministers in the Kyoto Protocol and the Doha Development Agenda of the need for coherence in policies should facilitate

the negotiation of an understanding to deal with the interface between trade and climate change policies. What is important is that the WTO dispute settlement process is not left to determine whether climate change measures with trade implications are 'appropriate' or not. What is needed from Copenhagen is an understanding as to how governments should act in the interim and a road-map for the future.

The form such an agreement should take is not clear and there are many possibilities. Governments can agree to formal treaties binding under international law to less rigorous nonbinding instruments that serve as guidelines. Cooperation can range from modest commitments to share information and undertake coordinated research, to more extensive agreements to restrict emissions, monitor compliance and enforce penalties.

The important point is that if non-WTO conforming trade measures are required to fulfil the objectives of the climate change regime, then the conditions according to which these measures can be invoked should be clearly specified. If, for example, it is agreed that countries doing 'too little' to reduce emissions can be discriminated against in trade (as foreseen in the Waxman-Markey Bill), then they will have lost their WTO rights not to be discriminated against. The conditions under which governments can apply trade sanctions for such purposes (eg how far short of an agreed emissions reduction target a country must be for another to impose a trade sanction) should be clearly spelled out in a multilaterally agreed understanding and not left to the judgement of the WTO dispute settlement process. These conditions should be set by those with the expertise and mandate to do so, not trade officials (Sampson 2006).

The WTO does, however, have a crucial role to play, but of a secondary nature.

Negotiating such an agreement should not be beyond the ability of governments. Agreements to ban trade in endangered species, hazardous wastes and chlorofluorocarbons that deplete the ozone layer all provide for WTO 'illegal' measures and were negotiated outside the WTO.

A coherent approach to policy formulation by governments at the international level is needed. For trade ministers alone to 'negotiate' the relationship between trade rules and climate change – as called for in the Doha Development Agenda – is a far too narrow perspective. Dealing with trade rules and competitiveness requires the involvement of trade, environmental and development finance communities. The overall conclusion of this paper in terms of trade and climate change policies is that the challenge at Copenhagen will be to set in motion a process for the negotiation of an understanding or treaty that will permit governments wanting to level the playing field. As countries are sure to move ahead at different speeds in enforcing their emission reduction targets, then the chorus of voices to level the playing field will strengthen. A prerequisite to an agreement on ambitious emission reduction targets will be an understanding as to how competitiveness considerations can be dealt with in a manner that is rational, equitable and coherent.

Endnotes

1 A measure is any law, rule, regulation, policy, practice or action carried out by government.

2 This is not a recently discovered problem (Sampson 2001).

3 The G-20 communiqué was described as "pitiful" in regard to the Doha round (Baldwin 2009).

4 These and related issues are addressed in The WTO and Global Governance: Future Directions, United Nations University Press, Tokyo, 2008.

5 Under the Green Paper proposals, 90 per cent of direct and indirect emissions costs would be shielded for industries with over 2000 T C02 (tonnes of carbon dioxide) per million dollars of revenue: a benchmark of 60 per cent would apply to industries with 1500-2000 T C02.

6 This follows from the Appellate Body's ruling in the Canada-Aircraft case.

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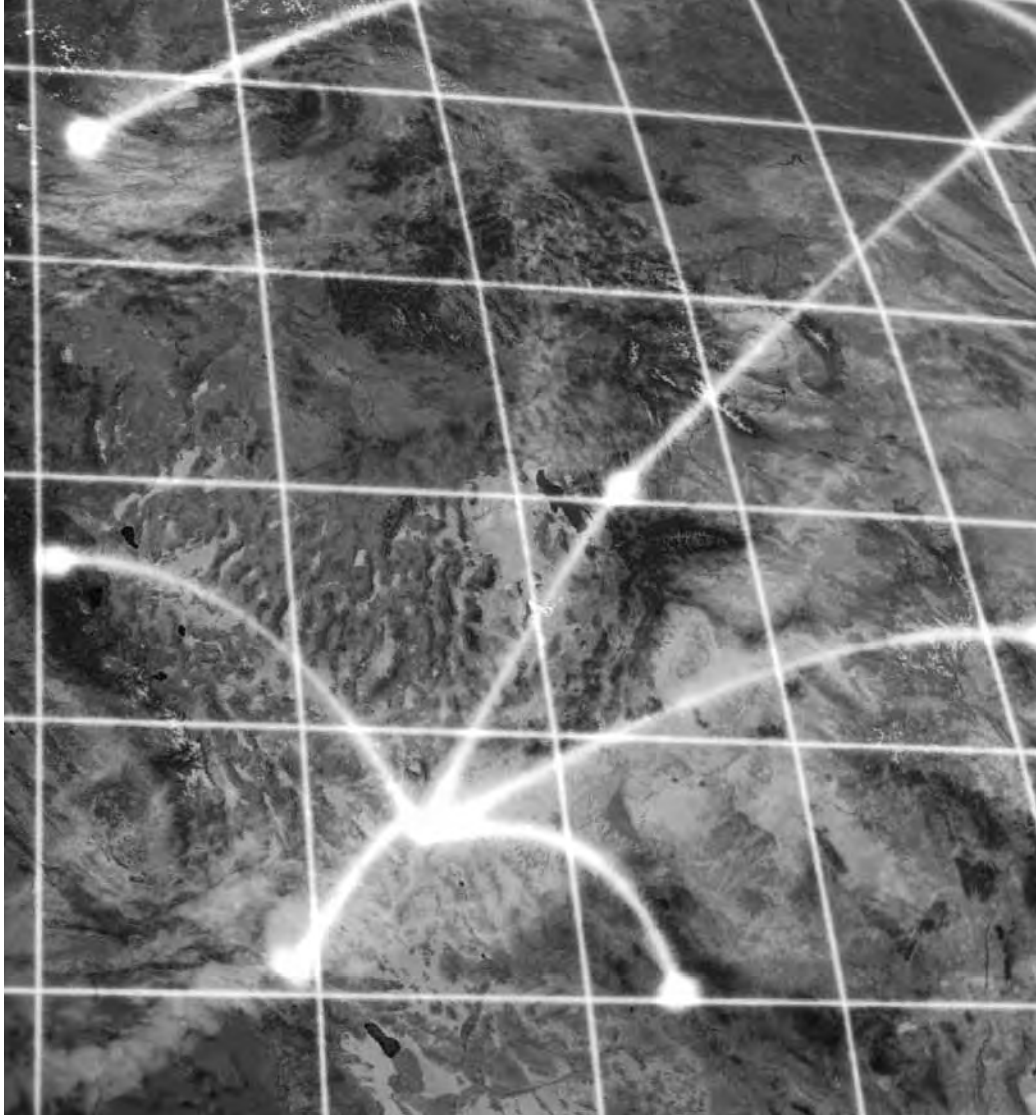
William D Nordhaus is Sterling Professor of Economics at Yale University. He completed his undergraduate work at Yale University and received his PhD in Economics in 1967 from the Massachusetts Institute of Technology, Cambridge. He has been on the faculty of Yale since 1967 and has been Full Professor of Economics since 1973. He is a member of the National Academy of Sciences and a Fellow of the American Academy of Arts and Sciences. He is on the research staff of the Cowles Foundation and of the National Bureau of Economic Research and has been a senior advisor of the Brookings Panel on Economic Activity, Washington, DC since 1972. Professor Nordhaus is a current or past editor of several scientific journals. He has served on the Executive Committees of the American Economic Association, the Eastern Economic Association, the Congressional Budget Office Panel of Economic Experts and the Advisory Committee for the Bureau of Economic Analysis.



The many advantages of carbon taxes

1.4

This paper is a revised version of an earlier paper by William D Nordhaus, "To tax or not to tax: Alternative approaches to slowing global warming", *Review of Environmental Economics and Policy*, vol.1, no. 1, Winter 2007. It also forms Chapter 8 in his book, *A Question of Balance: Weighing the Options on Global Warming Policies* (2007), Yale University Press, New Haven. Reprinted by permission.

1. Prices versus quantities for global public goods

When dealing with economic public goods like global warming, it is necessary to reach through governments to the multitude of firms and consumers who make the vast number of decisions that affect the ultimate outcomes. There are only two mechanisms that can realistically be employed: quantitative limits through government fiat and regulation; and price-based approaches through fees, subsidies or taxes.[1] This paper addresses the major differences and explains why prices, and in particular carbon taxes, have major advantages over quantitative approaches.

In the global warming context, 'quantitative limits' set global targets on the time path of greenhouse gas emissions of different countries. Countries then can administer these limits in their own fashion, and the mechanism may allow transfer and trading of emissions allowances among countries, as is the case under the Kyoto Protocol and the European Trading Scheme. This approach has limited international experience under existing protocols, such as the chlorofluorocarbon (CFC) mechanisms, and broader experience under national trading regimes, such as the United States (US) sulfur dioxide ($S0_2$) allowance-trading program.

The second approach is to use harmonized prices, fees or taxes as a method of coordinating policies among countries. There is no international experience in the environmental area of this model, although it has considerable national experience for environmental markets in such areas as the US tax on ozone depleting chemicals. On the other hand, the use of harmonized price-type measures has extensive international experience in fiscal and trade policies, such as the harmonization of taxes in the European Union (EU) and harmonized tariffs in international trade.

Attempts to address climate change through prices rather than quantities have been discussed in a handful of papers in the economics literature but much careful analysis remains to be done (Cooper 1998, Pizer 1998, Victor 1998, and Aldy *et al* 2003). A few of the details are highlighted here.

For concreteness, a mechanism called harmonized carbon taxes is discussed. This mechanism is a substitute for binding international or national emissions limits. Under this approach, countries agree to penalise

carbon emissions at an internationally harmonized 'carbon price' or 'carbon tax'. Conceptually, the carbon tax is a dynamically efficient Pigovian tax that balances the discounted social marginal costs and marginal social benefits of additional emissions.

The carbon price might be determined by estimates of the price necessary to limit greenhouse gas concentrations or temperature changes below some level thought to be 'dangerous interference', or it might be the price that would induce the efficient level of control. For example, if an international agreement were reached that global temperature increase should be limited to 2°C, then, according to earlier results,[2] the harmonized tax would be set at US$72 per ton carbon (US$20 per ton of CO2) for 2015, rising at about 3 per cent per year during the next decade, assuming full participation. This number could be estimated in several integrated assessment models and should be updated as new information arrives. Because carbon prices would be equalised, the approach would be spatially efficient among those countries that have a harmonized set of taxes. If the carbon tax trajectory follows the rules for 'when efficiency', it would also satisfy intertemporal efficiency.

Many important details would need to be negotiated on burden sharing. It might be reasonable to allow full participation to depend upon the level of economic development. For example, countries might be expected to participate fully when their incomes reach a given threshold (perhaps US$10,000 per capita), and poor countries might receive transfers to encourage early and complete participation. If carbon prices are equalised across participating countries, there is no need for tariffs or border tax adjustments among participants. The issues of sanctions, the location of taxation, international-trade treatment, and transfers to developing countries under a harmonized carbon tax are important details that require discussion and refinement.

The literature on regulatory mechanisms entertains a much richer set of approaches than the polar quantity and price types that are examined here. An important variant is a hybrid system which puts ceilings on the price of emissions-trading permits by combining a tradable permit system with a government promise to sell additional permits at a specified price. Price caps were considered and rejected by the Clinton administration in its preparation for the negotiations on the Kyoto Protocol. Such an approach should include floors as well as caps, although most hybrid proposals do not include floors. Hybrids, as a possible useful middle ground, are discussed in the final section of this paper.

2. Comparison of price and quantity approaches

This section compares the performance of quantity and price systems for regulating stock global public goods like global warming. The basic message is that because of its conceptual simplicity, a harmonized carbon tax might prove simpler to design and maintain than a quantity mechanism like the Kyoto Protocol.

Setting baselines for prices and quantities

Quantity limits are particularly troublesome where targets must adapt to differential economic growth, uncertain technological change and evolving science. These problems have been well illustrated by the Kyoto Protocol, which set its targets 13 years before the date on which the controls become effective (2008–12), and used baseline emissions from 20 years before the control period. Base-year emissions have become increasingly obsolete as the economic and energy structures, and even political boundaries, of countries have changed.

The baselines for future budget periods and for new participants will present deep problems for extensions of a quantity regime like the Kyoto Protocol. A natural baseline for the post-2012 period would be a no-controls level of emissions. That level is in practice impossible to calculate or predict with accuracy for countries with abatement policies in place. Problems would arise in the future as to how to adjust baselines for changing conditions and to take into account the extent of past emissions reductions.

Under a price approach, the natural baseline is a zero carbon tax or penalty. Countries' efforts are then judged relative to that baseline. It is not necessary to choose a historical base year of emissions. Moreover, there is no asymmetry between early joiners and late joiners, and early participants are not disadvantaged by having their baseline adjusted downward. The question of existing energy taxes does raise complications and these are addressed below.

Treatment of uncertainty

Uncertainty pervades climate change science, economics and policy. One key difference between price and quantity instruments is how well each adapts to deep uncertainty. A major result from environmental economics is that the relative efficiency of price and quantity regulation depends upon the nature, and more precisely, the degree of non-linearity of costs and benefits (Weitzman 1976). If costs are highly non-linear compared to benefits, then price-type regulation is more efficient; conversely, if the benefits are highly non-linear compared to costs, then quantity-type regulation is more efficient.

While this issue has received scant attention in the design of climate change policies, the structure of the costs and damages in global warming gives a strong presumption to price-type approaches. The reason is that the benefits of emissions reductions are related to the stock of greenhouse gases, while the costs of emissions reductions are related to the flow of emissions. This implies that the marginal costs of emissions reductions are highly sensitive to the level of reductions, while the marginal benefits of emissions reductions are insensitive to the current level of emissions reductions (Pizer 1999 and Hoel *et al* 2001). In the DICE model,[3] the benefit function for emissions of a single decade is essentially linear, while the cost function is highly convex with an elasticity of close to 3. This combination means that emissions fees or taxes are likely to be much more efficient than quantitative standards or tradeable quotas when there is considerable uncertainty.

Volatility of the market prices of tradable allowances

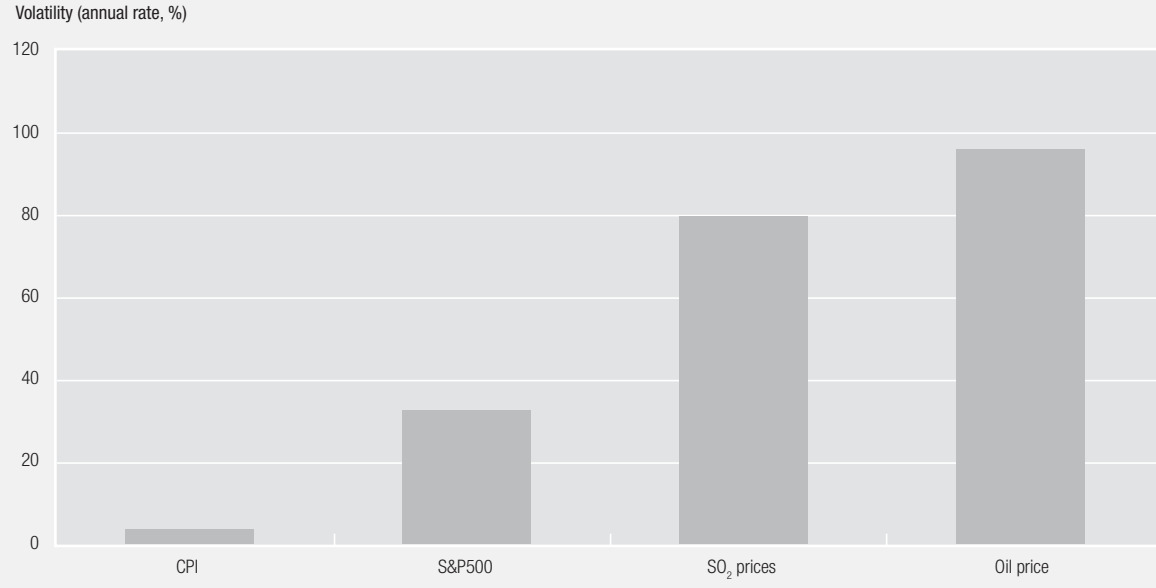
Uncertainties affect prices. Because supply, demand and regulatory conditions evolve unpredictably over time, quantity-type regulations are likely to cause volatile trading prices of carbon emissions. Price volatility for allowances is likely to be particularly high because of the complete inelasticity of the supply of permits along with highly inelastic demand for permits in the short run.

The history of European trading prices for CO_2 illustrates the extreme volatility of quantity systems. Over 2006, the range of trading prices was from US$44.47 to US$143.06 per ton carbon (Point Carbon 2006). The prices of allowances fell by more than 70 per cent in one month because of new regulatory information.

More extensive evidence on the trading prices of quantitative environmental allowances comes from the history of the US sulphur dioxide ($S0_2$) emissions trading program. This program includes an annual auction conducted by the Environmental Protection Agency (EPA) as well as private markets in which firms and individuals can buy and sell allowances. The comparison between the prices for $S0_2$ and carbon trading is useful because the economic characteristics of the two markets are similar. Both markets are ones in which the supply is fixed or near-fixed in the short run. Moreover, for each market, the demand is highly inelastic because it involves the substitution between a fuel (such as coal) and other inputs, where the technology is relatively inflexible in the short run. To some extent, the volatility can be moderated if an agreement allows banking and borrowing, meaning that firms can draw from future emissions allowances, or save allowances for the future. But programs are unlikely to allow borrowing, and banking provides only limited relief from price volatility.

Some insight is gained into the likely functioning of CO_2 allowances by examining the historical volatility

FIGURE 1:
PRICES OF SULPHUR EMISSIONS ALLOWANCES SHOW HIGH VOLATILITY



Note: This figure shows the estimated volatility of four prices over the 1995–2006 period. From left to right: the consumer price index (CPI), the stock price index for the S&P500, the price of US SO_2 allowances (SO_2 prices), and the price of crude oil (Oil price). Volatility is calculated as the annualized absolute logarithmic month-to-month change.

Source: Oil prices, CPI, and stock prices from DRI database available at Yale University. Price of SO_2 permits are spot prices provided by Denny Ellerman and reflect the trading prices.

of the price of $S0_2$ allowances. Spot $S0_2$ prices at the annual EPA auction have varied from a low of US$66 per ton in 1996 to a high of US$860 per ton in 2005. Futures prices have varied by a factor of 4.7 (EPA 2006). When looking at the private market, allowances prices varied by a factor of 69 in the period 1995–2006, and by a factor of 12 in the period 2001–06. Some changes have been induced by alterations in regulatory policies, but that feature would be relevant for the carbon market as well.

A more precise measure of variability is obtained by calculating the statistical 'volatility' of the prices of $S0_2$ emissions allowances and comparing them with other volatile prices. Volatility measures the average absolute month-to-month change, and is a common approach to indicating the variability and unpredictability of asset prices. Figure 1 shows the estimated volatility of four prices for the period 1995–2005: the consumer price index, stock prices, $S0_2$ allowances prices and oil prices. $S0_2$ prices are much more volatile than stock prices (or than the prices of other assets such as houses, not shown); they are vastly more volatile than most consumer prices; and their volatility is close to that of oil prices.

Such rapid fluctuations are costly and undesirable, particularly for an input (carbon) whose aggregate costs might be as great as petroleum in the coming decades. An interesting analogue occurred in the US during the monetarist experiment of 1979–82 when the Federal Reserve targeted quantities (monetary aggregates) rather than prices (interest rates). During that period, interest rates were extremely volatile. In part due to the increased volatility, the Federal Reserve reverted to a price-type approach after a short period of experimentation. This experience suggests that a regime of strict quantity limits might have major disruptive effects on energy markets and on investment planning, as well as on the distribution of income across countries, inflation rates, energy prices, and import and export values. It might consequently become extremely unpopular with market participants and economic policymakers.

Public finance questions

Another consideration is the fiscal-policy advantage of using revenue raising measures in restricting emissions. Emissions limits lead to valuable rights to emit, and the question is whether the government or private parties get the revenue. When tax or regulatory restrictions raise the goods prices, this increases inefficiency losses from the existing tax system. The reasoning is that the existing tax and regulatory system raises prices above efficient levels. Adding further taxes or regulations to existing ones increases the inefficiency or 'deadweight loss' of the existing system and should be counted as part of the additional costs of a global warming policy. This effect is the 'double burden' of taxation, analysed in the theory of the 'double dividend' from green taxes (Goulder *et al* 1997 and Goulder *et al* 1996).

If the carbon constraints are imposed through taxes, and the revenues are recycled by reducing taxes on other goods or inputs, then the increased efficiency loss from taxation can be mitigated so that there is no necessary increase in deadweight loss. If the constraints under a quantity-based system are imposed by allocations that do not raise revenue, however, then there is no government revenue to recycle to mitigate the increased deadweight loss. This is an important issue as the inefficiency losses can be as large as abatement costs.

While it is possible that emissions permits will be auctioned (thereby generating revenue with which the tax inefficiency can be mitigated), historical practice indicates that permits would be allocated at zero cost to 'deserving' parties, or distributed to reduce political resistance. In the cases of $S0_2$ allowances and CFC production allowances, virtually all permits were allocated at no cost to producers and with no revenue for governments to recycle. While pure tax systems are the most reliable device for raising revenue, a useful alternative in a hybrid system would buttress quantity approaches with taxes to capture at least part of the permit revenue.

Rents, corruption and the resource curse

An additional question concerns the administration of programs in a world where governments vary in terms of honesty, transparency and effective administration. These issues arise with particular force in international environmental agreements, where countries have little domestic incentive to comply and weak governments may extend corrupt practices to international trading. Quantity-type systems are much more susceptible to corruption than price-type regimes. An emissions-trading system creates valuable international assets in the form of tradable emissions permits and allocates these to countries. Limiting emissions creates a scarcity where none previously existed. It is a rent creating program. The dangers of quantity as compared to price approaches have been demonstrated frequently when quotas are compared with tariffs in international trade interventions.

Rents lead to rent-seeking behaviour. Additionally, resource rents may increase unproductive activity, civil and international wars, and slow economic growth – this being the theory of the 'resource curse' (Sachs *et al* 1995 and Torvik 2002). The scarce permits can be used by a country's leader for non-environmental purposes rather than to reduce emissions. Dictators and corrupt administrators can sell part of their permits and pocket the proceeds.

Calculations suggest that tens of billions of dollars of permits may be available for foreign sale from Russia under a tightened Kyoto Protocol. Given the history of privatizing valuable public assets at artificially low prices, it would not be surprising if the carbon market became tangled in corrupt practices, undermining the

legitimacy of the process. Imagine a revised Kyoto Protocol extended to developing countries. Consider the case of Nigeria, which had carbon emissions of around 25 million tons in recent years. If Nigeria was allocated tradeable allowances equal to recent emissions and could sell them for US$40 per ton of carbon, this would raise around US$1 billion of hard currency annually – in a country with non-oil exports worth only US$600 million in 2000.

Problems of financial finagling are not limited to poor, weak or autocratic states. Concerns arise in the wake of the recent accounting scandals in the US. A cap-and-trade system relies upon accurate measurement of emissions or fossil fuel use by sources in participating countries. If firm A (or country A) sells emissions permits to firm B (or country B), where both A and B are operating under caps, then it is essential to monitor the emissions of A and B to make sure that their emissions are within their specified limits.

Indeed, if monitoring is ineffective in country A but effective in country B, a trading program could actually end up raising the level of global emissions because A's emissions would be unchanged while B's would rise. Incentives to evade emissions limitations in an international system are even stronger than the incentives for tax evasion. Tax cheating is a zero-sum game for the company and the government, while emissions evasion is a positive sum game for the two parties involved in the transaction for a global public good.

A price approach gives less room for corruption because it does not create artificial scarcities, monopolies or rents. There are no permits transferred to countries or leaders of countries, so they cannot be sold abroad for wine or guns. There is no new rent-seeking opportunity. Any revenue needs to be raised by taxation on domestic consumption of fuels, and a carbon tax will add absolutely nothing to the rent-producing instruments that countries have today. It is a zero-sum game between the government and the taxpayer, so the incentives are stronger to ensure enforcement.

Here again, a hybrid system that combines both tax and quantitative systems dilutes the incentives for corruption in the quantity system. If the carbon tax is a substantial fraction of the carbon price, then the net value of the permits and the rents to seek, are reduced accordingly.

Administrative and measurement issues

There are many measurement and administrative issues that arise in implementing a harmonized carbon tax, and these have not yet been fully addressed. Perhaps the most important conceptual issue is the treatment of existing energy taxes and subsidies. Should we calculate carbon taxes including or excluding existing taxes and subsidies? For example, suppose a country imposes a US$50 carbon tax while maintaining an equivalent subsidy on coal production. Would this be counted as a zero or a US$50 carbon tax? Additionally, how would subsidies to zero-carbon fuels, such as wind power, be counted in the analysis?

One approach would be to calculate the net taxation of carbon fuels, including all taxes and subsidies on energy products, but not go beyond this to indirect, embodied impacts outside of exceptional cases. Such a calculation would require two steps. First, each country would provide a full set of taxes and subsidies relating to the energy sector; and second, there would need to be an accepted methodology for combining the different numbers into an overall carbon tax rate. There would of course be many technical issues, such as how to convert energy taxes into their carbon equivalent. Some of the calculations involve conversion ratios (from coal or oil to carbon equivalent) that underpin any control system. Others would require input-output coefficients, which might not be universally available on a timely basis. On the whole, calculations of effective carbon tax rates are straightforward as long as they do not involve indirect or embodied emissions.

To go beyond first-round calculations to indirect effects would require assumptions about supply and demand elasticities and cross-elasticities, which might engender disputes among countries and should be avoided if possible. The procedures would probably require mechanisms similar to those used in World Trade Organization deliberations, where technical experts would need to calculate effective taxes under a set of guidelines that evolve under quasi-legal procedures. Many of these issues are discussed in the literature on ecological taxes.[4]

3. A hybrid approach?

Many considerations enter the balance in weighing the relative advantages of prices and quantities in controlling stock public goods. However, we must be realistic about the shortcomings of the price-based approach. It is unfamiliar ground in international environmental agreements. Tax is almost a four-letter word. Many people distrust price approaches for environmental policy. Taxes are of special concern to environmentalists for global warming because they do not impose explicit limitations on the growth in emissions or on the concentrations of greenhouse gases. What would guarantee that the carbon tax would be set at a level that would prevent 'dangerous interferences'? Might the international community fiddle with tax rates and definitions, and measurement issues and coverage while the planet burns? These are real concerns and will require time and patience to address.

By contrast, quantitative approaches such as cap-and-trade regimes are widely accepted as the most

realistic approach to slowing global warming.

Cap-and-trade is firmly embedded in the Kyoto Protocol and most proposals for countries' policies, such as the US and elsewhere, as well as those for deepening the Kyoto Protocol, follow this prototype. A realistic worry about policies today is not whether they will be cap-and-trade instead of carbon taxes, but whether they will be just 'plain' cap-without-trade. For example, in implementing the Kyoto Protocol, some approaches favour countries doing a substantial fraction of their mitigation through 'domestic implementation' rather than 'buying their way out' by purchasing emissions permits from other countries. Even worse, countries might continue to argue and end up doing nothing, as has been the case for the US up to now.

Given the strong support for cap-and-trade among analysts and policy makers, is there a compromise where the strengths of the carbon-tax regime can be crossed with cap-and-trade to get a hardy hybrid? Perhaps the most promising approach would be to supplement a quantitative system with a carbon tax that underpins it. For example, countries could buttress their participation in a cap-and-trade system by imposing a tax of US$30 per ton carbon along with the quantitative restriction. Countries should also put a 'safety value' along with the tax, wherein nations sell carbon emissions permits at a multiple of the tax, perhaps at a 50 per cent premium, or US$45 per ton in this example.

The hybrid approach would share a little of the strengths and weaknesses of each of the two polar cases. It would not have firm quantitative limits like a pure cap-and-trade system, but the quantitative limits would guide firms and countries, and would give some confidence that the climatic targets were being achieved. The hybrid would have some but not all the advantages of a carbon tax system. It would have more favourable public-finance characteristics; it would reduce price volatility; it would mitigate the incentives for corruption; and it would help deal with uncertainties. The narrower the band between the tax and the safety-value price, the more it has the advantages of the carbon tax; the wider the band, the more it has the advantages of the cap-and-trade system.

The coming years will undoubtedly witness intensive negotiations on global warming as the planet warms, the oceans rise, and new ecological and economic impacts are discovered. A dilemma will arise particularly if, as has been suggested above, the quantitative approach under the Kyoto Protocol proves ineffective and inefficient. As policy makers search for more effective and efficient ways to slow dangerous climatic change, they should consider the possibility that price-type approaches like harmonized taxes on carbon, or perhaps hybrid approaches, are powerful tools for coordinating policies and slowing global warming.

Endnotes

1 This distinction is drastically simplified. For a nuanced discussion including variants and hybrids, see Aldy, Barrett and Stavins, (2003) and the many references and proposals therein.

2 These are set forth in Nordhaus, 2007b.

3 See "Accompanying notes and documentation on development of DICE-2007 model: Notes on DICE-2007.delta.v8 as of June 7, 2007", Yale University, June 2007, available at http://www.econ.yale.edu/~nordhaus/homepage/DICE2007.htm

4 See the pioneering study on ecological taxes in von Weizsaecker and Jesinghaus (1992).

5 From a technical point of view, the hybrid plan sketched here is a special case of a non-linear environmental tax, in which the tax is a function of economic or environmental variables, which are superior to either linear taxes or quantitative regulations.

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W. David Montgomery is Vice President of CRA International. Dr Montgomery is an internationally recognised expert on economic issues associated with climate change policy, and his work on these topics has been published frequently in peer-reviewed journals. Recent studies have been on the design of California's policies to limit greenhouse gas emissions and on the economic impacts of US climate legislation. Prior to joining CRA International, he held a number of senior positions in the US government. He testified at hearings on climate policy in the US House of Representatives during the 110th Congress. He taught economics at the California Institute of Technology and Stanford University, and he was a senior fellow at Resources for the Future. He holds a PhD in economics from Harvard and was a Fulbright Scholar at Cambridge.

Lee Lane is a Resident Fellow at AEI. His research centres on the political economy of climate change, energy, and technology policy. He is co-director of AEI's geo-engineering project. Between 2000 and 2006 he was the executive director of the Climate Policy Center. He is the author of Strategic Options for Bush Administration Climate Policy (AEI Press, November 2006). Mr. Lane has testified before Congress and been a consultant to the US Department of Energy, the US Department of Transportation, the State Department, and NASA, as well as with the Japanese Ministry of Economics Trade and Industry. He has consulted for CRA International an international economics and management consulting firm where he has worked with private sector clients in both the US and Australia.

Dr Anne Smith is a Vice President of CRA International and leads the company's Climate and Sustainability Group. Dr Smith has prepared many analyses and papers on policies for reducing greenhouse gas emissions, and testified in US Congressional hearings on climate policy. She gained particular recognition for her analyses of the emissions trading programs. Dr Smith is active in many other issues, including multi-pollutant policies for electricity generation, fine particulate matter and ozone ambient standards, regional haze, mercury, acid deposition, and clean up of the US nuclear weapons complex. Her clients have included research institutions, trade associations, private corporations, multi-stakeholder organisations, and governments. Previously, Dr Smith was a vice president at Decision Focus Incorporated, and an economist at the US Environmental Protection agencies. She holds a BA in economics from Duke University, and an MA and PhD in economics from Stanford.

R&D policy

1.5

1. Introduction

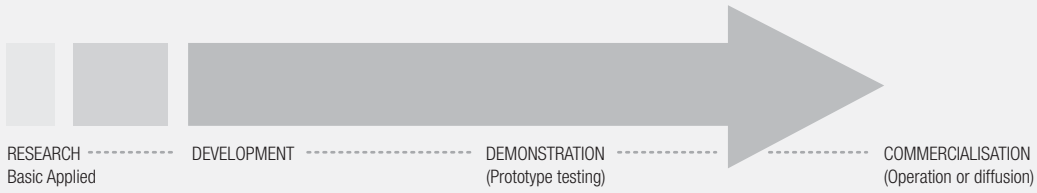
A critical step in reducing greenhouse gas (GHG) emissions is the introduction of new technologies for energy supply and use. This chapter deals with the question of what policies would be required to stimulate the kinds of R&D that would raise the odds of developing those technologies. This question is not as simple as it appears.

'Getting the price right' on GHG emissions is a necessary condition. Doing so provides a broad and appropriate incentive for reducing emissions, and adopting available technologies that are neglected because their ability to reduce emissions is only valuable when emissions are priced. Thus a price on emissions can correct what we may call the 'climate change market failure'.

However, R&D is itself subject to market failure in that it is impossible for researchers and innovators to capture for themselves the full value of the information that their activities provide to society. This spillover effect is a positive externality, but it also implies that without active government intervention there will be less R&D than is socially optimal.

R&D is a critical part of climate policy because of the nature of the climate change phenomenon and the radical transformation of the energy system required to stabilise global temperatures. Climate change is driven by the concentration of GHG in the atmosphere, making climate change what economists call a 'stock externality'. Concentrations of GHG do not respond to changes in emissions over short periods of time, but depend mostly on cumulative emissions over long time periods. Therefore, there is a choice of many different paths for emissions over time and these can lead to identical outcomes in global average temperatures. If R&D can reduce the cost of technologies that replace fossil fuels and other sources of GHG emissions, with alternatives that have lower or zero GHG emissions, then timing emissions reductions in order to take advantage of innovations that lower cost and introduce new opportunities can reduce the cost of meeting climate goals. By reducing the cost of moving to a low or zero carbon economy a worldwide agreement to reduce GHG emissions can become more likely. Although these propositions about the nature of the climate problem are widely accepted, relationships between concentrations and temperature increases, and the potential consequences of increased temperatures are highly

FIGURE 1:
THE 'R, D, D AND CONTINUUM' (RDD&C)



uncertain. Therefore the amount of action required to avoid temperature increases above some level, for example 2°C, is also highly uncertain. This leads many to characterise climate policy as an exercise in risk management rather than straightforward planning or cost-benefit analysis.

The need to develop and adopt new technologies as part of this risk management process is widely accepted. The policy problem is how to create incentives for the appropriate kind of innovation, and how much and what kinds of R&D to support. Answering these questions begins with an appreciation of the scale of emissions reductions required over time, and the radical changes in energy supply and use that this entails. Fundamental breakthroughs to make the use of new energy sources feasible, both technically and economically, are necessary to achieve changes of this scale at costs that are acceptable globally. Achieving those breakthroughs requires in turn a comprehensive and effective program of support and incentives for R&D, invention and innovation. Designing such a program will be very difficult, both because of the complex and unpredictable nature of the R&D process, and the political economy of support for new technologies. Nevertheless, failure to embark rapidly on such a program could leave the costs of stabilising GHG concentrations prohibitively high and make adaptation or geoengineering a much larger part of the risk management strategy.

1.1 R&D defined

Policy prescriptions about R&D can appear ambiguous or inconsistent without an explicit definition of R&D. The definition used by the National Science Foundation to collect data on R&D is:

> ***Research*** is systematic study directed toward fuller knowledge or understanding of the subject studied. Research is classified as either basic or applied, according to the objectives of the investigator.
>
> ***Development*** is systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes.

R&D is part of an innovation process, often depicted as in Figure 1, in which ***demonstration, deployment and commercialisation*** are different activities, that follow R&D in bringing a new product or improved process into use.

This linear conception does not correspond to case studies on how the innovation process actually works, and greatly oversimplifies the complex relationships between different activities and the institutions in which they are carried out (Nelson *et al* 1982). The process of technology development sometimes leads from a researcher's curiosity, for example, research at Bell Laboratories on solid state physics, to an innovation that transforms industries and society: the transistor. At other times the desire for a product, for example nylon, leads to directed R&D that ultimately finds exactly what it was looking for. The more accurate 'linked chain' conception and its implications for design of R&D policy are described later in this paper. But the simple linear conception, and the distinctions it draws between R&D and other activities involved in further developing and deploying an application that passes out from the R&D stage, is useful for delineating the subject of this paper.

1.2 Policy for R&D versus policy for technology deployment

Diverse institutional roles

Successful innovation also entails a social activity in which the new technique, product or knowledge is applied, marketed or disseminated. The profit motive is often assumed to dominate at this level of activity, and in many instances, it is influential. At the same time, creative work is actually done by individuals, who may be subject to complex motives. Then too, a firm seeking to profit from technological advance may often find itself dealing with many non-profit organisations. Innovation can, therefore, entail exceptional institutional complexities (Nelson 2005). See Figure 2.

In the United States (US), a diverse mix of institutions fund R&D and there is comparable diversity in the mix of those that conduct it. The US innovation system includes governments, various private sector entities and universities. It comprises federal and state

FIGURE 2:
INSTITUTIONS AND INCENTIVES IN TECHNOLOGY DEVELOPMENT

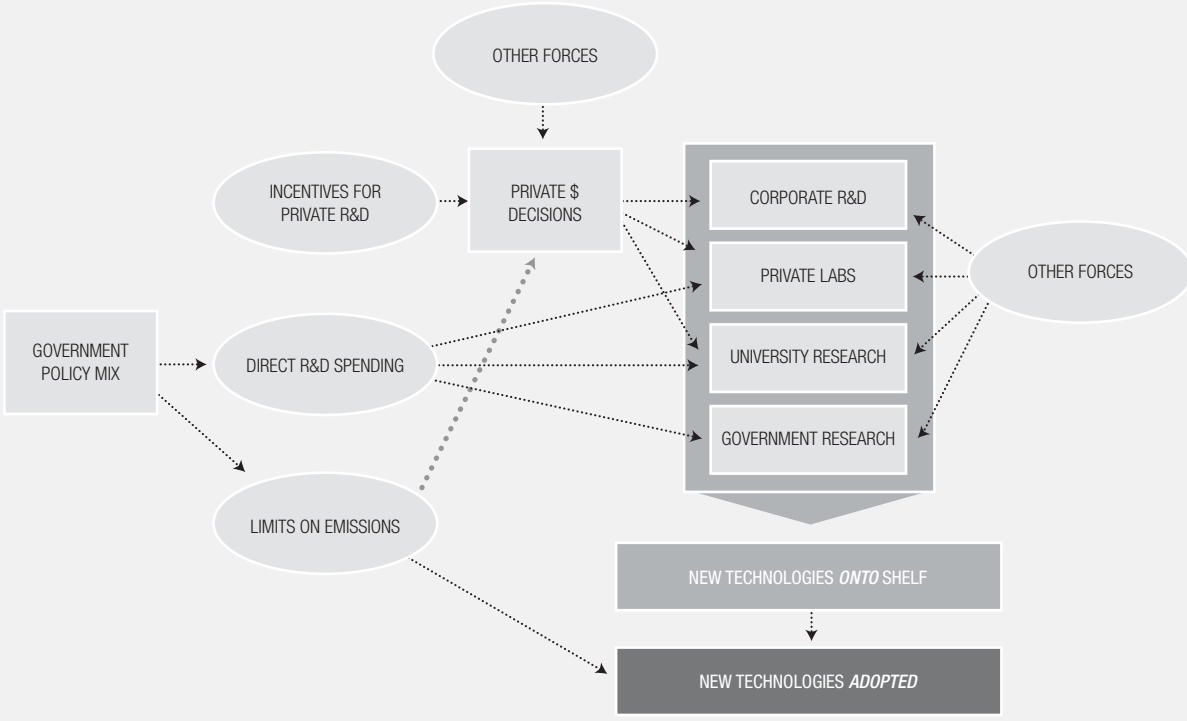


TABLE 1:
AGGREGATE R&D SPENDING

	BASIC RESEARCH	APPLIED RESEARCH	DEVELOPMENT	TOTAL
Industry	5 %	20 %	76 %	US$223.4 B
Government	59 %	33 %	16 %	US$94.2 B
Total	US$61.5 B	US$74.7 B	US$204.3 B	US$340.4 B

Source: National Science Foundation, Division of Science Resources Statistics, National Patterns of R&D Resources (annual series).

governments, for-profit and not-for-profit entities, and national and multinational institutions. These institutions perform a wide variety of R&D and is illustrated in Table 1.

This suggests, as will be discussed further, that the problem of appropriability is greatest in basic research, important in applied research, and smaller in development and later stages of demonstration, commercialisation and deployment.

There is little question that a clear, credible, consistent and stable policy that puts a price on CO_2 emissions will lead to cost-effective technology deployment and provide a demand-driven inducement to innovation. Credibility is greatest with policies addressing the climate externality that are economy wide, permanent, based on long-term goals, but with flexibility and cost containment, so that the policy can be expected to survive the inevitable unexpected shocks. The decision for any large-scale investment to deploy a new technology is certainly complex, depending on many factors not easily reduced to a simple rate-of-return calculation.

What should be equally clear is that a series of temporary, politically unstable, targeted subsidies, financial incentives, or even mandates for deploying specific GHG-reducing technologies will not provide adequate incentives for basic and applied R&D. This paper addresses the design of an R&D policy to get innovation started, and is therefore focused on an area where the need for government action is clear, but the appropriate mechanism is not.

1.3 R&D and the role of developing countries

The design of R&D policy must also take into account the major role of developing countries. That is, the opportunity to bring down costs and make action more attractive; different institutional, technical capacities; R&D networks – linking practice and research; and international networks to combine resources, create capabilities and exchange information, and provide practice-led R&D.

2. Nature and importance of the problem

Something more than a price on carbon is required to stimulate this kind of innovation. R&D investments directed at finding technologies that will reduce GHG emissions are subject to two important, but quite distinct kinds of market failure. One of these failures relates to the nature of R&D as an economic activity. The second relates to private markets' failure to reflect in prices the social costs of the climate change that is associated with GHG emissions (Newell 2005, Edmonds *et al* 2003). Because of climate market failure, there are no incentives to reduce CO_2 emissions below levels implied by weighing private fuel costs, and private costs and the benefits of energy efficiency.

Thus there is insufficient market pull for innovations to produce fuels with lower carbon content or new technologies for energy efficiency. However, remedying this market failure through, for example, a carbon tax does not address the R&D market failure. Theoretical reasoning and empirical evidence on the social rate of return to R&D establish that the impossibility of appropriating the full rewards of R&D also leads to insufficient incentives for R&D (Nordhaus 2007). A number of policies, including patent protection, special tax treatment of private R&D and government funding of research have been adopted to restore these incentives, but clear evidence of the remaining differences between the social rate of return on R&D and the private return establish that incentives for R&D remain deficient. Therefore, in addition to putting a price on carbon, climate policy must include additional policy instruments to increase the amount of R&D directed toward climate-related technologies.

In response to R&D market failure, government policy has long sought to encourage innovation. The challenge posed by climate change adds another dimension: how shall government encourage the development and adoption of technologies for which, absent policy, no demand would exist?

2.1 The two market failures

The 'inappropriability' of the benefits of R&D

Several features of the economics of R&D cause investments in producing innovation to fall well short of the levels that would be socially optimal. For example, it is often impossible to exclude others from the benefits of the discovery of new knowledge. In the discovery of new knowledge, large returns to scale are commonplace (Arrow 1962). Arrow points out that the fundamental returns-to-scale problem arises because R&D creates information, which has a fixed cost to create but near-zero marginal cost to transfer. Imitators can often copy a product or process based on the discovery of new useful knowledge. Therefore, in competitive markets, anticipated future prices may fall short of levels needed to recoup an innovator's R&D costs. At a minimum, the cost and uncertainty of exclusion reduces the net returns and therefore, weakens incentives for R&D (Arrow 1962).

Despite this problem, ownership of assets whose value is increased by innovation may call for some level of for-profit R&D, but that ownership is unlikely to provide an incentive equal to the entire marginal social value of the R&D (Hirshleifer 1971). It is also true that new knowledge may sometimes create monopoly power in the hands of the innovator, either through first mover advantages or through the operation of intellectual property rules, and this monopoly power may create incentives to invest in R&D. However, the use of this monopoly power will, itself, diminish the social benefits of the innovation.

Further, the production function of R&D is often unknown and sometimes unknowable. It depends, in part on the difficulty of the scientific problem being tackled, but the latter is uncertain until the problem and the nature of the solution are well understood (Arrow 1962). These uncertainties entail a high risk of failure. Knightian uncertainty, defined as the impossibility of assigning meaningful probabilities to outcomes, also implies limited or no opportunities for spreading risk or diversifying in order to reduce risk aversion. That risk may dissuade for-profit R&D. Depending on the comparison of private and social benefits, the Arrow-Lind argument for different social (risk-free) and private discount rates in the presence of non-diversifiable risks may apply and justify government intervention even when rewards are appropriable.

Uncertainties may create very large asymmetries of information. The information that an innovator or researcher obtains may be difficult to convey credibly to potential buyers or investors, and making that information available to potential buyers risks its appropriation by others. The latter difficulties may, among other things, degrade the efficiency of the capital market as well as the efficiency of the market for sale or license of innovations. This asymmetry clearly has something to

do with the structure of innovative industries, and the structure of some industries may inhibit innovation.

The R&D process is also characterised by network externalities such that the outcome of one strand of R&D may turn out to be the key link in some other process (Edmonds *et al* 2003). Thus, the value of any individual piece of research can only be established by tracing its influence through a number of other research projects and technologies. The difficulty of establishing the role of specific breakthroughs, and the chilling effect that hiding all research (so as to have a claim on all its value) would have on the research enterprise, again makes the financial reward to a useful result less than its full social value. Failures may convey as much information as success, in particular that a particular approach does not work, and incentives to disseminate information about failures may be very weak.

University research may be subject to another form of externality. University research often generates valuable information about the otherwise hard to gauge scientific talent of researchers. This information can be quite valuable to for-profit firms wishing to acquire expertise through hiring employees or retaining consultants. This information is, in effect, an external benefit of university science (Dasgupta *et al* 1994).

The climate damage externality

Because the harmful effects of climate change are not incorporated into the price of many activities that contribute to GHG emissions, the market will under-reward those who develop technologies that reduce such discharges. This external cost market failure stands in addition to the external benefit problem that plagues R&D (Edmonds *et al* 2003).

Two externalities require two instruments

The lengthy time scales involved in both climate change and technology development imply that expectations of future policies motivate current investments. Expected future prices for GHG emissions are especially important. The credibility of a government's commitment to future policies is vital as an incentive to invest in R&D. Uncertainties about future policies will motivate delays in investment decisions if additional, timely information is expected to become available (Blyth 2007). Policy uncertainty is not necessarily fatal. However, any time inconsistencies that bias government *ex post* decisions against high carbon prices will weaken private sector incentives to invest in the relevant R&D.

Time inconsistency arises because the carbon price required to provide an adequate return on the R&D investment is higher than the price required to motivate adoption of an innovation after it is discovered. Thus, what is optimal for a government to announce as a carbon price in advance of a discovery is greater than what is optimal for a government to announce, post-discovery.

This policy failure would persist even if current policy projects a high price on future carbon emissions (Montgomery *et al* 2007). Indeed, existing policy mandates that imply very high future carbon prices may actually fuel doubts about the commitment of future governments to those mandates.

2.2 Why R&D is critical in climate policy

Halting increases in global average temperature at some level demands that at some time in the future, annual emissions of GHG from human sources must not exceed the amount removed by natural processes. This goal of zero net emissions implies that global emissions must shrink to roughly 20 per cent of business-as-usual projections by mid- to late-century, if the goal is stabilising GHG concentrations at 550 ppm CO_2, and lower if a more ambitious goal is chosen (Clarke *et al* 2007).

For example, Figure 3 below shows the results from three models that analysed stabilisation scenarios for the US Climate Change Science Program. All three models found that for global emissions to stay at 550 ppm or less, emissions would have to remain 80 per cent below projected levels in 2100, a level at which each year's emissions would no longer exceed the amount of CO_2 naturally removed from the atmosphere.

The speed with which this emissions rate is achieved will determine the GHG concentration at which the atmosphere stabilises, and therefore global average temperature. Thereafter, net zero emissions must be maintained to prevent further increases in concentrations. Recent economic trends foresee global energy consumption doubling, or even tripling, by the end of this century. Without policies to change the choice of energy sources, this could lead to roughly similar increases in GHG emissions.

2.3 Need for fundamentally new technologies

Reaching the goal of zero net emissions with existing energy technologies, and incremental improvements to them, would require high costs (Hoffert *et al* 2002). Currently, the high cost of curtailing GHG discharges limits the size of emissions cuts that are cost beneficial. Indeed, with only incremental improvements to current technologies, achieving the emissions levels needed to hold temperature increases to 2°C or less, the marginal cost of abatement would exceed current estimates of the marginal damages from CO_2 emissions (Tol 2007).

Thus, for steeper GHG reductions to become cost-beneficial, technological progress must drive down the costs of abatement. Existing technologies and incremental improvements to them seem unlikely to produce cost reductions that would be large enough for this purpose (Hoffert *et al* 2002). Most projections of scenarios that achieve stable concentrations of GHG in the atmosphere are constructed from technologies that are not available today.

FIGURE 3:
FOSSIL FUEL AND INDUSTRIAL CO_2 EMISSIONS ACROSS SCENARIOS (GTC/YR)

Fossil fuel CO_2 emissions vary among the reference scenarios, but the three differing emissions trajectories lead to emissions in 2100 in the range of 22.5 GtC/yr to 24.0 GtC/yr. The timing of emissions reductions varies substantially across the stabilisation levels. In the Level 1 scenarios, global emission begin to decline soon after the stabilisation policy is put in place (as the scenarios were designed, after 2012), and emissions are below current levels by 2100 in all of the Level 1 and Level 2 scenarios. Emissions peak sometimes around the mid-century to early in the next century in the Level 3 and Level 4 scenarios and then begin to a decline that would continue beyond 2100.

Source: US Climate Change Science Program.

For example, in its 'Sustainable Mobility Project' the World Business Council on Sustainable Development (2009) concluded that the bulk of emissions reductions for personal transportation by 2050 would have to come from biofuels and fuel cell technologies not known today. This is presented in Figure 4.

The most plausible route to these more substantial cost reductions appears to depend on achieving multiple breakthroughs in basic science, as well as creating incentives for invention and innovation based on known science. Thus, a strategy for improving GHG-control technologies is not a pretext for delay. Rather, it is central to managing climate risks in a way that produces expected net economic benefits.

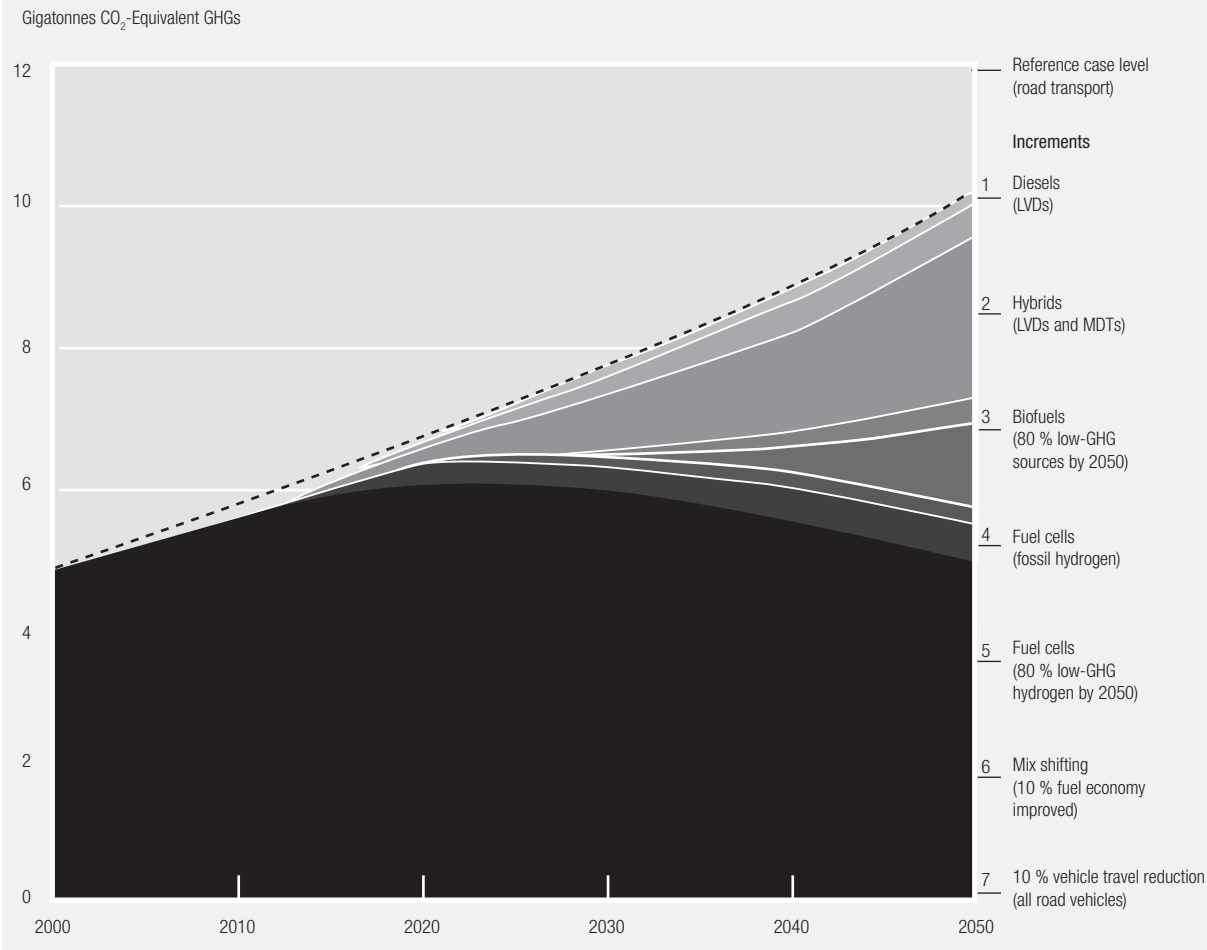
3. The nature of low-carbon R&D

3.1 An iterative model of the process

By now, though, the notion of a linear progression as a description of the innovation process has been thoroughly discredited (Rosenberg 1994). Descriptive contributions to the literature on R&D suggest a very different paradigm. The picture of a straight line is replaced by one of a linked chain with interactions and loops back and forth between basic science, product development and marketing occurring repeatedly until a successful (or unsuccessful) outcome is reached (Nelson *et al* 1982). Interactions also occur across chains, as discoveries in the pursuit of one application turn out to be useful for another development activity.

Typically, the effort to develop a discovery's practical application will lead to further questions that themselves, require basic or fundamental research to resolve (Nelson 2007). For example, pilot plants for production

FIGURE 4:
EMISSIONS REDUCTION – PERSONAL TRANSPORTATION



Source: Sustainable Mobility Project calculations

of alcohol from biomass reveal that the limiting factor on yields and costs is the proportion of lignin to cellulose in the feedstock. Lignin is a woody material that holds stalks up, and cellulose is the required input to fermentation. This observation led back to research in plant genomes to discover the genetic code that controlled this proportion. This step led in turn to the genetic engineering to create new variants, and finally, according to the National Renewable Energy Laboratory plant research to determine which will grow.

The other way of looking at this example is that the questions raised in practice can themselves provide a motivation for a particular form of basic research, such as the recent interest in carbon nanotubes as a result of the focus on cost-effective batteries for electric vehicles.

Unpredictability also characterises this process, which then becomes highly path dependent. Several historical studies establish that the scientists responsible for key breakthroughs (eg Shockley and the transistor) had no idea that their discoveries would be put to the uses that made them famous, and in many cases explicitly predicted that their discoveries would have no such use. Thus the notion of planning backward from a technology goal to the basic research required to reach it seems contrary to much of the history of innovation.

New knowledge about the regularities of the natural world enables discovery of new useful knowledge. New techniques often pose fruitful subjects for scientific inquiry or supply novel tools for measurement and observation (Mokyr 2004). History illustrates countless examples of new technology producing advances in science (Rosenberg 1994). These examples, of course, suggest some causal flows in the opposite direction of that suggested by the older linear model.

Further, most innovation implies the novel application of 'old' knowledge. Nelson offers a more inclusive perspective. He defines innovation as '...the processes by which firms master and get into practice product designs that are new to them, whether or not they are new to the universe, or even to the nation.' (Nelson 1992, p. 349). 'Invention' involves the development of

new knowledge. Cumulatively, the novel application of existing knowledge produces much economic value. This fact underscores the importance of the accessibility of 'old' scientific knowledge (Mokyr 2004). At the same time, though, unless the existing knowledge base is refreshed and expanded, diminishing marginal returns are likely eventually to set in (Mokyr 2004).

In Mokyr's view, inventions vary greatly in their significance. Incremental advances in knowledge yield micro-inventions. Large breakthroughs, sometimes referred to as macro-inventions, lead to new lines of technological development. The two types of inventions are synergistic. 'Door opening' macro-inventions are needed to avoid the onset of diminishing returns to innovative activity. The far more numerous 'filling in' micro-inventions are often required to reap the economic benefits that may be only implicit in macro-inventions (Mokyr 2004).

3.2 Implications of the iterative nature of the process

In the linked chain model, however, activities characterised by inappropriability and uncertainty may occur at any point in the innovation process, for example, if a pilot plant reveals a challenge that can only be overcome by going back to investigating some fundamental properties of matter. A highly proprietary (and potentially quite profitable) process being developed in a company may then need basic research that can only be carried out in some other institution, under conditions of inappropriability and uncertainty.

Therefore, just as the iterative nature of the innovation process complicates the task of defining the optimal IP rules; it also poses problems for government-funded R&D (Nelson *et al* 1982). The difficulties may be especially acute for government-funded R&D intended for private sector adoption. In this case, government-funded basic research might have to address problems that arise at the 'later' stages of the R&D process. These reverse flows may involve the private sector trying to get the attention of government funding and perhaps university researchers for basic research problems that arise in development or commercialisation phases. In other cases, the work flow may remain within the public sector.

In either case, there is a challenge for the basic researchers to be responsive. Culturally, this may not be an easy challenge for them to meet. And there are some signs that the federal appropriations process has a very hard time in shifting funds up and down the process to match the changes in the location of the work's center of gravity.

This feature of the process would appear to imply that support (subsidies, demand pull from carbon pricing) for technology demonstration is likely to be prone to failure, unless there are also mechanisms to provide adequate incentives for all the linked research efforts that may be needed to overcome obstacles (efficiently, without duplication of research effort or attempts to solve problems best addressed in the lab as part of large scale construction projects).

3.3 Time scales for diffusion of technology

The diffusion of macro-inventions can be especially time consuming with the pace likely shaped by institutions. Economic history indicates that institutional change was often a necessary prelude to technological change (North 1990). This generalisation will almost certainly apply to GHG reducing innovations. In many instances, adoption of such technologies will depend on disincentives for GHG discharges, created and enforced by government. Yet some governments may prefer to eschew GHG reduction strategies for sound political and economic reasons (Schelling 2005).

There are often very good economic reasons why old technologies remain in use for extraordinary lengths of time. For example, a long process of adaptation to local conditions may make seemingly primitive technologies formidable competitors (Edgerton 2007).

Because climate policy is, by its nature, a global concern, climate-related technology policy must also confront the international dimension. Cost-effective GHG reductions depend crucially on reducing emissions from all major national sources. Any important country's failure to participate in a control regime will cause a rapid increase in the costs of any given abatement goal (Nordhaus 2007).

With China already the globe's biggest emitter and India the sixth largest, these countries must participate or a GHG control regime will be doomed to fail. Currently these countries' economies are much more GHG-intensive than is that of the US, let alone of Europe or Japan. Although new investment in China is more GHG efficient than its installed capital plant, even the newer capital stock still trails that of the US in this regard. Substantial gains in GHG control, could, therefore, occur if China and India were merely to adopt US technology (Montgomery *et al* 2006).

Since even technologies that are currently economically new are not in use, the demand for improved low-carbon technologies will depend on institutional reform. To move beyond this goal, governments would have to adopt pricing or other policies to internalise the climate externality. However, the position taken by these governments in current climate negotiations suggests that they are disinclined to take this step. Absent such policies, no incentive exists to pull GHG reducing technology into these markets.

The successful transfer of technology, however, presents challenges. Economic history has often shown that institutional change can be a necessary prelude to technological change (North 1990). Currently, many institutional distortions in the Chinese and Indian economies discourage investment in more

energy-efficient technologies. Such distortions include poor protection for intellectual property, energy price controls and a failure to internalise environmental externalities. (Montgomery *et al* 2006). Further, at least in China, a whole suite of policies effectively subsidise the expansion of energy-intensive heavy industries (Rosen *et al* 2007). By inference, the successful diffusion of less GHG-intensive processes and products is likely to depend in part on institutional change within China and India (Montgomery *et al* 2006).

4. Why has low-carbon R&D policy failed and can anything be done?

4.1 The sources of energy R&D failure

Gaining and holding political power means that lawmakers impose net costs on society in order to secure support. These costs are the inevitable consequence of government, not an aberration (North 1990). A simple example, and one noticed by political observers since Thucydides, is that policies favor concentrated, powerful interests over dispersed, less powerful interests. The beneficiaries of a not-yet-invented technology are, almost by definition, politically silent. The problem is worse if the technology is useful primarily to lower the costs of supplying a global public good.

It is not surprising, therefore, that energy R&D had a long history of waste and failure. Cohen and Noll (1996) describe a dynamic based on incentives by executive agencies and congressional incumbents that leads to the conclusion that R&D programs will investigate too few risky alternatives in the early stages of research, commit prematurely to large scale demonstration, and continue to fund large scale projects long after their failure has become evident (Cohen *et al* 1991). This is exactly the opposite of the stable, long-term research program required to stimulate breakthrough research and introduce game-changing technologies.

The nature of the electoral process raises the *political* discount rate, especially for members of Congress. Supporting R&D projects that yield large, but diffuse, net benefits and those only after a long time, is a poor re-election strategy. However, when an R&D project reaches a large enough scale, it begins to have distributive significance. At that stage, the project may become politically relevant to legislators interested in re-election (Cohen *et al* 1991).

In the US, government R&D agencies exhibit an unwillingness to propose a sufficiently wide range of risky alternative approaches to achieve real breakthroughs. High-risk approaches with high potential may not come to their attention, since in the early stage of R&D there are significant agency problems in communicating the nature and potential of an approach (Cohen *et al* 1991). Career advancement is also more likely to come from successful projects rather than accumulation of useful information about approaches that do not work. This limits the set of alternatives considered for funding and leads to far too little risk-taking in government R&D and too narrow a view of possible avenues of approach.

This dynamic introduces a series of perverse incentives.

- First, it encourages officials to move technologies too swiftly to the phase of large-scale demonstration. As a result, these projects often run into technical problems that could have been resolved much more cost-effectively at a smaller scale, and to end up having chosen the wrong route overall.
- Second, congressional involvement has often led to poor projects surviving long after they should have been terminated. Representatives gain electoral credit for continued funding of local facilities and lose almost no electoral credit because the funding is accomplishing nothing.
- Third, the excess resources that demonstration projects consume, either because they are launched prematurely or because they linger too long on political life support, are likely to crowd out more valuable earlier phase research. In effect, projects at the early stage of development are not politically appealing because further work on them is not expensive enough to have distributive significance.
- Fourth, the rush to demonstration may distort the selection of technologies toward those that are more mature rather than toward those that are more promising. Where there is path dependency in technology selection such distortions may have long-term consequences.

In addition to the effects of the high political discount rate on a premature rush to demonstration at high cost, congressional influence on location and design of projects to benefit the most powerful members of Congress and their most influential constituents is unlikely to lead to the choice of the best qualified and most cost-effective organisation to carry out an R&D project, even if it has merit.

The institutional changes that would be required to suppress these tendencies would take away from Congress the ability to use these programs to satisfy constituency demands. It is unclear that there is any way to convince Congress to pass such a 'self-denying ordinance', given opposition to similar reforms such as the line-item veto.

4.2 Recommendations for reform of the climate R&D process

The prevalence of these perverse incentives poses a severe challenge to climate policy. Basic research is essential in the quest for climate solutions and the

private sector is unlikely to perform anything like an optimal amount of this work. Hence, government may need to adopt an active research role. The growing evidence that government GHG controls are likely to use relatively cost-ineffective tools reinforces the sense that emissions regulation alone are unlikely to succeed.

However, for the reasons just discussed, creating more direct incentives for R&D entails tackling an inherently very difficult problem. No clear guidelines exist for improving the prospects for a successful search. The task is international by its very nature. And national innovation systems vary greatly. That fact alone ensures that attempts to 'improve' the institutions that will conduct publicly funded R&D are not likely to advance along a single path. That said, a few ideas may merit relatively broad consideration.

Inducement prizes

Among economists, the idea of substituting prizes for research contracts is popular. Prizes have the great advantage of rewarding successful outputs rather than inputs. Thus, the incentives they create can be more closely aligned with the social objectives. Prizes also can stimulate innovation without the disadvantages of creating *ex post* monopoly power, a disadvantage of patents (Newell *et al* 2005).

Government support for generic innovation

One approach, which also fits well with the complex nature of the innovation process stressed by Nelson and others, is to strengthen the R&D supply side and its basic institutions as much as possible. With more resources devoted to R&D, the wide range of signals that technologies which reduce the cost of limiting CO_2 emissions are socially desirable, may then cause some of the results to be climate-relevant.

A much more difficult question is how to create effective economic incentives to shift a large share of R&D resources in that direction. Direct government subsidies designed to boost the supply of scientists, engineers, or research facilities would be one approach. More generous R&D tax credits (or patent protections?) would be others. Such efforts may either aim to increase the total resources committed to RDD&C (the Research, Development, Demonstration and Commercialisation Continuum outlined earlier) or to raise their cost-effectiveness. In either case, even if they are successful in boosting the rate of technological change, these approaches may not yield much in the form of GHG reductions.

In the US, the federal government also provides specialised research facilities at national laboratories that are crucial to many kinds of research. The federal government has modernised several of these facilities and announced plans for further upgrades.

Funding these inputs does not ensure targeting resources towards R&D work relevant to climate change. However, it is also true that some fields produce research skills of very general application despite their relatively low contribution to directly useable discoveries. Thus, Brooks, describing the results of a survey of industrial research executives from 130 industries, observes

> "…44 industries rated physics high in skill base (second only to materials science, computer science, metallurgy and chemistry, in that order), whereas physics was almost at the bottom of the list in respect to the direct contribution of academic research results to industrial applications" (1994, p. 480).

At the same time, Brooks notes that the need for "defensive science" to deal with various side effects of new technologies also implies that a broad range of disciplinary expertise is required today to bring any new technology to fruition.

At the very least, the potentially high opportunity costs of specialised resources used in R&D suggests that if government makes large increases in climate related R&D expenditures, it should consider the potential supply-side impacts and evaluate possible responses.

Broaden the climate-related research agenda

Substantial global warming is already inevitable, and technological progress seems to offer means by which its costs might be reduced 'adaptation'. Possible examples might include development of drought resistant crops or public health technologies able better to control the spread of tropical diseases. Experts have suggested other possible technological advances.

A substantial amount of climate change is inevitable. Past emissions have locked it into the climate system. Fortunately, much can be done to minimise the net social costs of this change. Many of these adjustments can be left in the hands of the private sector, and state and local governments. They have strong incentives to undertake the needed changes. Today, though, they are hampered by lack of knowledge about how regional climates will change and on what time scale (Repetto 2006). Generating and diffusing this kind of scientific knowledge should be a top priority of federal climate policy. Developing this knowledge will depend on a strong, non-ideological climate science program. New knowledge in this area would clearly boost the nation's long-term economic productivity.

In this policy realm, avoiding the worst outcomes may be more relevant than aiming for the best. This suggests that simply asking whether there are measures that can be counted on to move R&D in the right direction may be more important than designing or modeling optimal policies.

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Towards an international system

part 2

Alan Oxley is Principal of ITS Global, consultants on global issues. ITS Global are experts in international economic, trade and environmental agreements and related public policy issues. Alan Oxley is a former Australian Ambassador to and Chairman of, the GATT, the predecessor to the World Trade Organization. He is also Chairman of World Growth, a Virginia-based free market non-governmental organisation as well as Chairman of the Australian APEC Study Centre at RMIT University. World Growth has published research papers on the interface of development and sustainability in climate change, biosecurity and forestry.

Bill Bowen is Principal Environmental Consultant at ITS Global. He is an economist (Ms, LSE) and a former senior career official in the Department of Foreign Affairs and Trade, and the Department of the Prime Minister and Cabinet, with responsibility for providing advice on climate change and environment issues, and their negotiation internationally. He also served as the Assistant to the Executive Director at the World Bank, representing Australia, New Zealand, the Republic of Korea, Papua New Guinea and others. He has undertaken research on carbon credits, property rights and biosecurity, and trade and economic development.

Forging a global agreement on climate change: Realities, politics and practicalities

2.1

Introduction

This paper identifies what will be required to secure a practicable replacement for the Kyoto Protocol as the obligations to reduce emissions apply only between 2008 and 2012. The first point of departure is to understand why the Kyoto Protocol has failed. The weaknesses must be addressed in the design of a subsequent instrument if it is to succeed. Its second point is that there is no justification for rushing to negotiate a successor instrument. There is time to get it right and it should be taken.

Citing the imminence of an alleged 'tipping point' on climate change, the European Union (EU) and environmental non-government organisations (NGOs) assert that urgent action is needed. Therefore they argue that negotiations underway on a successor to Kyoto need to conclude at the December 2009 meeting of the United Nations Climate Change Conference in Copenhagen so that new commitments to reduce emissions can extend when the Kyoto obligations to reduce emissions expire in 2012.

They argue that without such action there will be catastrophic impacts from climate change. However, there is no global agreement about this so-called tipping point. It is not addressed in the Summary for Policy Makers of the Fourth Assessment Report by the Intergovernmental Panel on Climate Change, the document which is cited as representative of global consensus on climate change.[1] The EU tried to have this idea included in the mandate for negotiations for a new approach in Bali in December 2007 but was opposed by both developed and developing countries.[2]

Completing the climate change negotiations by 2009 in Copenhagen, as agreed by governments in Bali in 2007, was always unrealistic. The issues are too complex and difficult, and impinge on national sovereignty and competitiveness. Notwithstanding the swing by the United States (US) to a more positive attitude to forging a binding global agreement on climate change following the election of Barak Obama, the negotiating approaches of the key negotiating groups (the EU, the G77/China and the Umbrella Group[3]) remain far apart on key issues. Such differences will not be resolved quickly. Negotiators know this: it is the politicians and environmental NGOs who continue to argue the fiction that an early agreement is possible.

There is ample time to design a successor instrument to the Kyoto Protocol that will be practicable and reflect the realities. Unless the fundamental economic interests that currently divide attitudes on how to tackle climate change are recognised in an agreement, no global consensus is possible.

This paper argues that the only way to build global consensus on climate change is to aim for a global EMG (a treaty which is Evolutionary, Multi-Track and reflects Global consensus) not a global ETS (a treaty which seeks to tackle climate change with a 'take it or leave it' global Emissions Trading System).

Consensus exists: the United Nations Framework Convention on Climate Change

The fact that there is already a global consensus to address global warming is often overlooked. It is represented in the membership and provisions of the United Nations Framework Convention on Climate Change (UNFCCC) of which the Kyoto Protocol is an appendage. While the US (and Australia until it ratified the Kyoto Protocol in 2007) was widely pilloried for disregarding climate change, the primary contention being it did not ratify the Kyoto Protocol. However, the US subscribed to global action to tackle climate change through accession to the UNFCC – as had all other leading emitters of greenhouse gases, including China, India and other developing countries.

There is tacit acceptance the Kyoto Protocol has failed. That is why there is agreement among the parties to the UNFCCC to negotiate a new approach. So what are the options to create a new global approach to address global warming? There are key lessons to draw from the UNFCCC.

The UNFCCC is a classic example of good law-making and the implementation of good governance standards in international conventions. Aspirations for change and goals are set out, and the ultimate obligation for implementation lies with national governments acting under national law. There is no mechanism providing a penalty for non-compliance which is uncommon in international treaties.[4] Instead, there is the prospect of international and national pressure for being seen as failing to act. There is an obligation on parties to submit reports on national actions taken to meet the aims and purposes of the UNFCCC.

This model reflects the fact that the international community and the UN system are not ready to create a global executive function to regulate such important and far-reaching purpose: global management of emissions and control of greenhouse gases; and a global system to create and trade permits to emit emissions, as set out in the Kyoto Protocol. Creating a global currency would be easier and that is a task beyond the will or capacity of international institutions.

The Kyoto Protocol enshrined unachievable ambitions and the lessons of its failure should be drawn from it. These failures are summarised as follows.

Deficiencies of the Kyoto Protocol

It failed to reduce emissions. Less than half of the world's emissions were governed by it. Emissions from Annex One parties have increased.

It reflected aimless functionalism. It established the beginning of a process without agreement on a goal.

It delivered few benefits to developing countries. They acceded to the Protocol on condition that they were not obliged to reduce emissions and in expectation that technical assistance would be provided, particularly to support adaptation to the effects of global warming. This was not forthcoming.

The costs of commitment were too high. Most Annex One parties have failed to meet their targets to reduce emissions.

It failed to build a global consensus. The EU justified the decision to proceed to have some countries commit to reduce emissions on the grounds that the Protocol would be a 'first step', an exemplar that others would follow. They didn't. Formal approaches by the EU to developing countries over the last five years to agree to adopt formal commitments to reduce emissions were all rebuffed. They were rejected in the Bali mandate to negotiate a new approach to climate change.

It mandated a global cap on emissions. There was no global support for this as demonstrated by the condition demanded by developing countries for accession – the cap would not apply to them.

It mandated global emissions trading. Experience with the European emissions trading scheme as well as research in the US have demonstrated the formidable difficulty in administering a system of emissions trading. This includes over-active management by government in allocating permits, gaming to acquire permits, and the difficulty of ensuring compliance and verifying the integrity and value of the traded instruments.

Prospects for Copenhagen

The election of the Obama administration with its express commitments to institute an emissions trading scheme (ETS) means that the US is set to resume the place it traditionally occupies in global negotiations: a major player. However, that does not change the fact that the key issues are not even close to being agreed upon.

Developing countries continue to strongly resist binding targets and timetables. China has made it clear it will take no action that reduces economic growth. It sees binding targets to reduce emissions as clearly doing that. India, Brazil and most other developing countries take the same position. Developing countries argue that the responsibility to reduce emissions rests solely with developed countries. However, developed countries make it clear they are not prepared to indicate the level of their ambition to emissions reduction in a successor instrument until developing countries indicate what they are prepared to do. Developing countries also counter-propose a very expensive global fund to finance adoption by them of new technologies, to be financed by developed countries and administered by the UN. This was opposed strongly by the Bush administration and future administrations are likely to do the same. Congress has traditionally opposed this type of measure.

In Land Use and Land Use Change and Forestry, recognised in the Kyoto Protocol as important in reducing emissions,[5] is one of the more difficult issues under negotiation. A negotiating text has not yet been developed, let alone negotiated, to the stage where agreement can be reached at Copenhagen. The EU wants to use the UNFCCC to limit forestry in developing countries. Tropical forest developing countries instead want assistance to expand sustainable forestry to increase forest sinks.

Negotiating texts on other key issues either have not yet been prepared or negotiations on them are at a very early stage. A convention cannot be agreed on at Copenhagen. There will be no agreement on globally binding cuts in emissions or on establishing a global ETS.

The real measure of success at Copenhagen will be agreement on structures to implement the mandate agreed on at Bali. The biggest obstacle is the EU. If it continues to push for agreement on a fresh version of the Kyoto Protocol, including agreement to globally binding reductions of emissions, the consensus necessary to create an effective global approach to climate change will not be achieved.

Negotiation, signature and ratification

It is a mistake, which environmental NGOs make, wittingly or unwittingly, to conflate the four steps needed to bring a new multilateral instrument into force. These steps are negotiation, signature, ratification and entry into force. Each is a separate process and brings separate interests to bear. All have to be anticipated if the process is to succeed.

The importance of this is most clearly demonstrated through the historical experience of the US Congress towards ratification of international conventions. Attitudes inside the EU and among environmental NGOs imply a belief that the US Congress can be pressured or shamed into adopting measures proposed by international agencies. History suggests the opposite. More than one US President has found Congress to be unafraid of embarrassing them.

On any major issue, if a measure is likely to be rejected by Congress there is little point proposing it. The Clinton/Gore administration disregarded this and played politics of a high order by signing the Kyoto Protocol. The Senate showed the point by adopting a measure (the Byrd-Hagel amendment)[6] which unanimously expressed rejection of the terms of the Kyoto Protocol. Byrd-Hagel specified that the measures in the Kyoto Protocol would be unacceptable while developing countries like China and India did not have parallel obligations. That sentiment has been expressed again in proposals tabled in Congress to establish an ETS.

Shaping an effective global strategy

Drawing on the lessons from the Kyoto experience, principles can be drawn to achieve a global strategy on climate change that will be effective and regarded as equitable. Above all, it needs to be seen and to act as a strategy that supports, not impedes, economic development.

An effective global strategy should:

Enjoy consensus among countries that account for a substantial majority of global greenhouse gas emissions

The atmosphere is a global commons. Action to prevent environmental damage to it by human activity must of necessity be global. No government regulation can control any part of the atmosphere. So, to reduce the impact on the atmosphere generated by human activity requires collaboration by governments whose states can regulate a substantial majority of that human activity.

Set a common goal
No agreement can successfully advance a strategy unless it reflects a common goal. For example, there is none in the Kyoto Protocol.

Support national development objectives
Action to protect the environment is not without cost. Greenhouse gases are generated by human activities which generate prosperity and raise living standards. The largest countries in the world have the largest number of poor. They are also committed to lift those people out of poverty. Any climate change strategy must enable countries to pursue national development objectives.[7] Numerous studies demonstrate that the wealthier a state is, the more resilient to whatever climate change occurs in the future.

Foster or recognise strategies to reduce emissions
The agreement needs to demonstrate that parties are taking action that contributes to a common result.

Demonstrate tangible short-term results
Most environmental NGOs believe that climate change strategies should reduce emissions in the short term. The debate is over how big reductions should be. It does not have to be so constrained. There are many other ways to demonstrate that economies are taking action to reduce emissions. For example, the chapter on Forestry in the Fourth Assessment Report of the IPCC points out that increasing sustainable forestry is the most effective way to reduce emissions.

Perceptibly spread costs equitably
The level of carbon intensity among economies varies greatly. The burden of the adjustment will be greater for the more carbon intense economies, wealthy and poor. Countries must be able to consider that the cost of the strategy falls equitably. The measure of this will not be the comparative cost to economies but the comparative impact on their populations.

Facilitate adaptation and mitigation
The UNFCCC recognised facilitation of adaptation as well as mitigation.[8] For some countries, climate change strategies need to have high priority for adaptation. The Chinese government observed in its strategy to address climate change, released in June 2007, that more focus was required on adaptation.

Provide for flexibility and revision
Addressing climate change is a long-term exercise, as reflected in interest among governments in setting long-term targets to reduce emissions. The differences over the economic impacts of various measures will alter as economic circumstances change, in particular the expected increase in wealth and prosperity in most major developing economies. A global strategy has to be capable of revision to adjust to changing economic circumstances.

The Kyoto Protocol could not meet any of these criteria and replicating it cannot and will not work. A different approach is required. First it has to reflect global consensus: it must satisfy the interests of all major emitters.

The need for global consensus and collaboration

The optimal policy strategy on climate change cannot be implemented by any one country acting alone, no matter how large it is. To do so potentially will be very costly as economic activity will tend to shift offshore and global emissions not necessarily be reduced. Any strategy to reduce global emissions will only succeed if there is international consensus and collaboration, particularly among those countries that account today, or in the future, for the larger share of global greenhouse gas emissions. Key countries are the US, the EU, Japan, China, India and Russia.

China is already the second largest emitter of greenhouse gases. Its economy is growing rapidly and, as a consequence, China is expected to become the largest emitter in the near future. For example, China has plans to build 544 new coal-fired power plants to meet the surge in domestic demand for energy, and is now reported to be building approximately two power plants every week. Similarly, India is ranked among the top ten emitters of the world and its economy is growing at historically high levels.

Since the engagement of the developing world in the process of addressing climate change is crucial, the international community needs to appreciate the importance of balancing the implementation of climate change goals with economic development strategies and practices. Economic growth in the developing world is highly correlated with energy use and with greenhouse gas emissions.

Industrialised economies will have to accept that energy consumption by these developing countries will grow for some time. China's target for levelling off is 2030.[9] Mitigation efforts will have to focus on improving efficiency in energy consumption and modest investments to research and develop low-emissions technologies in cooperation with industrialised countries. Thereby, over the medium to long term, developing countries will increasingly be able to realise greater energy efficiencies and progressively lower their rates of emissions.

Climate change is considered a long-term challenge

by most less developed countries. Reducing poverty is a more immediate priority.[10] To lift people out of poverty, economic growth has to exceed population growth for many years. A developing country has to build-up its productive base. Only then will it acquire the physical, human and technical capabilities that are necessary to tackle climate change. The long-term nature of development needs to be reflected in climate change policy.

The achievement of economic growth has to be recognised as a 'double dividend'. Not only will it provide the wherewithal to enable developing countries to lift their populations progressively out of poverty, it will also increase their capacity both to mitigate and adapt to the consequences of climate change in a sustainable manner. Any policy response to climate change running counter to this direction puts more than global warming at risk.

This does not have to be regarded as an 'either/or' proposition; either reduce emissions or increase economic growth. If climate change is treated as the very long-term problem it is, the development interest of low income economies can easily be met.

The economics of an optimal climate change strategy

One of the consistent findings in extensive peer-reviewed literature on the economics of climate change is that the optimal strategy which balances the economic and environmental interest is *long-term*: one that entails *modest* initial cuts in greenhouse gas emissions followed by *progressively deeper* cuts over the medium to longer term.

The world's pre-eminent economist on climate change economics, Professor William Nordhaus at Yale, has characterised the optimal climate change strategy as one which follows a 'policy ramp'. Its logic is quite straightforward. In a world where capital is productive, the investments with the highest rates of return are mostly in tangible, technological and human capital. This includes investments in research and development in low-carbon emissions technologies.

As the prospective damage from climate change becomes more evident over the coming decades and countries acquire additional resources and technological know-how, it then becomes more economical to shift investment toward measures that involve progressively more intensive reductions in greenhouse gas emissions. The exact shape of this 'policy ramp' in terms of the mix and timing of the emissions cuts will depend upon the costs, the prospective damages from climate change, and the extent to which those changes are 'lumpy' and irreversible.[11]

Drastic and immediate policy measures to reduce emissions, as proposed by the Stern Review, are unlikely to be cost-effective in achieving the desired environmental outcomes. The Stern policy strategy will simply lead countries to invest too little in conventional capital and too much in 'climate capital'. After five decades or so, countries will find their conventional capital – economic infrastructure, plant and equipment, skills and knowledge – to be substantially reduced, but any increase in 'climate' capital will be slight.

The Stern Review does not represent mainstream thinking among climate economists about what approach delivers the best economic result for developing countries. It has been roundly criticised by economists for being set up in a way that reduced the cost of early deep cuts on poor countries and expanded the benefits of that strategy in the long term.[12] In that it was funded by the British Government and was released in the lead-up to the release of the Fourth Assessment Report and the climate change conference which adopted the Bali mandate, it certainly served the function of trying to alter the assessment of developing countries that increasing the cost of energy by steep reductions in emissions will undermine strategies to increase growth and reduce poverty. It did not change the opinion of governments in developing countries.

In giving weight to the contention that early dramatic action to reduce emissions was necessary, the Stern Review has arguably made achieving global agreement more difficult by reducing, instead of increasing, the prospect for building consensus on what to do.

A more flexible approach is required

Dealing with climate change is a long-term process. It is going to take between 50 and 100 years to achieve substantial progress on reducing the growth in global greenhouse gas emissions. It is not amenable to five-year Kyoto Protocol commitment periods. As developing countries become richer, they are better placed to afford the technologies, and other policies and institutional settings that will be required if they are to reduce the growth of their greenhouse gas emissions. An effective instrument therefore needs to reflect the long-term nature of economic development and the time required to address climate change.

A flexible instrument is consistent with developing countries' desire to grow. The instrument also provides a mechanism to enable the Nordhaus 'policy ramp' to be implemented if consensus emerges to go in that direction. The model of short-term targets and timetables, as provided for in the Kyoto Protocol, cannot achieve this.

There is diversity in climate change strategies

The public debate over how to address climate change has tended to concentrate on the merits or otherwise of the regulatory approach to reducing emissions – a mandated set of targets to reduce emissions with the cost distributed by emissions trading. Those favouring this approach frame the debate in terms that this is the only effective model. The questions to decide are how much to cut and by when.

An alternative approach has been under active consideration by governments, initially in the Asia-Pacific Partnership on Clean Development and Climate,[13] initiated by the Bush administration and the Howard government, and then expanded by the Bush administration in consultation with Large Emissions economies.[14]

The Partnership adopted a program to explore the various measures that can be taken to reduce emissions without requiring binding targets. A number are being pursued by most governments which also favour regulatory controls. These include investment in new low-carbon technologies for abatement and sequestration of greenhouse gases, improvement in processes and increased energy efficiency. These measures have been recognised by developing countries. For example, China has indicated that it is considering achieving its objective of improving energy efficiency.[15]

It is clear that neither the regulatory approach as embodied in the Kyoto Protocol, with short-term and/or long-term binding commitments, nor the voluntary collaborative approach, as reflected in the Asia-Pacific Partnership approach, provide the room to cater for the spectrum of positions in the global debate on how to shape an effective and pro-development strategy which will secure broad consensus.

Only if all major interests are catered for can consensus be built. There is a straightforward option which straddles both camps and meets all the criteria for a successful global strategy. It is a Multi-Track Strategy whereby parties agree to broad goals for a climate change strategy then select the track which best suits them to meet that goal.

The basis for such an approach is already embedded in UNFCCC Article 4.1.b,[16] where parties are required to develop and implement their own national strategy to address climate change. The UNFCCC reflects the only global consensus today on how to tackle global warming. It makes eminent sense to build on it.

Setting the goal

In the approach envisaged here, governments collectively form a consensus over the goal for a climate change strategy. It is clear from debate over the last decade that the goal cannot be a common, binding target to reduce emissions by a specified amount by a specified date.

An interesting option is the concept of an aspirational target for reducing emissions. The Bush administration showed interest in the concept of a target to reduce emissions by 50 per cent by 2050 as an aspirational target. The Major Economies Process came close at its final meeting in July 2008 to reaching agreement on a long-term, ambitious, aspirational collective emissions reduction goal.

Another option is to set various targets for different countries, or to exempt some classes from any commitments, as in the Kyoto Protocol where developing countries were absolved from the obligation to reduce emissions. Evidently the Kyoto model should not be repeated since it did not reflect a consensus view among parties about the objective to be met.

General goals for what the climate change strategy aims to achieve have to be indicative, not mandatory, and broad goals for mitigation should probably be a mix of qualitative and quantitative measures if consensus is to be secured.

Adaptation has to be specifically addressed. Developing countries made clear, both when the UNFCCC and the Kyoto Protocol were negotiated, that adaptation to climate change was a higher priority for them than mitigation.

Flexibility in implementation

The less publicised work on measures to address climate change, as referred to above, show that all leading economies are engaged in endeavors to reduce their emissions.

A successful global approach must allow each party to define the path it wants to take. It should provide for multiple tracks tailored to best fit their circumstances, in particular their level of development and the degree of carbon dependence and intensity of their economies.[17]

Governments that want to use regulated controls on energy consumption to meet goals, for example through national cap and trade systems or carbon taxes, can do so, in national administration and in conjunction with other parties if they wish. If some want to continue to use the Kyoto Protocol to harmonise regulatory approaches with others, there is no reason why they can not.

Similarly, those that want to participate in a collaborative arrangement like the Asia-Pacific Partnership on Clean Development and Climate are free to demonstrate reductions in emissions through that program. And those that want to demonstrate mitigation and adaptation through national programs can use that avenue. Some might use all three avenues.

Scope has to be provided for each country to set out its own goals. It is speculated that China might consider setting a target of increasing efficiency in generation of energy, for example, reducing the number of emissions per unit of fuel burned. This will still allow it to increase emissions which it has said is essential. If members of

the EU or even the Australian government decide to set binding national targets as national policies, this can be their contribution to a global strategy to work towards a long-term aspirational goal.

Whatever the goal might be, it must be for individual countries to determine. It can be to attain a particular level of emissions in ten year's time; a level of emissions intensity; a certain amount of investment in new technology; changes in policies or institutional settings that would reduce the rate of emissions over time; or a goal of increasing the proportion of renewable energy in total energy consumption.

A dynamic not static framework

Given the uncertainties about the processes and future conditions, it is pointless, if not irresponsible and counterproductive, to lay down a rigid program to achieve a specific result in 40, 50 or 100 years.

Flexibility is also required in the way consensus is established. The key challenge to negotiators is that they are trying to build a global approach to regulate processes which are not known. There is a great deal more to be learnt about the science of climate change. All who work on it admit it is rudimentary. Given that uncertainty, any strategy must have in-built capacity to adjust as technical understanding of climate change and global warming improves.

The principal tool being proposed in the regulatory model is to alter economic behaviour, in particular by reducing consumption of energy. It is reasonably certain that the economic interests of key economies will change significantly over coming decades. Economic interests determine approaches to climate change. Evidently any global strategy also has to be flexible to meet the changing economic interests of key economies.

The only practical approach is to build into the global strategy a process of periodical review of the goals and strategies, say every decade, and adjust them to changing circumstances and in the light of progress in meeting them. This provides a framework in which a global consensus on common measures can be constructed, particularly as economic interests change.

Compliance

There needs to be an obligation on parties to regularly report on progress in meeting the goals set out in their national strategies. Perhaps they can be reviewed every five years to enable the strategy to be adjusted to take into account changing circumstances and new research and technologies.

Such a system needs to reflect the reality that major economies will not subject their interests to the sort of supranational control underpinning the Kyoto Protocol.[18] The proven model to measure compliance is public review and scrutiny. Peer review is a powerful means of helping countries adhere to their aspirational goals.

It is not widely understood just how valuable peer reviews are in the multilateral arena. Amongst other things, they can help governments implement policy and/or institutional change. Governments can point to peer reviews as a reason for making policy change. Successful systems have been developed in the Organisation for Economic Co-operation and Development (OECD) as well as Australia-Pacific Economic Cooperation. OECD staff analyse policies and programs, they prepare reports and discuss them with member governments before considering them in specialised committees. Over many years, this peer review process has been shown to help members adhere to their commitments, especially when the reviews identify a slippage in a country's relative performance.

In Australia's case, OECD peer reviews on policy settings across virtually the full range of government activity have had a considerable influence on policy change, not least when the OECD concludes that Australia's ranking is slipping.

This model was considered when the Kyoto Protocol was negotiated, described then as a 'pledge and review' process. It should be reconsidered. One of the reasons the Kyoto Protocol failed was the mandatory nature of its commitments.

Connecting to the UNFCCC

The most effective way to build a new political consensus which recognises the realities of today and tomorrow is to start from where consensus currently exists, that is, the common policy platform on which the UNFCCC currently sits. It sets out the actions countries should take as national measures, but without mandatory commitments or targets, and places equal emphasis on measures to adapt to the impact of climate change as well as measures to mitigate it.

Agreement by members of the UN to implement a flexible, dynamic and multi-track strategy to tackle climate change can be a subsidiary instrument of the UNFCCC, in the same manner as the Kyoto Protocol.

Conclusion

Persisting with an approach of binding targets and timetables is a formula for not securing agreement on a practical outcome. There was never any prospect of securing agreement in Copenhagen to a successor to the Kyoto Protocol along such lines. Even if there was, the global financial crisis has changed the policy

environment. The cost of deep cuts in emissions will be less acceptable to industrialised and developing economies alike.

The case to rush is not established. Even if it was, the reality that has been lost sight of is the capacity of the global community to construct a global strategy to address climate change is inherently a political question. The failure by environmental NGOs and a number of western governments to recognise this is the reason why the Kyoto Protocol was a failure.

There is time to negotiate a practical global strategy to address climate change. It needs to have a long-term perspective; it has to express the achievable consensus today; and it has to provide the flexibility necessary to adjust to the changing circumstances that will shape every country's approach to measures to reduce their emissions of greenhouse gases.

What does this mean for Australia? There is little or no prospect of a successor instrument to the Kyoto Protocol that seeks to replicate its key provision being negotiated any time soon. The presumption in policy development in Canberra that the costs flowing from the Carbon Pollution Reduction Scheme can be minimised by connecting an Australian scheme to an international scheme was misplaced from the start. The lessons from the failure of the Kyoto Protocol have not been absorbed.

Endnotes

1. The link to the Fourth Assessment Report is available at http://www.ipcc.ch/ipccreports/ar4-syr.htm.
2. See for example World Growth, *Bali – A Good Start – Reality Prevails Over Emotion*, available at http://www.worldgrowth.org/resources/?subsec=24.
3. The Umbrella Group comprises Australia, which chairs the Group, US, Japan, Russia, Canada, NZ, Norway, Iceland, the Ukraine and others.
4. Few international treaties provide penalties for non-compliance. The agreements administered by the World Trade Organization establish the most developed system.
5. The land clearing result that Australia achieved at Kyoto was central to Australia being on track to meet its Kyoto Protocol target. It is one of the few countries likely to meet its target without recourse to the Kyoto Protocol's flexibility mechanisms: emissions trading, the Clean Development Mechanism and Joint Implementation.
6. A link to the Byrd-Hagel Amendment is available at http://www.nationalcenter.org/KyotoSenate.html.
7. In economic terms, the discount rates in countries such as China and India are much higher than those applicable in developed countries. In other words, people and governments in developing countries place a much higher premium on current over future consumption than those in developed countries. For a more detailed analysis of these issues, including the deficiencies of the Stern Review on discount rates, see the report by World Growth, *The Real Climate Change Threat to Developing Countries – Early, Deep Cuts in Emissions*, available at www.worldgrowth.org.
8. UNFCCC Article 2, on the Objective for the Convention, is as follows: 'The ultimate objective of this Convention *and any related legal instruments that the Conference of the Parties may adopt* (italics added) is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.'
9. National Development and Reform Commission 2007, *China's National Climate Change Programme*, available at http://en.ndrc.gov.cn/newsrelease P020070604561191006823.pdfhttp://en.ndrc.gov.cn/newsrelease P020070604561191006823.pdf. For an analysis of the Programme, see Lewis, Joanne, *China's Climate Change Strategy*, Association for Asian Research, available at http://www.asianresearch.org/articles/3083.html.
10. In other words, their discount rates are much higher than in developed economies.
11. The *rate* of emissions reductions would most likely have to accelerate over time. In other words, the upwards trajectory of the 'policy ramp' is best represented by a curve rather than a straight line. The shape of this 'policy ramp' for addressing climate change has survived extensive and rigorous testing. This has been done by way of sensitivity testing by the relevant authors, peer-review of their work prior to publication, and full public disclosure of their data and quantitative methods, including the computer code.
12. Nordhaus, William, *The Stern Review on the Economics of Climate Change*, 2007, available at http://qed.econ.queensu.ca/pub/faculty/milne/872/SternReviewD2.pdf. Nordhaus' argument that Stern's discount rate, at one per cent, is too low and at variance with mainstream economics is shared by other prominent economists. See, for example, Martin Weitzman, "A review of the Stern Review of climate change", Journal of Economic Literature, 2007, 45 (3); Richard Tol and Gary Yohe, "Climate Change: A stern Reply to the Reply to the Review of the Stern Review", available at http://www.fnu.zmaw.de/fileadmin/fnu-files/publication/tol/tolyohe-stern-we2.pdf; and Ian Byatt et al, "The Stern Review: A Double Critique", *World Economics*, vol 7, No. 4, Oct-Dec2006, available at http://www.uoguelph.ca/~rmckitri/research/Byattetal.pdf. The Wikepedia item on Stern's review, including criticisms of it, is at http://en.wikipedia.org/wiki/Stern_Review. A further criticism of the Stern Review is that developing countries, in most cases, would have to borrow to invest in a large number of projects at commercial interest rates that can only be justified based on a discount rate, on Stern's own estimates, of one per cent. A one per cent discount rate would be less than the real rate of interest they would have to pay, the nominal rate of interest on the borrowing less the rate of price inflation in the currency in which the loan was denominated. More seriously, this mitigation investment would 'crowd out' private investment needed to sustain and expand the productive capacity of developing countries.
13. Members of the Asia-Pacific Partnership on Clean Development and Climate are Australia, Canada, China, India, Japan and South Korea, available at http://www.asiapacificpartnership.org/.
14. The Major Economies Process on Energy Security and Climate Change. This added to the Asia-Pacific group all large economies and large emitters.

15. A report entitled *China's National Climate Change Programme*, prepared under the auspices of China's National Development and Reform Commission and published in June 2007, states the following under *Part 3 Guidelines, Principles and Objectives of China to Address Climate Change*, section *3.3 Objectives*, sub-section *3.3.1 To control greenhouse gas emissions*, (on page 26): "By all these means, China will achieve the target of about 20% reduction of energy consumption per unit GDP by 2010, and consequently reduce CO_2 emissions." A link is at: http://en.ndrc.gov.cn/newsrelease/P020070604561191006823.pdf. A white paper titled *China's Policies and Actions for Addressing Climate Change*, issued by the Information Office of China's State Council on 29 October 2008, states the following under Chapter III. *Strategies and Objectives for Addressing Climate Change* under the sub-heading *Control of Greenhouse Gas Emissions*: 'Through these measures, the energy consumption per-unit GDP is expected to drop by about 20 percent by 2010 compared to that of 2005, and carbon dioxide emissions will consequently be reduced.' Available at http://sf.chinaconsulatesf.org/eng/wjb/zwjg/zwbd/t521857.htm.
16. Article 4.1of the Convention states that: 'All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objective and circumstances shall: (Article 4.1.b) Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adaptation to climate change.'
17. The merits of peer-reviewing the achievement of objectives has been argued by Charles F Sabel, Professor of Law and Social Science at Columbia University Law School, as being applicable to a wide range of policy challenges. He concludes that centrally-dictated and definitive targets present fundamental problems. An article Sabel co-authored with Jonathan Zeitlin, "Learning from Difference: The New Architecture of Experimentalist Governance in the EU", published by the *European Law Journal* in May 2008, proposes an approach for the EU along virtually identical lines to the EMG approach to climate change set out in this paper. Sabel and Zeitel argue (pages 273 and 274) that "Subsidiarity in this architecture implies that in writing framework rules the lower-level units should be given sufficient autonomy in implementing the rules to be able to propose changes to them. But in return for this autonomy, they must report regularly on their performance, especially as measured by the agreed indicators, and participate in a peer review in which their results are compared with those pursuing other means to the same general ends. Finally, the framework goals, metrics, and procedures themselves are periodically revised by the actors who initially established them, augmented by such new participants whose views come to be seen as indispensable to full and fair deliberation". Available at http://www2.law.columbia.edu/sabel/learning%20from%2difference%20ELJ%202008.pdf.
18. The procedures of the World Trade Organization are the most advanced for providing determination of compliance and penalties for failing to comply with measures. This has taken 60 years to construct and is accepted by members because of the nature of the balance of rights and obligations created by the GATT and the other Agreements. The UNFCCC and the Kyoto Protocol are simplistic legal instruments in comparison.

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Adele Morris is a Fellow and Deputy Director for Climate and Energy Economics at The Brookings Institution. Prior to this she was the senior economist for the Joint Economic Committee. She served nine years with the US Treasury Department as its chief natural resource economist. On assignment to the US Department of State in 2000, she was the lead US negotiator on land use and forestry issues in the international climate change treaty process. She served as the senior economist for environmental affairs at the President's Council of Economic Advisers during the development of the Kyoto Protocol. She began her career at the Office of Management and Budget. She holds a PhD in Economics from Princeton University, an MS in Mathematics from the University of Utah, and a BA from Rice University.

Emerging United States climate policy and the prospects for Copenhagen

2.2

Discussion current as of 13 May 2009.

Introduction

Climate policy is on the front burner for United States (US) legislators, regulators, diplomats, activists and lobbyists this year, despite the global financial crisis and major economic downturn. Enactment came relatively easily for the US$42 billion in US stimulus spending on low-carbon energy and energy efficiency, but binding regulatory measures and ambitious international commitments are a heavier lift.[1] The eyes of the international community are on the US, gauging its approach and assessing its leadership potential at the next round of talks under the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen in December 2009.

The myriad moving parts of climate policy in the US Congress and Obama administration make assessing the US situation difficult. This paper begins by reviewing the US journey from Kyoto to Copenhagen. It notes that despite positive indications for US engagement at Copenhagen, the broad political landscape in the US casts some shadows on the ultra-high hopes of the international community. The paper then looks in more detail at the parts in motion in the US and examines how the US domestic debate may affect the international process. To illustrate the complexity of the US policy process, the paper explores two particular sticking points: the allocation of cap-and-trade allowances; and the possible inclusion of regulatory standards for energy efficiency in comprehensive climate and energy legislation. The paper concludes with a prescription for greater success at Copenhagen and beyond.

From Kyoto to Copenhagen

The position at home

Even before 1997, when the US delegation brought the Kyoto Protocol home, the US Senate had expressed skepticism about the form of the agreement in a non-binding but very widely supported resolution. The protocol's lack of serious commitments by major developing country emitters, like China and India, gave fodder to legislators likely to have opposed the protocol anyway on the grounds that it was too stringent.

At 7 per cent below 1990 levels by 2008 to 2012, the Kyoto target formula for the US was not notably tighter than other countries' targets. However, US greenhouse gas emissions were growing rapidly and in 1997 were already 10 per cent above 1990 levels.[2] Thus, the emissions reductions necessary to achieve the Kyoto target were highly ambitious. Many economists thought compliance was unfeasible without large and politically untenable purchases of allowances from countries with looser targets, such as Russia.

Through the fall of 2000, negotiations to agree on the details of the protocol continued under the UNFCCC, culminating at The Hague in November of that year. However, talks collapsed when the European Union (EU) balked at accounting rules for land use and forestry activities that would have made it easier for the US to comply. Given the skeptical signals from Congress, the Clinton administration left office in January 2001, without the essential step of seeking the Senate's advice and consent for ratification of the protocol.

The Bush administration's abrupt withdrawal from the Kyoto Protocol in the spring of 2001 and the president's continued opposition to mandatory limits on emissions soured further relations between the US and EU. Although emissions growth tapered off during the Bush administration, in 2007 US gross levels of emissions were about 17 per cent above 1990 levels. This was far above the goals agreed by the Clinton administration at Kyoto.[3] The US lost credibility and was widely viewed as an impediment to global progress.

Since the inauguration of President Obama in January 2009, new domestic and international dynamics have emerged. Consistent with his campaign pledges, the president released a budget that promised to achieve 1990 levels of greenhouse gas emissions by 2020 which was a 14 per cent cut relative to 2005 levels. The president also promised renewed international engagement on climate policy. The first instalment came in April with the Major Economies Forum meeting in Washington and although no breakthrough agreement was reached, the international community welcomed the new openness of the US to engage on climate change.

Other developments also raised the prospect of serious US commitments to abate emissions. In the fall 2008 elections the Democratic Party, with a platform endorsing domestic regulation of greenhouse gases, built its majority in both houses of Congress and regained the White House. Senate Democrats are currently only one member short of the 60 votes necessary to override blocking manoeuvres by Republicans. The Democrats could add their sixtieth Senate member shortly when a contested election in Minnesota resolves. Election gains in the House of Representatives were also substantial for the Democrats, and a re-shuffling of key committee chairmanships has prompted early consideration of draft climate legislation. With a supportive president and a solid Democratic majority in Congress, prospects for a post-Kyoto framework that includes the US are at the highest level in recent memory.

Despite these drivers, a survey of the broader US political landscape may dampen hopes for both domestic greenhouse gas emissions regulation and a system of tight targets and timetables at Copenhagen. The recession has weakened US political enthusiasm for adopting any policy that raises energy prices or threatens jobs, even if such measures do not take effect until after a recovery is underway. Further, a workable international agreement with binding targets and timetables is possible only if the Obama administration can secure a deal within the intersection of what is feasible domestically and what is acceptable internationally. This intersection may prove slim along several dimensions, particularly the stringency of the US target, financing for mitigation and adaptation by developing countries and the adequacy of commitments by large developing countries like China, India, and Brazil. To illustrate the gap in rhetoric on US abatement, the EU has called on the US to adopt a target of 25 per cent below 1990 levels by 2020 (about 35 per cent below 2005 levels). India's stance is that the US should cut emissions by 40 per cent below 2005 levels by 2020 (Seeley *et al* 2009). In contrast, even the most stringent draft bill in Congress is more modest, targeting 20 per cent below 2005 levels by 2020, and the president has supported 14 per cent below 2005 levels by 2020.

The position of developing countries

In addition to clashes over the stringency of US targets, the Copenhagen talks could flounder on concerns raised by developing countries. Coalitions of developing countries are calling for large transfers from industrialised countries to poor countries to finance adaptation and mitigation. For example, Bolivia and others proposed that developed countries contribute one percent of their gross domestic product (GDP), close to US$700 billion per year, to compensate poor and vulnerable countries for their costs from a disrupted climate.[5] For the US, a contribution of one per cent of GDP would have been over US$142 billion in 2008, nearly quadruple the US$37 billion that the US spent on international (non-defence) affairs the same year.[6] Although it is doubtful that Bolivia could delay global consensus, its views illustrate the high expectations many developing countries have for their interests within the Copenhagen accord.

Another wild card for Copenhagen is the role of China. India, Brazil, Russia and others play a role as well, but an agreement without serious commitments from China is likely to meet particularly strong Congressional opposition. Competition from China is already perceived by many in the US as an important cause of the decline of American manufacturing, and a treaty that Congress views as slanting the playing field further will no doubt face an uphill battle. Indeed,

nearly all draft bills for a cap-and-trade program feature ways to counteract the leakage of jobs and emissions abroad, including some measures that could violate World Trade Organization rules. From the US perspective, the best outcome of the Copenhagen negotiations in this regard is to put a significant price on carbon in (at minimum) trade-exposed energy-intensive sectors within all its major trading partners, especially China. Recent reports indicate that China is studying a potential carbon tax to reduce emissions, although when or if China agrees to such a measure under the UNFCCC remains to be seen (Reuters News Service 2009).

The myriad moving parts of US climate policy

The US Congress

The Congressional politics of climate policy remain fraught, although now the central conflict is economics not skepticism about climate science. Cap-and-trade legislation could impose large overall costs and disparately affect different states, sectors and income classes. In addition, the mechanism by which emissions allowances are distributed promises a treasure trove of revenue or compensation, depending on one's perspective. Congress is beginning to grapple with these issues more seriously than it did during the Bush administration, when Congressional debate was arguably academic since President Bush would likely have vetoed any mandatory climate bill.

The rising attention to the effects of cap-and-trade on the idiosyncratic constituencies of Congressional members creates friction that is less partisan and more regional, challenging the Democratic leadership to assemble a winning coalition even though it controls both chambers. With all the attention on the impact on special interests, few Congressional hearings have grappled with the overall macroeconomic costs of greenhouse gas emissions constraints and the important role of the stringency of the cap. This critical issue may come to the fore when more politically potent issues are resolved.

The most salient issue has been the thorny politics of the allocation of cap-and-trade allowances. Allowance allocation is all-important to firms that prefer to get them for free rather than to pay the full price at auction; even a modest share of free allowances could mean billions in higher profits. The interests of regulated firms received the most attention, but a number of groups argued for consumer rebates or dividends. Others see US$100 to US$400 billion a year in potential revenue to offset the federal budget's deficit of over US$1 trillion or to lower other taxes.[8] The sheer number of affected interests and the political difficulty of striking tradeoffs across them may result in a delayed and lengthy debate.

Another key issue is the extent to which firms can use credits from offset projects to comply with their domestic rules. Including offsets in the program would allow regulated firms to cover their emissions with credits for emissions reductions made elsewhere, such as in unregulated domestic sectors or abroad. Some environmental groups are uneasy about offsets, arguing that it is difficult to ensure that offset project reductions are truly additional to what would have happened without the project. Accordingly, some draft bills limit the total number of offset credits firms can use to comply and others prohibit them entirely. The probability of these constraints in the final bill means the treatment of offsets under domestic regulation and not the UNFCCC treaty language will determine US demand for such reductions. Developing countries that hope to rely on selling large numbers of offsets to US firms may be disappointed.

Diverse constituencies also drive divergent views on ancillary policies under debate including: the promotion of nuclear power, and carbon capture and storage; measures to protect trade competitiveness; renewable energy subsidies and mandates; and automotive standards for fuel economy and fuel carbon content. Raising so many issues at once may hamper cap-and-trade by expanding the set of objectives, or it might foster agreement by broadening the space for horse trading. In either case, the stakes in this year's Congressional debate are higher than ever as it is likely that the new president will sign the deal that emerges.

Although Congress and the Obama Administration have focused on a cap-and-trade approach, some legislators are promoting a greenhouse tax. Supported by former Vice President Al Gore, other prominent experts and many economists, a climate tax is nonetheless viewed by many as politically unviable (Gore 2006). Indeed, some Republicans opposed to cap-and-trade described its key flaw as that it is a tax by another name. Nonetheless, at least five members of the House of Representatives sponsored climate tax bills, most emphasising the return of revenues to consumers or taxpayers.[7] If squabbling over allowance allocations stalls the cap-and-trade bill unduly, it is possible that a dark-horse tax bill could emerge to prominence. The marketing would be challenging, but a climate tax bill that is revenue neutral or funds popular programs could gain momentum.

A stronger possibility is the emergence of a middle ground between a cap-and-trade program and a pure tax. For example, some Senate bills included a safety valve that allows firms to purchase allowances from the government at a pre-determined price each year, effectively capping the price and converting the system to a tax if it becomes too stringent.[8]

The US legislative calendar is not a friend to the UNFCCC process. Even if the House of Representatives reports a climate bill out of committee by June, as the leadership has promised, the Senate is unlikely to take up the measure until mid-summer. Its docket is crowded with competing high-profile issues such as health care reform and the confirmation of a new Supreme Court justice. Further, a group of 16 Democratic senators, called the Moderate Dems Working Group, may slow the process in order to have their concerns about the effects of climate policy in coal-dependent states addressed more fully.

The Senate

The limelight of climate policymaking fell on the US Senate in 2008 as it debated the Boxer-Lieberman-Warner cap-and-trade bill. Several factors drove the bill's fairly rapid demise once it left the Environment and Public Works Committee. First, the bill had the misfortune of hitting the Senate floor amid record high oil prices. Second, the bill tried to be all things to all people, carving the pools of allowances and allowance revenues into dozens of slivers to be managed by numerous new bureaucracies. Rather than creating decisive support as the drafters intended, the complexity and opacity of the transfers in the bill bogged it down. Finally, moderate Democrats from coal-using states began having doubts about taking on the issue in an election year and the leadership pulled the bill from the floor.

Although the Senate took the early lead on climate legislation, the Senate's rules, composition and committee structure make the chamber more challenging for high-stakes policy than the House of Representatives. In particular, in the Senate only one committee can have primary jurisdiction over a bill at one time. This constraint is particularly ill-suited to cap-and-trade legislation which requires close coordination across environmental, energy, foreign policy, market oversight and fiscal policy aspects of the program. As a result many bets are on the House to produce the next promising bill.

The House of Representatives

Indeed, the epicentre of debate in the US has moved to the House this year. Democrats Henry Waxman and Ed Markey of the Energy and Commerce Committee offered a draft climate and energy bill, The American Clean Energy and Security Act of 2009. The bill adopts President Obama's proposed long-term emissions target, an 83 per cent decrease from 2005 levels by 2050, along with more aggressive short-term targets than the president supported: a 20 per cent reduction in emissions by 2020 relative to 2005 and a 42 per cent drop by 2030. The 648 page Act is both highly inclusive and notably silent on important policy issues.[9] The draft bill includes not only the cap-and-trade title, but also a renewable electricity standard; energy efficiency standards for buildings, appliances and lighting; and measures to promote carbon capture and storage, and electricity grid planning. At the same time, the bill is silent on how the hugely valuable emissions allowances will be devolved from the government to regulated firms.

The drafters may have left out those key elements in order to foster debate and compromise but the greatest effect may be to foster lobbying. The feeding frenzy began in earnest last year. According to the Center for Public Integrity, more than 770 companies and interest groups hired an estimated 2340 lobbyists to influence federal policy on climate change in 2008 (Lavelle 2009). This reflects an increase of more than 300 per cent in the number of lobbyists on climate change in just five years, or four climate lobbyists for every member of Congress. The Center estimates that lobbying expenditures on climate change in the US last year topped US$90 million.

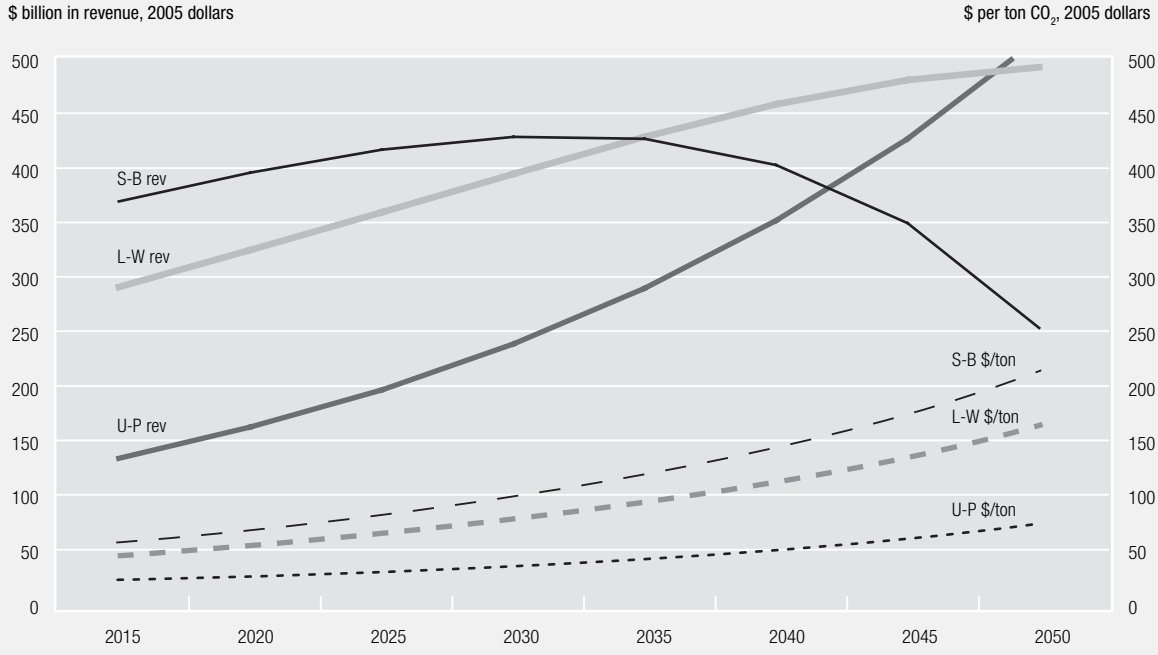
The Obama administration

To date, the Obama administration has not weighed in on the specifics of bills before Congress, but the president has called for new authority to control greenhouse gas emissions. In April, the US Environmental Protection Agency (EPA) released an 'endangerment finding' that greenhouse gas emissions pose a threat to public health and welfare. This development means that the administration can – indeed must – use its existing authority under the Clean Air Act to regulate greenhouse gas emissions if Congress does not act quickly to provide new authority. This poses a credible threat to prompt new legislation. Unless Congress overrides it, the Clean Air Act requires the EPA to regulate greenhouse gases in a way that could be much more costly than the same reductions through a cap-and-trade program or carbon tax.

Another direction greenhouse gas emissions regulation could originate from is through the Endangered Species Act (ESA). The Bush administration listed the polar bear as a threatened species under the ESA due to the melting of its sea-ice habitat. However, it also issued a special rule that limits the use of the ESA to regulate greenhouse gas emissions because such gases are only indirectly related to changes in the bear's habitat. Environmental groups are pressuring the Obama administration to overturn the rule and allow greenhouse gas emissions regulation under the ESA, but so far the administration has rejected that policy direction.

Perhaps the most important role for the president will be in helping Congress overcome its regional and sectoral disputes by offering a detailed but high-level compromise. The president is in the best position to weigh the overall costs to the US economy of new legislation and he could offer fiscal reforms, such as

FIGURE 1:
AUCTION REVENUE AND CARBON PRICES DEPEND ON THE CAP



Source: Paltsev et al, MIT Joint program Report 146, April 2007

using allowance auction revenue to reduce the federal deficit, which could greatly lower the overall cost of the program. The next section of this paper explores these and other important options for the disposition of allowances.

Allowance allocation and the cost of cap-and-trade

A cap-and-trade program to control US greenhouse gas emissions creates a set of emissions allowances that regulated firms must surrender to the government to cover their emissions. The allowances will be valuable, and a key feature of the program is how the government distributes that value – either in the form of the allowances themselves or via the proceeds of allowance sales. Allowance auctions require policymakers to decide how to use the revenue. Free allowances require policymakers to decide how to 'spend' the equivalent value in marketable assets. Either way, the government has to divide up the total value of the allowances (the 'allowance value'). Under either approach, a secondary market for permits will develop and firms will trade the permits at the fair market value of the right to emit.

Although the two are regularly blurred in the discussion of cap-and-trade, the value of allowances is importantly different than the economic cost of the program. If the government auctions the allowances, the government receives revenue that it can spend or rebate to taxpayers, for example, by lowering other taxes or issuing dividend checks. The revenue represents a transfer from whoever bore the burden of paying for the allowances at auction to whoever benefits from the government revenue. This is a transfer that will likely redistribute income but it won't incur real resource costs to the overall economy. Giving the allowances to firms for free will result in a different redistribution of income, but again, it's a transfer and not a resource cost.

In contrast, the cost of abating emissions is a real resource cost, not just a transfer. The total abatement cost will be the sum of the costs of each successive ton of abatement – the sum of countless investments that will reduce energy use and lower emissions. These are the costs that are minimised through the trading of allowances since firms that have higher abatement costs can purchase allowances from firms with lower abatement costs. Thus, the price people pay to the government for allowances affects the cost to those people, but not the overall burden on the economy. In particular, giving away allowances for free doesn't lower the overall cost of the program, and auctioning them doesn't raise the cost of the program.

Auction or no auction, the price on carbon will be passed to those who can't pass it along to someone else. Although the regulated firms will include electric utilities, for example, the cap-and-trade program will result in higher consumer prices for electricity and other goods and services. Regulated firms will pass along their costs as best they can, and so will everyone else. The final incidence of the program falls on people who can't avoid or pass along their costs – mainly consumers in the short to medium term.

Auctioning all allowances will bring in a lot of money to the federal government. Exactly how much revenue will depend on the cap as well as other possible features, such as offsets. For example, Massachusetts Institute of Technology researchers studied three different possible caps using an economic model (Paltsev et al 2007). The caps correspond approximately to the range in stringency of various Congressional proposals, with the most stringent analysed being similar to the targets that President Obama has supported. Revenue estimates exceeded US$100 billion in the early years of the least stringent programs and rose to over US$450 billion in later years for two of the scenarios. The curve labelled 'S-B rev' in Figure 1 above shows that as the cap ratchets down over time, auctions may eventually bring in less revenue each year, particularly in the most stringent scenarios. Although each allowance will become more valuable (see dashed curves for allowance price), the tighter cap allows a lot fewer of them.

Using allowance value to lower costs

The way in which the federal government allocates allowances can affect the overall costs of the program. It can also counteract the regressive burden of the program, compensate those who bear the costs or enrich those who don't. The 'cost' of the program means the gross overall cost to the US economy of abating emissions under the cap-and-trade program, not accounting for the environmental and economic benefits of protecting the climate. The costs of a cap-and-trade program come in two parts. The first, as discussed above, is the direct costs of abating emissions, which raises the price of energy and the other goods and services that embody energy or non-CO_2 greenhouse emissions (a large share of total goods and services). These higher prices lead indirectly to the other part of the costs. Higher overall real price levels depress the returns to working and investing. As those activities are already taxed, the cap-and-trade program introduces another broad drag on economic activity, called the tax interaction effect.

Using revenue from allowance auctions to reduce the federal budget deficit or reduce other tax burdens can greatly lower the overall cost of the program. This is because the budget deficit, which increases future tax burdens and lowers current investment, and existing taxes burden the economy by distorting incentives to work and invest. Reducing these distortions provides economic benefits that help sharply offset the costs of the greenhouse gas emissions constraint. Some estimates suggest that lowering the deficit or other taxes can lower the overall costs of the program by 75 per cent (Parry 1997).

Using allowance value to compensate

If a policy burdens lower-income households relatively more than higher-income households as a share of household income, then the policy is called regressive. The level of regression of a cap-and-trade program greatly depends on the definitions of burden and income. In general, lower income households spend a higher percentage of their income on energy and other goods likely to experience a price rise. However, a recent study shows that some of this level of regression disappears when the extra expenditure is measured against overall economic status over a lifetime rather than income in a particular year (Hassett *et al* 2009).

Even if the burden on higher-income households will be a relatively smaller share of their income, they will pay more of the total costs. Wealthier people use more energy and consume more emissions-intensive goods, like air travel and manufactured products, just as they consume more in general. Thus compensation that is directed primarily at the lowest income households isn't really compensating those who bear greater levels of burden. Rather, it's compensating those whose burden *proportional to their income* is higher.

The distribution of burdens across the country shows households in different regions bear similar burdens as a share of income. People in different regions use different mixes of fuels to heat and cool their homes, and in some regions they consume proportionately more gasoline than others. The study by Hassett and others indicates that these differences can even remove the impact of higher energy prices (Hassett *et al* 2009). In addition, households in most regions consume similar baskets of non-energy goods. However, the study estimates that a carbon tax could fall a little harder than average on households in Eastern central states because of their higher overall fuel consumption as a share of income.

However desirable it is to use allowance value to protect consumers from the full cost of the program, it is important that compensation preserves the price signals of the program. For example, if allowance value – either through free allowances or through the proceeds of auctions – goes to blunting increases in electricity prices, then consumers will conserve less. This means that to reach the cap, more emissions abatement will have to occur in other, more costly, sectors. This worsens the overall burden and ultimately hurts the very consumers the compensation aims protect.

Linking cap-and-trade and regulatory standards

Many in the environment protection community support both a cap-and-trade program and higher energy efficiency or low carbon standards for buildings, appliances, vehicles, lighting and transportation fuels. Many also support a renewable electricity standard (RES) that requires electricity utilities to produce (or acquire) a specified share of electricity from renewable sources such as wind and solar. The RES is meant to give renewable energy firms a guaranteed return on investment and to help drive down the cost of renewable energy over the long term.

Some of these measures are gaining traction. In February, President Obama delivered on a campaign promise to consider California's request for higher automotive fuel efficiency standards. If the EPA grants California's request to adopt standards more stringent than pending federal requirements, at least 13 other states are likely to follow California's lead to require a nearly 30 per cent reduction in greenhouse gas emissions from tailpipes by model year 2016, or an average of about 42 miles per gallon by 2020. Current federal law requires an average fuel economy of at least 35 miles per gallon by 2020. Both Senate and House draft bills include an RES, and the measure has support from key committee chairs although they disagree on how stringent the standard should be.

The president and others hail greater fuel economy, renewable energy and energy efficiency as ways to reduce US dependence on foreign oil and protect the climate. Indeed, energy efficiency investments may prove to be some of the lowest cost ways to reduce emissions. However, that raises the question of whether the metaphorical belt of mandating certain levels of efficiency and renewable power should be combined with the suspenders of a cap-and-trade program.

Standards that take affect before a cap-and-trade program may provide carbon emissions reductions in the interim years. However, once the emissions caps are set and firms are trading rights to emit, fuel economy, renewable electricity and other regulatory standards produce no net climate benefits. That is, if the price signal on carbon induces greater energy efficiency, then the standards may not bind. Alternatively, if the standards do bind to reduce emissions in the relevant sector, then the very nature of cap-and-trade means that other sources can emit more than they otherwise would in the absence of the standards. For example, relatively tighter fuel economy standards in California reduce emissions from vehicles in California, but other sources, including motorists in other states, can emit more. Thus, the influence of the standards can drive abatement towards more costly technologies but can't affect its overall level. In addition, some standards programs, such as a federal RES, would impose the transactions costs of tracking and trading certificates.

Along with raising costs, tighter fuel economy rules could inadvertently undermine overall climate benefits if they prompt legislators to exempt transportation fuels from the cap-and-trade program, as proposed by Representative John Dingell, a Michigan Democrat. If firms are prone to cover their last ton of emissions with offset credits from abroad, including efficiency standards might provide greater abatement in the US than the cap-and-trade program alone. However, the standards would also produce higher emissions abroad by reducing the demand for offsets (assuming the offsets were from truly additional reductions). While some may view greater domestic emissions abatement as a good thing, those reductions would come at a higher cost than the alternative offsets and make no net difference to the atmosphere.

Ingredients for a successful conclusion at Copenhagen

The challenge for the Obama administration is to promote an approach that solidifies and preserves the consensus for domestic action over the long term and leverages US action into greater emissions abatement abroad. This is a tall order, but below are some suggestions on how to proceed.

All parties should stick to commitments that are feasible and sustainable domestically.
One clear lesson from the Kyoto Protocol is that little environmental progress is made by making concessions internationally that are unfeasible domestically. A modest but credibly increasing price for emitting greenhouse gases can efficiently shift the economy to a low greenhouse gas emissions future. Starting modestly will reduce costs by allowing new technologies to develop before the steepest emissions cuts kick in. Keeping costs low will help the policy endure for generations. This is far more important than the short-term benefits from overly aggressive policies that would collapse at the next economic downturn or oil price spike.

Be willing to walk away.
Given the substantial demands on the US going in to Copenhagen, US negotiators must risk antagonising the EU, other industrialised allies and developing countries to stay credible domestically. The other countries have virtually no leverage over Congress to accept tighter emissions abatement or financial commitments than it otherwise would. The US delegation must

broker considerable departures from the opening bids of key interlocutors at Copenhagen or be willing to walk away, for example, to pursue agreements outside the UNFCCC process.

Define success creatively and dynamically.
A 'successful' outcome of the Copenhagen talks can be something other than stringent binding targets and timetables for developed countries and large financial packages to aid developing countries' mitigation and adaptation efforts. If US climate legislation is incomplete, it will be better to craft an agreement that recognises US energy spending from the stimulus package, crafts a technology cooperation agreement, for example, and promises further talks when US legislation is more developed.

Allow countries the flexibility to set price signals instead of hard caps.
China recently announced that it is considering taxes on carbon. Potentially this is an important move forward for China, and it could be a helpful example for other developing countries that fear severe constraints on their economic growth. UNFCCC parties should embrace commitments in the form of price signals on carbon and other greenhouse emissions.

Use commitments by major developing countries to avert protectionism.
When the US implements its own economy-wide emissions abatement program, it can argue more persuasively that all major economies should reduce greenhouse gas emissions, including large industrialising developing countries. The US should begin by seeking committed reductions in the sectors of major developing countries that are most likely to increase emissions as a result of the US and other developed countries controlling their own emissions. Including, at least, those leakage-prone sectors in the international agreement will improve its environmental performance and help neutralise climate policy as a cover for more protectionist motives.

Conclusion

The myriad moving parts of climate policy in the US make predicting the future tricky. A convergence of forces, such as the supportive new president and the increased majority of Democrats in Congress, drives unprecedentedly strong prospects for a binding domestic regulatory program and active international engagement by the US on climate policy. At the same time, the costs and distributional effects of a stringent cap-and-trade program require Congress to strike large trade-offs across sharply competing interests, made sharper in the context of the recession and acute troubles in the automotive industry, for example. Moreover, even if the US does pass climate legislation promptly, the measure may clash with the inflated expectations of the international community. One can only hope that excessive bickering over obligations for the next decade will not derail the much longer journey towards a safely stabilised climate.

Endnotes

1. See "Energy Provisions in the American Recovery and Reinvestment Act of 2009 (P.L.111-5)", *Congressional Research Service Report 40412*, 3 March 2009, available at http://assets.opencrs.com/rpts/R40412_20090303.pdf.
2. For details on US emissions, see the US Environmental Protection Agency's *Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2007*, p. ES-4, Table ES-2, April 2009, available at http://www.epa.gov/climatechange/emissions/downloads09/ExecutiveSummary.pdf.
3. See above.
4. World GDP figure from the US Central Intelligence Agency, *The World Factbook 2008*, available at https://www.cia.gov/library/publications/the-world-factbook/print/xx.html.
5. The GDP figure is from the US Department of Commerce, Bureau of Economic Analysis, available at http://www.bea.gov/national/index.htm#gdp. US international affairs spending is described in the president's Fiscal 2009 Budget Request, available at http://www.usaid.gov/policy/budget/cbj2009/100014.pdf.
6. The deficit figure for 2009 comes from the president's fiscal year 2010 budget, *A New Era of Responsibility*, p. 14, available at http://www.whitehouse.gov/omb/assets/fy2010_new_era/A_New_Era_of_Responsibility2.pdf.
7. A compendium of climate tax bills appears at the website of The Carbon Tax Center, *Legislative Proposals for Carbon Pricing in the 111th Congress*, available at http://www.carbontax.org/progress/carbon-tax-bills/.
8. See for example, S.1766, 110th Cong. (2007) sponsored by Senators Bingaman and Specter. Other hybrid systems have also been proposed. See for example, McKibbin, WJ & Wilcoxen, PJ 2002, *Climate Change Policy After Kyoto: Blueprint for a Realistic Approach*, The Brookings Institution Press.
9. For a more complete bill summary, see VanNess Feldman Attorneys, *Issue Alert*, 3 April 2009, available at http://www.vnf.com/assets/attachments/471.pdf.
10. Politicians and others often similarly blur the potential revenues from a carbon tax and its economic cost. The revenues are not net costs to the economy, but rather transfers from those who pay the tax to those who get the revenue.
11. Higher consumer energy prices are an important result of the program because they provide incentives for greater energy efficiency.

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Yin Zhongyi is the senior research fellow, PhD supervisor and Vice President of China Institute for Reform and Development. He has been designing, organising and conducting reform policy research projects since 1994 and providing onsite intellectual support for annual conferences of the Boao Forum for Asia. He has published 12 books and dozens of academic papers on China's economic reform and opening-up strategy. At present, he is guiding PhD students doing research in economic transition and social transformation for China's North Eastern University.

Fairness and justice: Two prerequisites for real international action on climate change

2.3

Introduction

Although worldwide consensus has evolved about the need for international cooperation to deal with climate change, international negotiations on reducing greenhouse gas emissions have not run smoothly. One reason is the substantial difference between the positions of the developing and developed countries. This is a result of a variety of factors including resource endowments, technological capacities, development stages and, the concepts of and attitudes towards consumption.

At the United Nations Framework Convention on Climate Change (UNFCCC) in December 2008, the differences between the positions of developing and developed countries on a common vision for long-term cooperative actions, as well as post-2012 emissions reduction goals for developed countries, remained the same as before.

The positions of developing countries are quite similar or basically the same. Firstly, the developed countries must recognise their historical responsibilities to substantially reduce their greenhouse gas emissions and commit to appropriate medium-term reduction goals. Secondly, the developed countries should change their unsustainable production and consumption models to reduce their per-capita emissions to an acceptably lower level and allow developing countries a comparable level of per-capita emissions because, everyone, from either a developed country or a developing one, should have an equal right to energy consumption. And thirdly, in terms of financial and technical assistance, the relationship between the developed and developing countries is not that of donor and recipient. Rather, developed countries have obligations and responsibilities to support developing countries deal with climate change by providing them with technical and financial assistance.

Developed countries, on the other hand, hold that consensus should be built on a vision of sustainable development for all countries. While developed countries take the lead in reducing greenhouse gas emissions, developing countries should also take similar action. By such means, developed countries hide their own reduction potential. They stress global reduction and the potential of developing countries to reduce greenhouse gas emissions as a diversion designed to focus attention on the growth of emissions in developing countries and on their economic strengths.

In brief, the most fundamental difference between developed and developing countries is the sheer fact that the former are trying their utmost to evade their historical responsibilities by establishing a framework of international responsibility at the expense of the right of developing countries to develop. For their part, developing countries insist on principles of fairness and justice. They urge the developed countries to accept their moral responsibility for their historical greenhouse gas emissions which have seriously destroyed humankind's eco-system.

In terms of a joint effort by the international community to deal with climate change, if the developed countries do not accept the values of fairness and justice that they advocate as universal, then it will be extremely difficult for the international community to have truly common actions.

The responsibility of developed countries for climate change

It is the compelling responsibility of developed countries to take the lead in reducing greenhouse gas emissions and provide technical and financial assistance to developing countries to improve their energy efficiency and develop renewable energies.

For some time, the United States (US), Japan and the European Union (EU), as well as United Nations Conference on Trade and Development (UNCTAD), have repeatedly stressed the importance of China, India, Brazil and other developing economies reducing their greenhouse gas emissions. They seem to believe that the problem of climate change can be thoroughly solved as long as these developing countries reduce their greenhouse gas emissions, as they urge. This self-willed and incorrigibly obstinate position shows that some developed countries turn a blind eye to the reality of global greenhouse gas emissions. Their true intention is to shirk their international obligations.

Some developed countries' exaggeration of the reduction potential of developing countries, and their attempts to evade mentioning their own, substantially distorts the true picture concerning global greenhouse gas emissions. Particularly misleading is their exaggeration of the reduction potential of the major developing countries. Take China as an example. According to a report by the United Nations Development Programme (UNDP), although China is the largest developing country with relatively lower energy efficiency, its per-capita emission of greenhouse gases in 2006 was only 18 per cent of US emissions, 39 per cent of Japan's, and 38.3 per cent of Germany's and the United Kingdom's (UK). As the second largest developing country in the world, India's per-capita emission of greenhouse gases was even lower (United Nations Development Programme 2007).

The statistics disclosed by China's trade minister during an interview with the media in 2007 were exactly the same as those reported by the UNDP. In its long history of development, China's total emissions of greenhouse gases have remained quite small. In more than the half-century between 1950 and 2002, China's population remained about 20 per cent of the total world population but its total CO_2 emissions from burning fossil fuel was only 9.33 per cent of the world's total. And before 1950, the proportion of China's CO_2 emissions from burning fossil fuel as a percentage of the world's total, was much smaller. In the same 52-year period between 1950 and 2002, China's ranking in terms of per-capita CO_2 emission remained 92nd among all countries of the world. In 2004, China's per-capita CO_2 emission was 3.65 tons, only 87 per cent of the world average and one-third of OECD countries. Thirdly, China's elasticity coefficient of CO_2 emissions per-unit GDP is small. According to statistical estimations made by the International Energy Agency, for every 1 per cent of GDP growth in the world between 1990 and 2004, the world's average CO_2 emissions grew by 0.6 per cent, while in China this figure was only 0.38 per cent (Xin Yu *et al* 2007).

It is difficult to understand why some developed countries do not regard those countries with enormous historical CO_2 emissions, high per-capita emissions and larger elasticity coefficient of CO_2 emissions per-unit GDP as major threats to climate change. Are they being objective and just? Some statistics show that by burning fossil fuels, developed countries emitted 95 per cent of the CO_2 between 1750 and 1950, and between 1950 and 2000, emitted 77 per cent of the CO_2. CO_2 can stay in the atmosphere for 3000 years. It is the developed countries having emitted huge amounts of CO_2 in their long history that should be made responsible for climate change.

According to a report submitted to the website of the Ministry of Commerce of the People's Republic of China by the Economic and Commercial Counselor's Office of the Chinese Embassy in France on statistics quoted by many French media,[1] among all the signatory states of the Kyoto Protocol, only 4 developed countries had, during the 16 years between 1990 and 2005, decreased their emissions of greenhouse gases: Germany by 18.4 per cent, UK by 14.8 per cent, Switzerland by 7.3 per cent and France by 1.9 per cent. In that time, many developed countries' emissions of greenhouse gases had grown with that of Spain rising by 53 per cent, Portugal by 42.8 per cent, Ireland by 26 per cent, Australia by 25.6 per cent, Canada by 25 per cent, and the US by 16.3 per cent. As a recently emerging economy, China's total emissions of greenhouse gases grew by only 25.3 per cent since 1990,

but its per-capita emission is still much lower than that of developed countries in the West.

China produces consumer goods for the whole world, making it inevitable that it consumes energy. According to a report launched by the International Iron & Steel Institute in 2008, China produced 36.4 per cent of the world's crude steel in 2007 and 46 per cent of the world's cement in 2006.[2] In terms of home appliances, China produced 33 per cent of the world's refrigerators and washing machines, 70 per cent of the world's air-conditioners, 68 per cent of the world's air conditioner compressors and 70 per cent of the world's microwave ovens.[3]

One-third of China's total greenhouse gas emissions are a consequence of producing exports. According to UN statistics, China's total exports comprised 37 per cent of its total GDP in 2005, while in 1990 this proportion was only 19 per cent. To a large extent, the growth of China's exports has driven up China's energy consumption. In other words, the unsustainable consumption model of developed countries, or rather their wasteful life-styles, is an important reason for the growth of China's greenhouse gas emissions. Therefore, it is fair for developed countries to bear certain international obligations for the greenhouse gases emitted by China. As the major consumers of the world's exports, developed countries in the West have a responsibility to help developing countries like China to improve their energy efficiency.

The total historical greenhouse gases emissions of developing countries is small and their per-capita emissions have been low. The growth in their emissions in recent years is a result, to a very large extent, of many energy-consuming manufacturing industries moving away from developed countries. China, along with other developing countries, now manufactures goods for the whole world, particularly for the developed world. For this reason, instead of blaming them, the developed countries should be providing advanced technologies to developing countries to improve their energy efficiency and develop renewable energies.

The efforts of developing countries to stop climate change

International mechanisms should not ignore the enormous efforts developing countries are making to improve their energy efficiency and develop renewable energies.

Climate change is a global problem and a common concern of the international community. It concerns the survival of humankind's environment, and the prosperity and development of all countries. Like many other developing countries, the Chinese government has always attached great importance to the issue of climate change. It pursues a national policy of saving resources and protecting the environment, and strives for sustainable development as a national strategy. In short, the Chinese government has made enormous and effective efforts, as follows. It has:

- issued the China's National Climate Change Program, which stipulates the specific objectives, and basic principles, priority areas and policy measures to deal with climate change by 2010;
- encouraged reducing energy consumption per unit GDP as a constraining indicator for economic and social development in its 11th Five-year Program for National Economic and Social Development. It has also established a system of accountability to monitor and appraise each level of local government and the business community;
- given much attention to the transformation of the economic development model and the readjustment of the country's economic structure by encouraging adoption of production and consumption modes that save energy and other resources;
- strengthened policy guidance and fiscal investment to energetically develop clean and renewable energies such as hydropower, nuclear power, wind power and rural bio-gas projects;
- expanded energy pricing reform for other resources as well, and introduced complementary reforms of the taxation and fiscal system. These changes have been advanced to bring the guiding role of local government into full play and make full use of market regulating mechanisms to encourage all of society to save energy and other resources;
- implemented eco-system building strategies such as protecting natural forests and wetlands, and converting farmland into forest or pasture. As a result of these measures the capacity of forests to absorb greenhouse gases has been further strengthened;
- introduced a series of laws and regulations to enforce resource conservation and environmental protection education in order to speed up the building of a resource-saving and environment-friendly society; and
- it has established a national leadership group on climate change to guide all the departments of the central government and all provincial governments.

These measures are producing tangible results. Between 2000 and 2008, China's wind power capacity grew from 0.34 to 10 million kilowatts, hydro-electric power generation capacity from 79.35 to 163 million kilowatts, and nuclear power capacity from 2.1 to 8.85 million kilowatts. Meanwhile, China's forest coverage has grown from 13.92 per cent at the beginning of the 1990s to 18.21 per cent in 2005. Further, polluting activities have been cut back. In 2007 alone, many small thermal power units with a total capacity

of 14.38 million kilowatts, more than 10,000 small coal mines, inefficient iron smelting facilities with a total capacity of 46.59 million tons, inefficient steel plants with a total capacity of 37.47 million tons and cement plants with a total capacity of 87 million tons were closed (Wen Jiabao 2008).

Meanwhile, ten major energy-saving projects were launched. Breakthroughs were made in carrying out desulfurising projects for coal-fired power plants. The central government provided financial support for 691 projects to prevent and control water pollution in major river valleys. Work continued on ecological conservation projects such as those to protect natural forests and control the causes of sandstorms. During the five-year period, the area of farmland retired for reforestation and other lands planted with trees amounted to 31.91 million hectares, and grazing land returned to natural grasslands totaled 34.6 million hectares (Wen Jiabao 2008).

People became more aware of the importance of conserving resources and protecting the environment. Thanks to the intense efforts of the whole country, encouraging progress was made in conserving energy and reducing emissions. In 2007 there was a 3.27 per cent year-on-year drop in energy consumption per unit GDP, and for the first time in recent years there was a reduction in both chemical oxygen demand and the total emissions of sulfur dioxide, with the former down 3.14 per cent and the latter down 4.66 per cent from the previous year (Wen Jiabao 2008).

Great strides have been made in developing renewable energy in China's rural areas. By the end of 2005, there were already more than 2.2 million rural household biogas digesters, over 2400 large-scale husbandry farm and industrial waste biogas projects, and 140,000 living sewage biogas projects. In total, close to 1 billion cubic meters of biogas were utilised to provide quality living fuel for around 80 million rural residents.

Large-scale development projects to generate electricity from biomasses, photovoltaic electricity generation and solar thermal utilisation are being undertaken. According to incomplete statistics, the total amount of renewable energy utilised in China in 2006 (exclusive of biomass energy utilised in conventional ways) was close to 200 million tons of standard coal, accounting for 7.5 per cent of total energy consumption in that year. The development and utilisation of renewable energy has produced marked environmental effects. By the end of 2005, the annual emissions of sulfur dioxide had decreased by 2.5 million tons, of nitrogen oxide by 1 million tons, of smoke in fluegas by 1.3 million tons and that of carbon dioxide by 400 million tons.

Regrettably, despite developing countries like China making enormous efforts to improve energy efficiency and develop renewable energies, they are not eligible for support from the existing international mechanisms. Following are two examples involving China.

China's rural population still largely comprises 700 million people in more or less 200 million households. Many still burn crop stalks or straw for cooking and heating. As recently as a decade or two ago, in a randomly selected village of 1000 people in the countryside, there would be 300 or more chimneys puffing black smoke into the sky, three times a day for cooking purposes and, in winter, 24 hours a day for heating. To reduce greenhouse gas emissions, the Chinese government has made an enormous effort encouraging rural households to build biogas pools for cooking, heating and lighting.

The second example concerns the 11.5 million rural population for whom it is technically and economically impossible to transmit electricity because they prefer to live in remote areas. The Chinese government has decided to provide each family with both a solar and a wind power unit so that they will not cut down trees for cooking and heating.

It would appear that these two examples of developing and utilising renewable energy to reduce greenhouse gas emissions are seldom, if ever, covered by any of the international support mechanisms. One reason is that the existing international finance mechanisms are designed with inadequate information. They do not include all the renewable energies that can be developed and utilised in developing countries to reduce greenhouse gas emissions in the short to medium term, and safeguard energy security in the long term. Another reason is that the two examples described above are not lucrative for some existing international mechanisms because financial agencies are designed to achieve profits in industrial sectors only.

In essence, under the pretext of a 'low-carbon and high-growth global economy', some international mechanisms turn a blind eye and deaf ear to the development needs of developing countries. They ignore their most pressing requirements to improve energy efficiency and develop much needed and feasible renewable energies. This is neither fair nor just to developing countries. If developed countries continue to ignore the needs and appeals of developing countries, there is little hope of reaching agreement on widely accepted common actions to deal with global climate change.

Two important principles for dealing with climate change

With the deepening impacts of the current global financial crisis, many pessimists around the world believe that the world economy may well stay in recession for quite some years. Fortunately, despite the global financial

crisis being the most important and urgent agenda for the entire world, neither developed nor developing countries have openly advocated suspending efforts to cope with the challenges of climate change.

The EU has guaranteed a climate economic stimulus package. European countries, which have always been enthusiastic about environmental protection, take innovations in energy technologies as the core of a new economic revolution and their green recovery plan. Apparently their hopes are placed on technological innovations to stimulate their economies. In the US, according to President Obama's green revitalisation plan, by 2020 greenhouse gas emissions will be reduced to 80 per cent of 1990 levels, the proportion of green energy in its total energy consumption will increase to 30 per cent and US$15 billion will be provided every year to invest in solar, wind and biomass power.

The economic stimulus packages of large developing countries like China, Brazil and India also contain objectives to optimise energy consumption structures and reduce emissions. One-fourth of China's 4-trillion-yuan economic stimulus package is earmarked to strengthen development of renewable energy. To stimulate its economic development, India is investing heavily in wind and solar power.

The policy initiatives of developed countries are all good signs of the international community's willingness to deal with the challenges of climate change. Nevertheless, they are all meant, in the first instance, to cope with their own difficult economic and social situations, though ultimately they may also produce positive impacts on global climate change. At the same time, the developed countries may repair their international image, in particular the US, and attract developing countries to make similar commitments.

If developed countries really want to set examples for developing countries to follow, instead of simply imposing on them unfair and unjust expectations, they really should keep in mind the principles of fairness and justice. When attempting to persuade developing countries to make commitments about reducing greenhouse gas emissions, they should look at this issue historically, objectively, justly and comprehensively. Developed countries should not look only at a developing country's total amount of emissions while ignoring its per-capita emission; they should not look only at its present emissions while ignoring its very low historical level of emissions; they should not look only at its production but also at its consumption; and they should not look only at its emissions figures while ignoring its current stage of development.

China, for example, is still a developing country with per-capita GDP as low as a little over US$3000. Fifteen million rural residents live in absolute poverty and 22 million urban dwellers live with minimum living conditions. China is in the process of rapid industrialisation, but with per-capita greenhouse gas emissions less than one-third of that of developed countries. Historically, its per-capita emission was even lower. Of its current total greenhouse gas emissions, a large proportion is a byproduct of producing life essentials for its huge population and a consequence of the international shift of the manufacturing sector. China is responding to multiple pressures including developing its economy, eradicating poverty and reducing greenhouse gas emissions. All the resource and environment-related problems that have been exposed gradually in the process of industralisation of developed countries during the past 200 or so years have suddenly appeared in China. Plus they have all appeared together. The problems with saving energy and reducing greenhouse gas emissions have taken developed countries a number of decades to solve after they were highly developed. It would be difficult for China to solve these problems in a short time.

Taking global action

During the past 30 years or so, developed countries have been transferring their resource-intensive industries to developing countries, taking advantage of their natural resources and cheap labor to produce low-cost goods largely for their own consumption. This has been at the environmental cost of the developing countries. Although this transfer has increased the economic growth of some developing countries, it has unquestionably degraded their eco-systems. So it should be that developed countries provide low-cost technologies, consulting services and financial assistance to the efforts being made by developing countries to reduce their greenhouse gas emissions. Only under the prerequisite of fairness and justice will it be possible for the international community to take the common actions required to cope with climate change, based on the following principles.

Firstly, the international community should make real joint efforts to deal with climate change. Climate change has all kinds of impacts on humankind. No single country can escape independently from its impacts, nor can it independently take on the heavy responsibility of coping with it. Therefore, international cooperation is the only way. However, international cooperation should be based on a full consideration of the reality of each country, its development stages, its historical obligations and its per-capita emission. Each country should face its own history squarely, focus on the present situation and look to the future to participate in dialogues and pragmatic cooperation in all aspects of dealing with climate change. Every member of the international community should understand that

helping others is also helping itself; harming others is also harming itself.

Secondly, all efforts to cope with the challenges of climate change should aim at sustainable development. Though climate change is an important environmental issue, it is, after all, an issue of development. Neither dealing with the challenges of climate change at the cost of development nor pursuing economic growth while neglecting the threats of climate change accords with the common interest of the international community.

The present climate change challenge is largely a consequence of long-accumulated greenhouse gas emissions by developed countries. Developing countries in general and the least developed countries in particular, are weak, with low capacity to adapt to climate change. It is unfair to leave them to suffer the serious consequences of climate change. Developed countries should change their consumption model, reduce their greenhouse gas emissions and assist developing countries to follow a sustainable development path in accordance with their respective national realities. In this way, both economic development and successful management of climate change will be organically unified.

Thirdly, the principle of common but differentiated responsibility should be adhered to. This principle, requiring developed and developing countries to fulfill different obligations in dealing with climate change, is a basic guideline for dividing responsibilities among members of the international community. Developed countries should face squarely their historical responsibility for the accumulation of greenhouse gas emissions and their high per-capita emissions by providing developing countries with financial, technical and capacity-building assistance. The international community should take into account fully the special concerns of developing countries in dealing with climate change. And on the other hand, developing countries, with the support from developed countries, should make the utmost effort to reduce their greenhouse gas emissions and make their due contributions to the mitigation and adaptation of climate change.

Fourthly, the Millennium Development Goals, as set forth by the UN, must be adhered to although there is still a long way to go in achieving them. At present, around one billion people in the world still live below the poverty line. It is the responsibility of all UN member countries to enable these people to share the benefits of human development and modern civilisation. The international community must understand that without the economic and social progress of developing countries, it is impossible either to realise the objective of dealing with climate change or keep in tact the prosperity and stability of the whole world.

Global actions to deal with climate change should promote rather than hinder economic development and poverty reduction in developing countries. They should help narrow rather than widen the income gap and technological divide between rich and poor countries. They should protect rather than harm fairness, justice and social harmony in the international community.

Endnotes

1. Retrieved from http://finance.people.com.cn/GB/42773/6584713.html, 28 November 2007.
2. Retrieved from http://invest.people.com.cn/GB/6827906.html, 28 January 2008.
3. Retrieved from http://www.cmwin.com/CBPResource/StageHtmlPage/A275/A275200711804128328.htm, 8 November 2007.

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Dr Prodipto Ghosh is Distinguished Fellow at The Energy & Resources Institute (TERI). He is a member of the Indian Prime Minister's Council on Climate Change, the National Expert Committee on Climate Change, the National Security Advisory Board, and a Scientific Consultant in the Office of the Principal Scientific Adviser to the Government of India.

He is also Chair of the Task Force on Climate Change of the Federation of Indian Chambers of Commerce and Industry (FICCI), and Senior Advisor to the World Bank on the Economics of Adaptation to Climate Change.

His past positions include Secretary to the Indian Ministry of Environment and Forests, economic advisor to the Prime Minister, and Senior Environment Specialist, Asian Development Bank.

Dr Ghosh has a PhD in Economics and Policy Analysis from the Carnegie-Mellon University, Pittsburgh PA and a BTech in Chemical Engineering from the Indian Institute of Technology, New Delhi.

The climate change debate: The story from India

2.4

Introduction

The debate on multilateral action on climate change between the developed and developing countries has been sharply polarised for a long time. If one may mix a metaphor with a descriptive term, India has been in the eye of this storm since the beginning of multilateral concern on climate change in the 1980s since it has invariably and forcefully brought in the 'development' and 'poverty eradication' sides of the argument. India seems not to buy into the response from many developed countries that the concern for the preservation of the planet's present climate supersedes the former, or that aggressive climate action is consistent with maintaining, or even improving growth rates.

Over time the positions of both sides, developed and developing, seem to have become further entrenched. In particular since the rejection by the United States (US) Congress of the Kyoto Protocol, stating that GHG (greenhouse gas) emissions mitigation action by the US would be negated rapidly unless 'key developing countries', that is China and India (but also Brazil, South Africa, Mexico and South Korea), also undertook similar actions. The US rejection and its stated grounds for it, have subsequently spawned a massive political effort by many developed countries, in particular the European Union (EU), Japan, Canada and, more recently, Australia, to reach a comprehensive global arrangement that would also include the US and these key developing countries. Other developing countries are not as serious a target of these efforts.

The main feature distinguishing these key developing countries from other developing countries is, of course, their size. Brazil is slightly smaller in size in terms of land area (8.514 million sq km) and about 60 per cent population (187 million) as that of the US (9.632 million sq km and 299.8 million), the largest developed country. India is slightly under four times the US in population (1,134.4 million), but with only about 34 per cent of its land area (3.287 million km^2 the area under crop agriculture is, however, about the same). China is more than four times the US in population (1,313 million), with about the same land area (9.598 million sq km).[1] Surely, the developed countries' argument goes, the rapid growth of these developing countries' economies, involving increased use of energy, would lead to such massive quantities of GHG emissions, that no matter how stringent the emissions curbs in developed countries, the planet's climate would, in short order, be at severe risk.

The broad response to this argument, which is immediately pointed out by these very countries, is that they are all still very poor.[2] No matter that they have experienced high gross domestic product (GDP) growth rates in recent times, their per-capita energy use (and consequently per capita GHG emissions) are a fraction of those of the developed countries. And in terms of the accumulations of GHG in the atmosphere, which is what actually leads to climate change, their responsibility is actually negative (see below). Moreover, endless media repetition has led to several myths being spread in developed countries about the alleged energy profligacy and environmental irresponsibility of these key developing countries.

This paper presents the gist of arguments being made by India, as one of the targeted key developing countries, but they also broadly reflect the concerns not only of that group but also of a much broader set of developing countries. Except for its scale, India is in most respects pretty typical of the poorer half of the developing world. However, before that, it needs to be clearly understood who exactly is responsible for climate change, and by how much.

Responsibility for anthropogenic climate change

It is widely accepted that the problem of climate change commenced with the industrial revolution, based on fossil energy, and gained momentum around 1850. Accordingly, to assign responsibility for the problem, one needs to start from this date.

It is often argued by developed countries that an emissions level of 2 tonnes CO_2 per capita globally would be (just) within the world's carrying capacity. This would provide a subsistence level of existence. Any emissions above this level should then count as responsibility for climate change.

Figure 1 presents the historical responsibilities for GHG emissions from 1850 to the present (extrapolated to 2010 based on current trends) for selected developed and developing countries. The historical responsibility of the US (30.5 per cent) is more than fully compensated by either India (–35.6 per cent) or China (–41.4 per cent). In point of fact, China and India together (–77.0 per cent) have provided the entire environmental space taken by all developed country parties in the aggregate (60.8 per cent) to the United Nations Framework Convention on Climate Change (UNFCCC).[3]

India's development challenges

Despite several impressive technological achievements for example, in space exploration, nuclear energy, information technology, automobile engineering and agriculture, and a thin sliver of prosperity and cosmopolitanism in its teeming metropolitan cities, India remains one of the world's poorest countries. Of the 1 billion+ population,[4] more than 800 million people (79.9 per cent of the population), a population larger than that of North America and EU combined, still subsist on less than US$2 per day. Within this group, more than 350 million people, about the population of the US, live on less that US$1 per day. More than 700 million people still cook on traditional cook-stoves using crop waste and animal residue. A majority of this group, more than 400 million people, live without electricity.

One of the enduring images of India's recently concluded general election is that of the rural poor mobbing Parliamentary candidates, demanding electricity so that their children could do their school homework. Electricity enables literacy, as well as healthcare, immunisation, safe water and sanitation, which would enable India to improve its human development indicators[5] (global rank:128; HDR value: 0.610; life expectancy at birth: 63.2 years; adult literacy rate: 61.0 per cent; GDP per capita: US$ in PPP 3,452), that are next only to Sub-Saharan Africa.

No country in history has improved its level of human development without a corresponding increase in per capita use of energy. To expect India to do so is unrealistic. At present, India's per capita energy consumption is about 20 per cent of the global average – just 4 per cent of US consumption and 28 per cent of China's consumption.

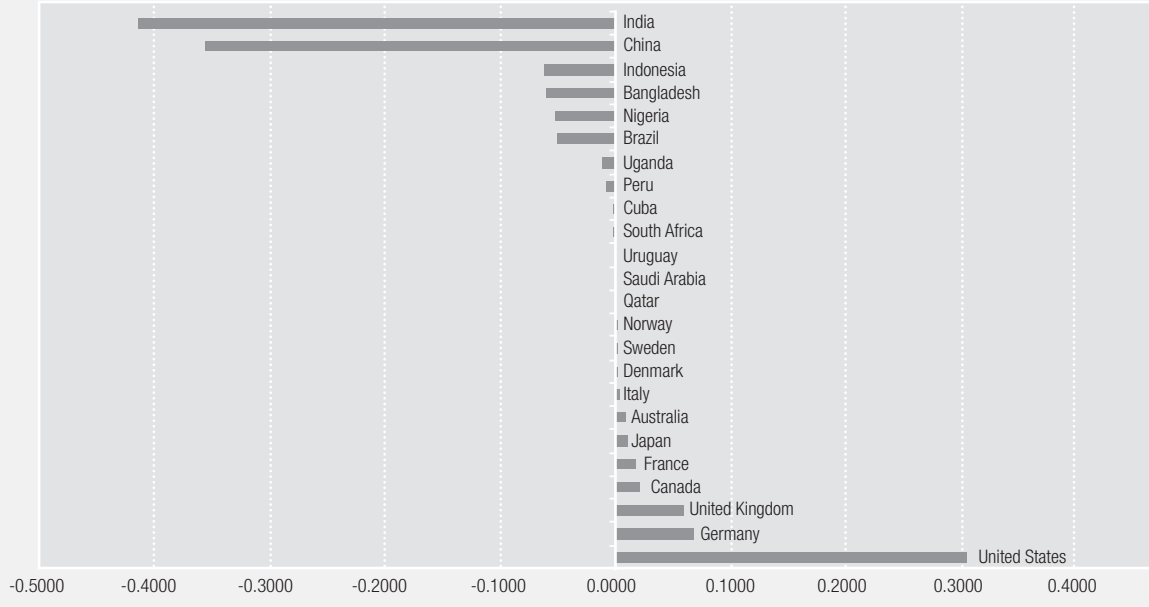
There are several myths circulating about India and climate change which are discussed below.

Myth 1: India has done nothing to promote clean energy and energy conservation

Many policymakers in developed countries acknowledge that while India's need for increased use of energy is legitimate, it should ensure that energy is used efficiently and that clean energy options are employed. By implication, the Indian government has done precious little on this front.

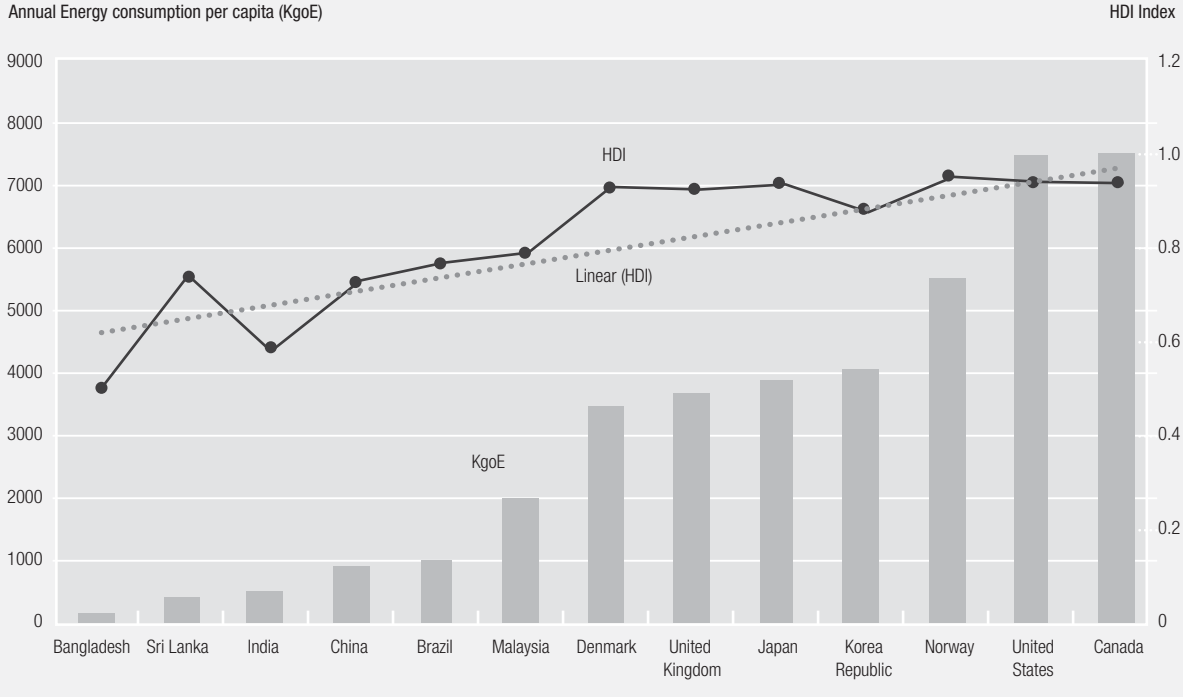
In fact, over several decades India has pursued policies backed by legislation, regulation, tariffs and publicly funded (almost entirely from domestic fiscal

FIGURE 1:
HISTORICAL RESPONSIBILITY OF SELECTED DEVELOPED AND DEVELOPING COUNTRIES
(ALLOWING FOR SUSTAINABLE LEVELS OF GHG EMISSIONS)



Source: TERI analysis (2009).

FIGURE 2:
AN INTERNATIONAL COMPARISON BETWEEN HUMAN DEVELOPMENT INDEX AND PER-CAPITA ENERGY CONSUMPTION



Source: World Development Indicators Database.

resources), and established programs focused on energy conservation and deployment of renewable energy technologies. Some of these are:

1. Reforming Energy Markets (Electricity Act 2005, Tariff Policy 2003, Petroleum & Natural Gas Regulatory Board Act, 2006 etc) involving:
   - removal of entry barriers and raising competition in exploration, extraction, conversion, transmission and distribution of primary and secondary energy;
   - instituting price reform; that is, full competition at point of sale; net back pricing for non-traded energy when domestic market is not competitive etc;[6]
   - tax reforms to promote optimal fuel choices;
   - augmenting and diversifying energy options, sources and energy infrastructure;
   - providing feed-in tariffs for renewables (solar, wind, biomass cogen); and
   - strengthening or introducing independent regulation.
2. New and Renewables Energy Policy, 2005: The policy promotes dependence on sustainable, renewable energy sources, accelerated deployment of renewables through indigenous design, development and manufacture.
3. Rural Electrification Policy, 2006: The policy promotes renewable energy technologies where grid connectivity is not possible or cost-effective.
4. Biodiesel Purchase Policy: The regulation mandates biodiesel procurement by petroleum companies.
5. Ethanol Blending of Gasoline: The regulation mandates 5 per cent blending of ethanol with gasoline from 1 January 2003 in nine states and four union territories.
6. Energy Conservation Act, 2001: The legislation aims to reduce specific energy consumption in different sectors, and sets up a specialised Bureau of Energy Efficiency (BEE) to institutionalise energy efficiency measures, monitoring, and measurement at plant and macro-levels.
7. Energy Conservation Building Code, 2006: This regulatory code, soon to become mandatory, is designed to ensure energy efficiency in all buildings with > 500 kVA connected load or air-conditioned floor area > 1000 m^2.
8. Bachat Lamp Yojana (Efficient Lamps Program): This is a country-wide program for replacement of incandescent lamps by compact fluorescent lamps (CFLs) in households using Clean Development Mechanism credits to equate the respective purchase prices. It also ensures safe collection and disposal of used CFLs.
9. 50,000 MW Hydroelectric Initiative, 2003: Some 17 per cent of India's electricity is currently generated by hydropower. Additionally, 162 new hydel projects, totaling 50,000 MW, have been identified for project preparation and several are already under implementation.
10. Several other programs: These include: promotion of solar thermal water heaters, solar PVs, wind-power generation, biomass gasifiers, biogas and manure management, promotion of fuel cells, energy recovery from urban wastes etc.

In addition, an Integrated Energy Policy, as an overarching framework, was adopted in 2008. Key provisions of the policy include:

- promotion of energy efficiency in all sectors;
- emphasis on mass transport;
- emphasis on renewables, including biofuels and fuel plantations;
- accelerated development of nuclear and hydropower Technology Missions for Clean Energy; and
- focused R&D on several climate change related technologies.

In addition, in specific economic sectors, a number of policies and programs have important positive implications for GHG emissions mitigation. Several of these are presented schematically in Table 1.

Myth 2: India remains an energy profligate

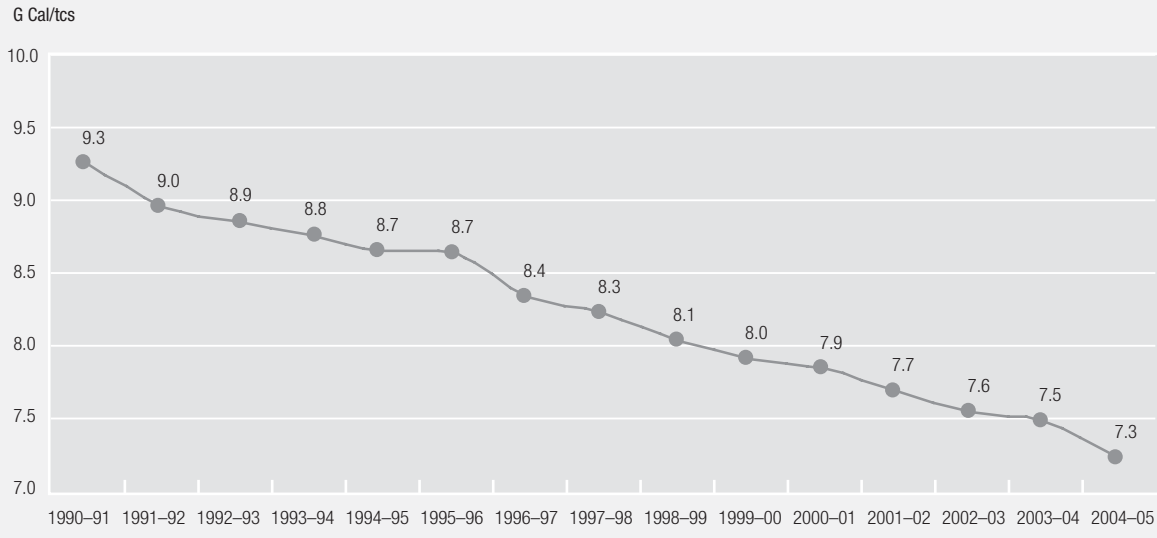
Regardless of actions taken by India to promote energy efficiency and clean energy choices, an impression persists among many scholars and policymakers in developed countries that these actions have not 'worked', or are inadequate, or are poorly implemented. Therefore the consequence being that India is a profligate user of energy, in the sense that India uses much more energy per unit of output (with consequent higher GHG emissions), than would be considered respectable in developed countries. Hopefully, the following data will dispel this impression.

Consider first, integrated steel plants, one of the industrial sectors involving large-scale energy use and shown in Figure 3.

It would be apparent that in the decade and half to 2005, specific energy consumption in this sector declined sharply. The average decline was, in fact, more than 22 per cent. Accompanying this decline is an increasing share of the 'direct reduction' steel making technology. In fact, the newer Indian steel plants are among the most energy efficient globally.

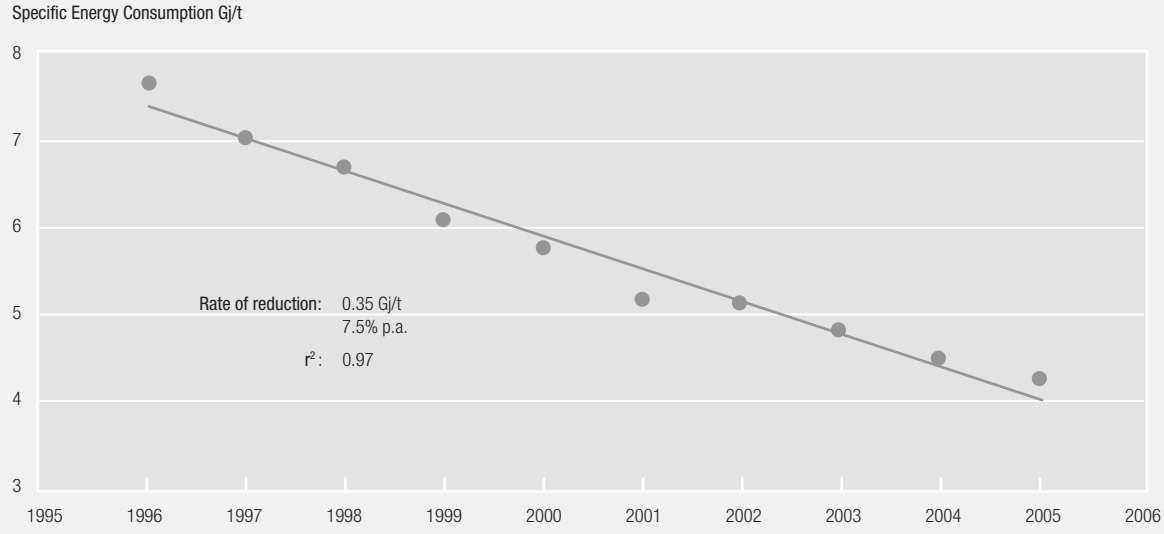
Consider next, another major energy using sector, cement. The annual decline in average specific energy consumption in the decade to 2006 is 7.5 per cent (Figure 4). Two of the most energy efficient cement plants in the world are in India.

FIGURE 3:
AVERAGE SPECIFIC ENERGY CONSUMPTION IN INTEGRATED STEEL PLANTS



Source: The Steel Authority of India (2006).

FIGURE 4:
CEMENT SECTOR ENERGY TRENDS



Source: Bureau of Energy Efficiency, India (2007).

The situation is similar in the fertilizer sector, Figure 5. This sector has witnessed on average 26 per cent and 25 per cent improvements in specific energy consumption in ammonia and urea plants, respectively, in the 15 years to 2003. In that year, the top 25 per cent of Indian fertilizer plants were more energy efficient than the top 25 per cent in the world. The best ammonia plant in India had a specific energy consumption of 7.2 GCal/ton, compared to the world's best of 7.0 GCal/ton. The industry association of the fertilizer sector has set a near-term target of 6.5 GCal/ton.

The picture is similar in respect of other major energy using sectors; for example, aluminum, paper, power plants, petroleum refining. The world's most energy efficient refinery, according to Shell, and also the world's largest, is located in Gujarat, India.

TABLE 1:
INDIAN POLICIES AND PROGRAMS IMPACTING ON GHG EMISSIONS MITIGATION

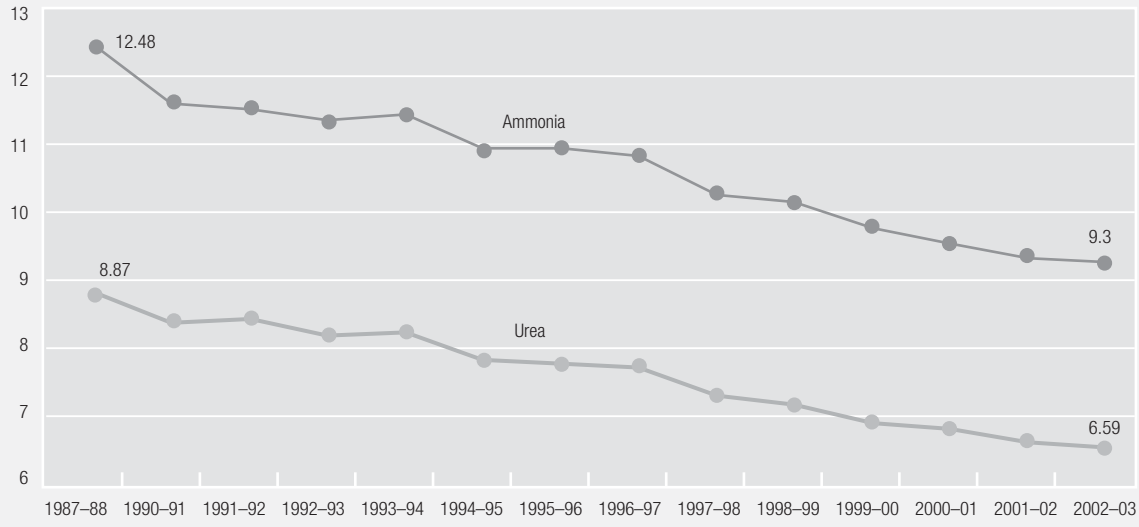
SECTOR	POLICIES	PROGRAMS AND SCHEMES
Energy	Integrated Energy Policy Electricity Rules 2005 Tariff Policy Coal Conservation and Development Act 1974 Petroleum and Natural Gas Rules 1959 The Oilfields (Regulation And Development) Act 1948 Biodiesel Purchase Policy 2005 The Electricity Act 2003 Rural Electrification Policy (Approach to Rural Electrifications) Energy Conservation Act 2001 Integrated Coal Policy 1996 Petroleum & Natural Gas Regulatory Board Act 2006 New and Renewable Energy Policy	Distribution Reforms and Upgradation Management (DRUM) Bachat Lamp Yojana Remote Village Electrification Solar Thermal Energy Programme Solar Energy Biomass Power Programme National biogas and Manure Management Programme (NBMMP) Hydrogen Energy (R&D) 50,000 MW Hydro Electric Initiative Energy Recovery/Power Generation from Industrial and Commercial Wastes and Effluents National Gas Hydrate Programme (NGHP) Ethanol Blended Petrol Programme Integrated Rural Energy Programme Village Energy Security Programme Solar photovoltaic (SPV) Programme National Biogas Programme Biomass Gasifier Programme Biomass Energy and Co-generation (Non-Bagasse) in Industry Fuel Cells (R&D) Energy Recovery from Urban Wastes New Technology Group for the year 2006–07 (Continuation of Programme/Schemes–MNRE) Special Area Demonstration Programme (SADP)
Environment	Charter on Corporate Responsibility for Environmental Protection (CREP) The Municipal Solid Wastes (Management and Handling) Rules 2000 Recycled Plastics Manufacture and Usage Rules 1999 (as amended 2003) Batteries (Management and Handling) Rules 2001 Forest (Conservation) Act 1980 Ozone Depicting Substances (Regulation and Control) Amendment Rules Bio-Medical Waste (Management and Handling) Rules 1998	Mangrove Conservation Programme National Afforestation Programme (NAP) Econ-Development Forces (EDF) Ozone Cell Regeneration and Eco-Development Grant-in-aid for Greening India Joint Forest Management Cell (JFM)
Science and technology		*Science & Technology Application Programme* a) Science & Techonolgy Application for Rural Development (STARD) b) Science & Technology Application for the Weaker Sections (STAWS) *Integrated Village Development* ii. Coordingated Programmes iii. Non-Edible Oils (NEO) *State Science A Technology Programme (SSTP)* * Technology Development Programmes * Technology Systems Programme * Joint Technology Projects Under Science and Technology Advisory Committee Mechanism (STAC/IS-STAC) *Technology business incubators*

TABLE 1:
INDIAN POLICIES AND PROGRAMS IMPACTING ON GHG EMISSIONS MITIGATION

SECTOR	POLICIES	PROGRAMS AND SCHEMES
Housing and urban development	Constitution (Seventy-Fourth Amendment) Act 1992 Model Municipal Law	Jawaharlal Nehru National Urban Renewal Mission (JNNURM) Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) Tax Free Municipal Bonds
Transport	Motor Vehicles Act, 1988 National Auto Fuel Policy National Urban Transport Policy, 2006 Central Motor Vehicles Rules, 1989 Integrated Transport Policy, 2001 Pollution Under Control (PUC) 2004	
Biotechnology		DBT Biofuels Programme DBT Programmes on Environmental Biotechnology
Industry	New Industrial Policy Industries (Development and Regulation) Act Indian Boiler (Second Amendment) Regulation 2006 National Jute Policy, 2005 National Steel Policy, 2005 Gas Cylinder Rules Indian Boilers Act 1923 National Textiles Policy (NTxP), 2000 Micro, Small and Medium Enterprises Development Act, 2006	Integrated Development of Leather Sector (IDLS) Technology Mission on Cotton (TMC) Indian Leather Development Programme (ILDP) Integrated Technology Upgradation and Management Programme (UPTECH) (renamed as "Small Industry Cluster Development Programme"), 1998 Technology Upgradation Fund Scheme (TUFS) Industrial Infrastructure Upgradation Scheme (IIUS), 2003 Tannery Modernisation Scheme, 2000 Jute Technology Mission (JTM), 2003-04 to 2008-09
Agriculture	National Agriculture Policy	Technology Mission on Oilseeds, Pulses and Maize Inter-Ministerial Task Force on Integrated Plant Nutrient Management Using City Compost Integrated Development of Tree Borne Oilseed by NOVOD Board
Land resources		Drought Prone Area Programme Integrated Wasteland Development Programme (IWDP) Started in 1989–90 Watershed Development fund Soil Conservation for Enhancing Productivity of Degraded Lands in the Catchment of River Valley Projects and Flood Prone Rivers Desert Development Programme (DDP) National Watershed Development Project for Rainfed Areas (NWDPRA) Watershed Development Programme in Shifting Cultivation Areas (WDPSCA) Western Ghats Development Project (WGDP) and Hill Area Development Programme (HADP)
Water supply and sanitation	National Water Policy (September 1987)	Accelerated Rural Water Supply Programme (ARWSP) Central Rural Sanitation Programme (Total Sanitation Campaign)
Rural development		Pradhan Mantri Gram Sadak Yojan Special Central Assitance for Tribal Welfare Rural Housing Programme: India Awaas Yojana
Mining	National Mineral Policy, 1993 Mines And Minerals (Development And Regulation) Act, 1957	

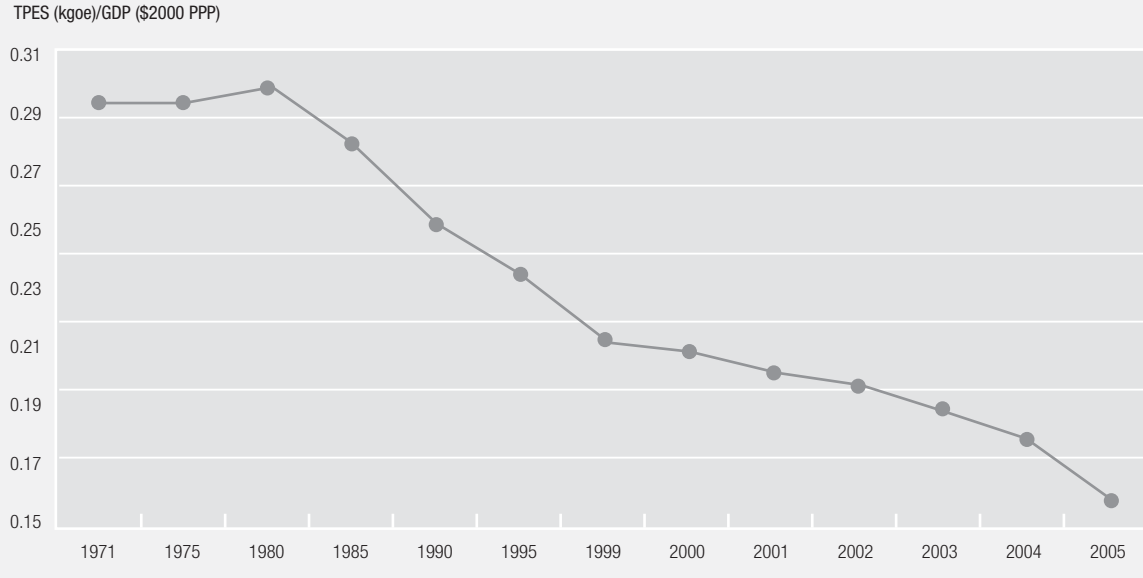
Source: FICCI Task Force on Climate Change (2007).

FIGURE 5:
TRENDS IN SPECIFIC ENERGY CONSUMPTION IN THE FERTILIZER (AMMONIA AND UREA PLANTS) SECTOR



Source: Fertilizer Association of India 2008.

FIGURE 6:
INDIA'S ENERGY INTENSITY TRENDS

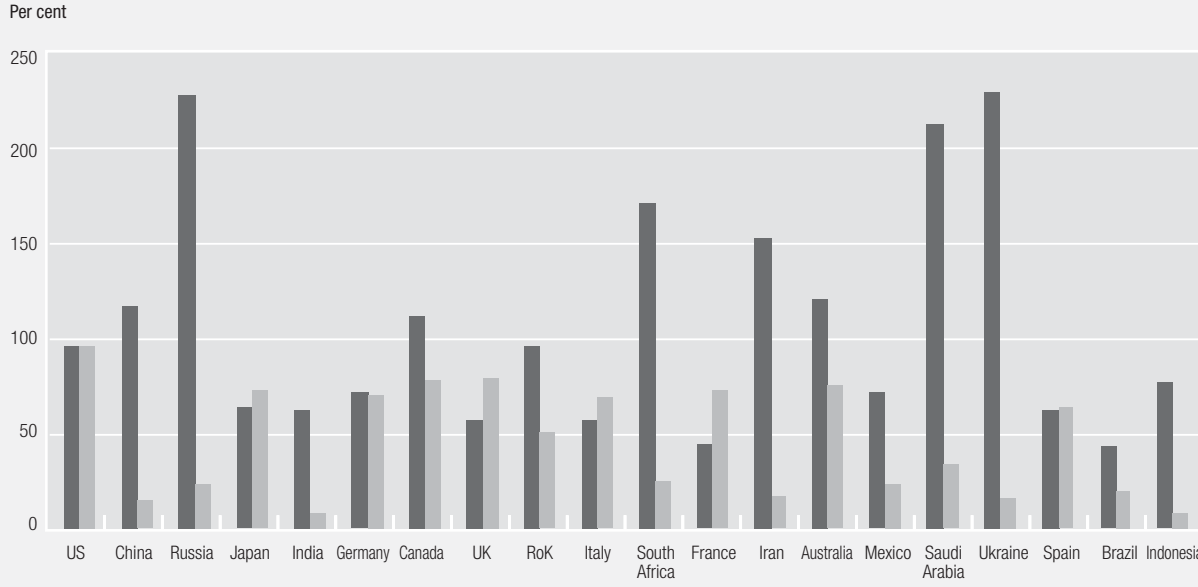


Source: International Energy Agency, Paris, Database (2006).

The sectoral situations are also reflected in the macro-level picture. Since the mid-1980s, India's energy intensity (ie, energy consumed per unit of GDP at PPP) has declined continuously and currently is comparable to EU countries, according to data from the International Energy Agency.[7] Figure 6 bears this out.

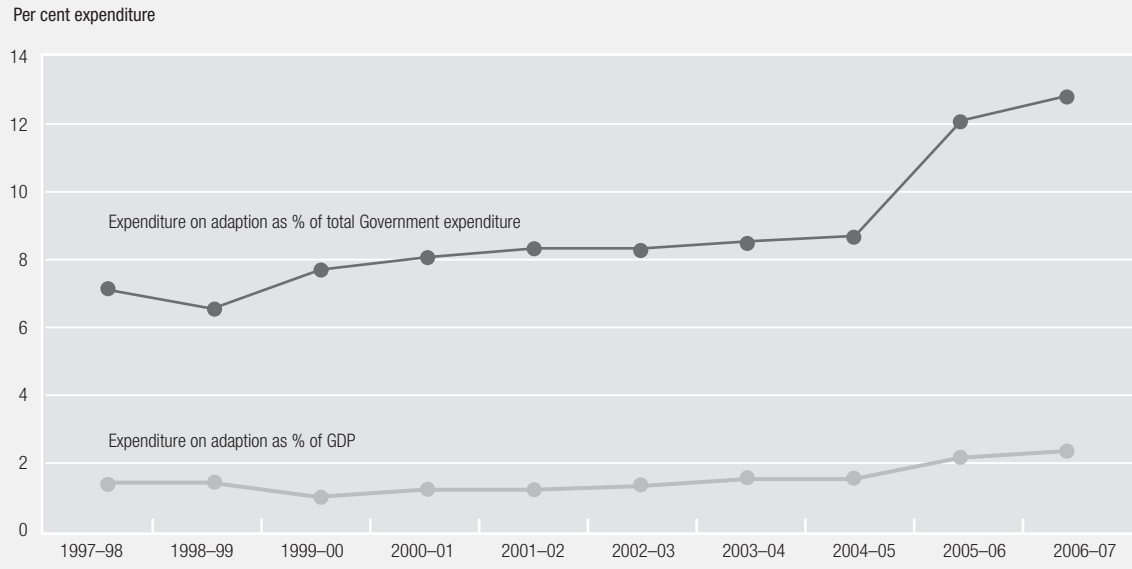
There is an even more interesting comparison. A World Bank study published in 2007 looked at the fossil fuel CO_2 intensities of the world's 20 largest economies. A graphical presentation of the findings is given below in Figure 7.

FIGURE 7:
FOSSIL FUEL CO_2 INTENSITIES AND GDP PER CAPITA OF THE WORLD'S 20 LARGEST ECONOMIES



Source: Data in 'Growth and CO_2 Emissions – How do different countries fare?',Roger Bacon and Soma Bhattacharya, World Bank (2007).

FIGURE 8:
ANNUAL CENTRAL GOVERNMENT EXPENDITURES TO ADDRESS CLIMATE VARIABILITY



Source: Data from Government of India Budget Documents, several years.

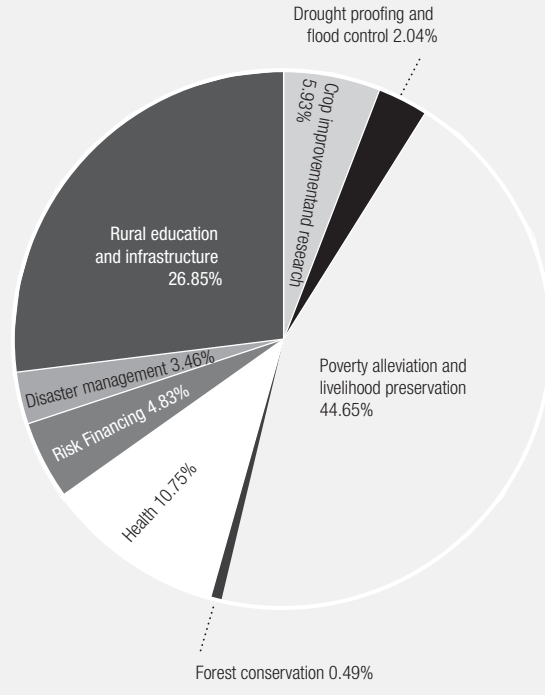
The data is scaled in respect of both CO_2 intensities and GDP per capita in terms of percentage of the corresponding US figure. A brief examination reveals that there is no basis for the common belief in developed countries that they have lower CO_2 intensities per unit of GDP than developing countries. Indeed a formal regression analysis reveals no statistically significant correlation. However, note the CO_2 intensity data for India: It is better than Germany's and about the same as Japan's, universally cited as the world's most energy efficient economy.

Myth 3: India is unconcerned about its vulnerability to the impacts of climate change

Another common belief in developed countries is that India's alleged inaction on curbing GHG emissions stems from an irresponsible mind-set among its policy-makers that India need not fear the ravages of climate change. Is there any basis for this belief?

India has been highly vulnerable to climate variability (floods, droughts, cyclones, ocean surges) for millennia. Not just the present-day policy-makers, but the erstwhile British administrators and before them, successive Indian dynasties who over the centuries grappled with the impacts of the fickle climate. For many decades, India has seen major, publicly funded programs to address both the direct impacts, or prevention and control, of climate risks. In addition, other major public programs that focus on creating of infrastructure or poverty eradication had a major objective of the reduction of vulnerability to climate risks. At present, India's Central (Federal) Government, spends no less that 12 per cent of its annual budget, or 2.63 per cent of the GDP, on these programs. In point of fact, this is more than India's annual defence expenditure. Figure 8 provides some recent data on the aggregate expenditures, while Figure 9 shows the program areas where the money has been spent. The program areas were identified on the basis that each program would have among its stated objectives, reducing vulnerability to climate variability.

FIGURE 9:
WHERE THE MONEY WENT



Source: Data from Government of India Budget Documents, (2007–08).

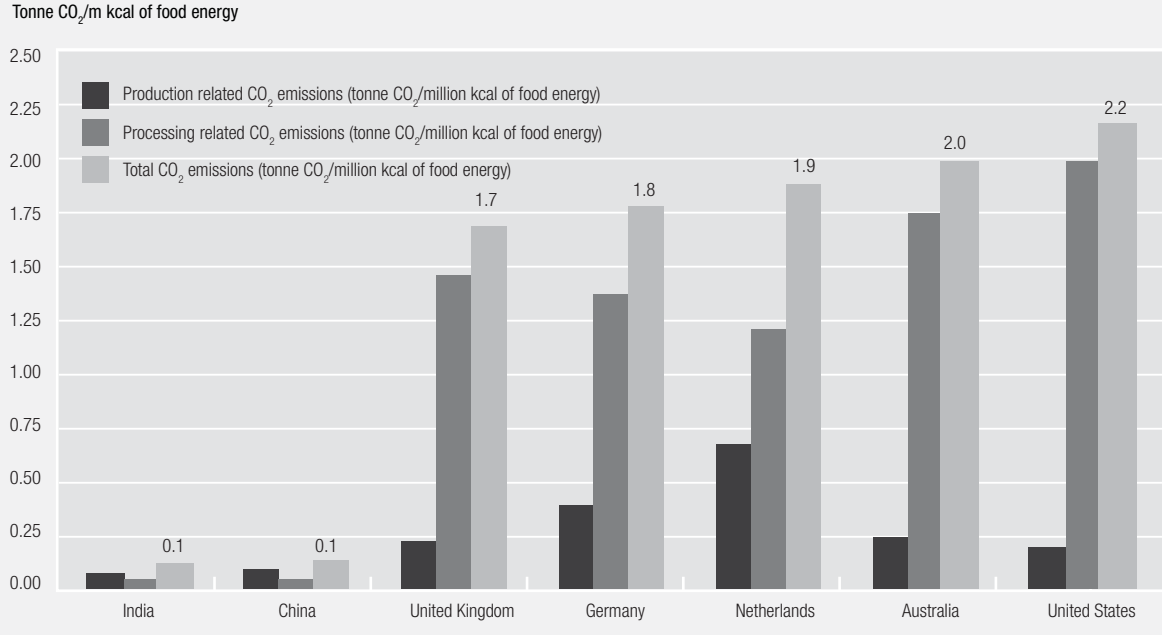
Myth 4: India is an environmentally unsustainable economy

A curious perception is that India's low level of current and historical responsibility for climate change simply reflects its large-scale poverty, and as people become wealthier they would quickly assume the life-styles prevalent in developed countries, but without the attendant environmental safeguards. The view does not account for the strong environmental ethic, specifically a 'waste not' mindset and deep reverence for nature and all living forms, that is deeply embedded in the culture of Indian people. This remains unchanged with increased prosperity. Nor does it reflect awareness of the comprehensive policy and regulatory structure, besides publicly funded programs, that are in place to address environmental concerns. Some international comparisons are given below to illustrate: first, the fact that India has a strong environmental performance in terms of key sustainability parameters which are indexed to eliminate the effects of incomes; and second, the outcomes are traceable to environmental interventions by the government.

In the case of India and China, the CO_2 emissions from the food sector per kCal of food are an order of magnitude below that of the developed countries shown. A break-up of the GHG emissions in each case into the respective contributions of the food production and food processing components (including packaging) show that in the case of developed countries, the latter dominates the CO_2 emissions. Indians prefer fresh produce to processed food, and irrespective of economic status, buy fresh produce each day. Moreover, there is very little meat consumption (in terms of percentage of daily caloric intake from meat), and this remains true even when people become richer.[8]

Figure 11 displays comparative data on recycling rates of municipal waste for India and three developed countries.[9] India is well-ahead of even Japan, the developed country with the most aggressive regulations to promote recycling. What accounts for India's performance? Very simply, India has a long cultural tradition of recycling (as well as repair and reuse). Even wealthy households recycle everything possible – paper, metal, glass, plastic. A well-established network of non-formal sector recyclers visits every household at least once a month to buy recyclables from households. Stripped bare of recyclables, the actually disposed municipal

FIGURE 10:
CO_2 EMISSIONS FROM THE FOOD SECTOR



Source: TERI analysis (various data sources).

FIGURE 11:
RECYCLING OF SOLID WASTE AND WASTE RELATED EMISSIONS

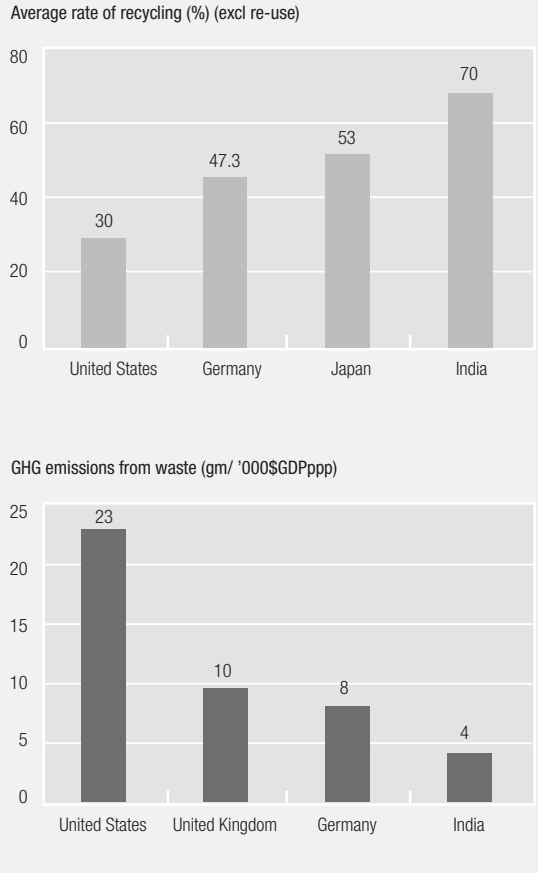
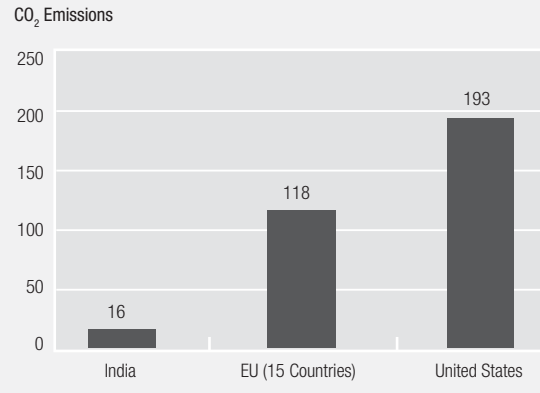


FIGURE 12:
CO_2 EMISSIONS FROM PASSENGER TRANSPORT



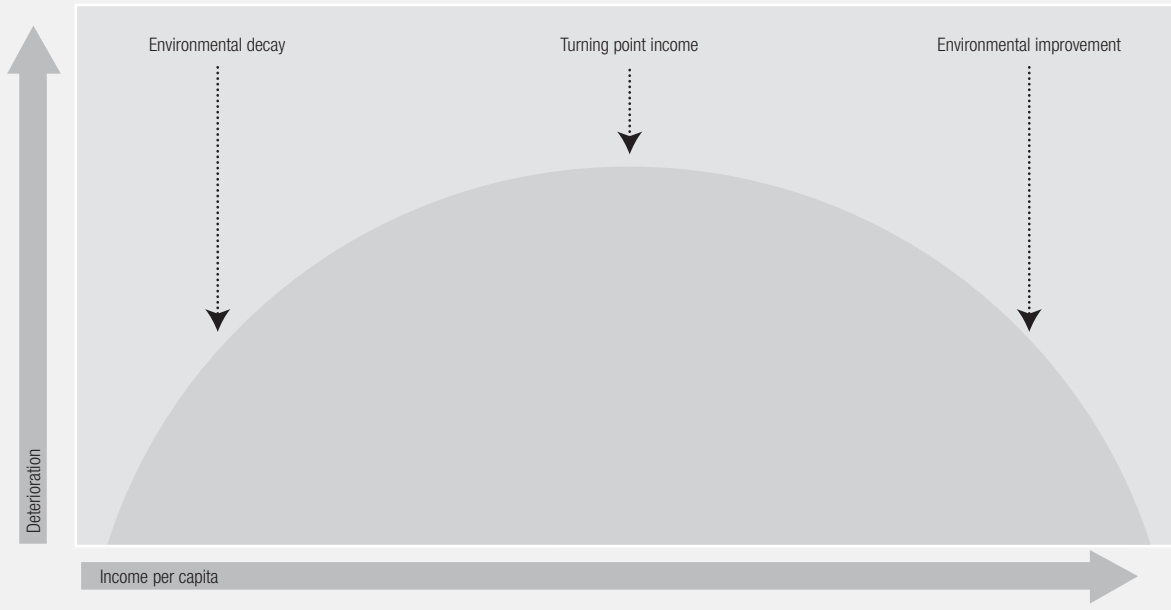
Source: TERI Analysis, 2005, various data

garbage consists mainly of kitchen waste, which is largely made into compost, rather than land-fill.

Another indicator of sustainability is CO_2 emissions from passenger transport.

A comparison is presented in Figure 12 of data from India, EU-15 and the US on CO_2 emissions per passenger-kilometer of transport use. Again, India's emissions are less than one-seventh of EU-15 and just one-twelfth of the US. What accounts for this enormous difference? Notwithstanding recent increases in private vehicle ownership, public and mass-transport,

FIGURE 13:
ILLUSTRATION OF THE CONCEPT OF ENVIRONMENTAL KUZNETS CURVE



(ie rail and bus) account for the major share of transport demand, including the annual incremental increase. Even in respect of automobiles there is a strong cultural preference for fuel-efficient vehicles[10] (ie cars and two-wheelers). Also there is a rapid increase in the use of vehicles powered by natural gas and more recently, especially in the case of two-wheelers, electric vehicles.

There are numerous other dimensions of India's culture that are conducive to sustainability. Most Indians are, in fact, not vegetarians, but almost all Indians are mostly vegetarian, signifying that only a small proportion of daily calorie intake is from foods of animal origin. Indians bathe twice a day, every day, but with a single bucket of water (25 litres). They switch-off all appliances promptly when not required.[11] They do not waste food. These habits do not change when Indians become richer, for instance, they do not consume more meat. The National Geographic's Greendex, which evaluates a large set of developed and developing countries for environmental sustainability, has in May 2009, ranked India as the world's most environmentally sustainable society.[12]

A further demonstration of sustainability is provided by a comparison of the so-called Environmental Kuznets Curve (EKC) of India and some other countries. The EKC reflects a near-universal phenomenon that as countries grow, their environmental parameters at first worsen and then improve as higher incomes raise public environmental consciousness, and also enable public resources to be spent on environmental management. A typical turning point for developed countries in respect of several sustainability parameters is an income level of approximately US$6000–7000 (PPP). The concept of the EKC is illustrated in Figure 13.

In the following tables, estimates made by various authors are presented of the turning points (in terms of per-capita incomes) of statistically estimated EKC curves for India and several other countries.

Table 2 presents the estimates of the EKC turning points for India and a set of 32 countries, which include both developed and other developing countries, for two key municipal wastewater parameters in the receiving waters. The estimated turning points for India, by various authors, are much less than for the set of 32 countries.

Similarly, Table 3 gives the estimated EKC turning points for several key urban air quality parameters (ie sulphur dioxide (SO_2), suspended particulates (SPM) and nitrogen oxides (NOx)). Once again, the estimated turning points in the case of India are much lower than for the other sets of countries.

Similarly, Table 4 presents estimates of the EKC turning points for India and several other country groups in respect of energy intensity of the GDP. All three developing countries (Bangladesh, India, Sri Lanka) accomplished their turning points at much lower income levels than the three developed countries (Japan, Norway, Switzerland). Of all countries, the turning point in respect of India was at the lowest per-capita income level.[13]

TABLE 2:
EKC ESTIMATES OF TURNING POINTS FOR INDIA AND A SET OF 32 COUNTRIES (DEVELOPED AND DEVELOPING) FOR WASTEWATER TREATMENT

	COUNTRIES	BIOLOGICAL OXYGEN DEMAND	CHEMICAL OXYGEN DEMAND	WASTEWATER
Mukherjee and Kathuria^ (2006)	India		$523	
Grossman and Kueger^ (1995)	Up to 32 countries	$7,623	$7,853	
Chandra Sahu and Bali^ (2006)	India	$2,369		
Narayanan and Palanivel^^ (2003)	India	$65**		
Current Study	India	$548 and $2,388*	$1,668**	$3,150 (CI cities) $1,694 (CII cities)

Notes: ^ In 1985 US $. ^^ In 1995 US $.
"CI" cities refers to Class I cities (5 metros), and "CII cities" refers to Class II cities – in India cities are classified in terms of size.
For the study by MK, a composite index of pollution including 63 environmental indicators has been used as the dependent variable.
"Current study" refers to a TERI Study, 2008.

TABLE 3:
AIR QUALITY: COMPARISONS OF EKC TURNING POINTS FOR INDIA AND SEVERAL OTHER COUNTRY GROUPS

	COUNTRIES	SO_2
Mukherjee and Kathuria^ (2006)	India	$523
Cole et al^ (1997)	11 OECD	$6,900
Gorssman and Krueger^ (1993)	Up to 32 countries	$4,107
Gorssman and Krueger^ (1995)	Up to 32 countries	$4,053
Panayotou^ (1995)		$3,000
Panayotou^ (1997)	30 developed and developing	$5,000
Seidon and Song (1994)	22 OECD and 8 developing	$10,700
Shafik and Bandhapadhya^ (1994)	31 countries	$3,670
Our estimates*	India:	
	– industrial,	$1,695
	– transport	$957
	– residential	$1,752

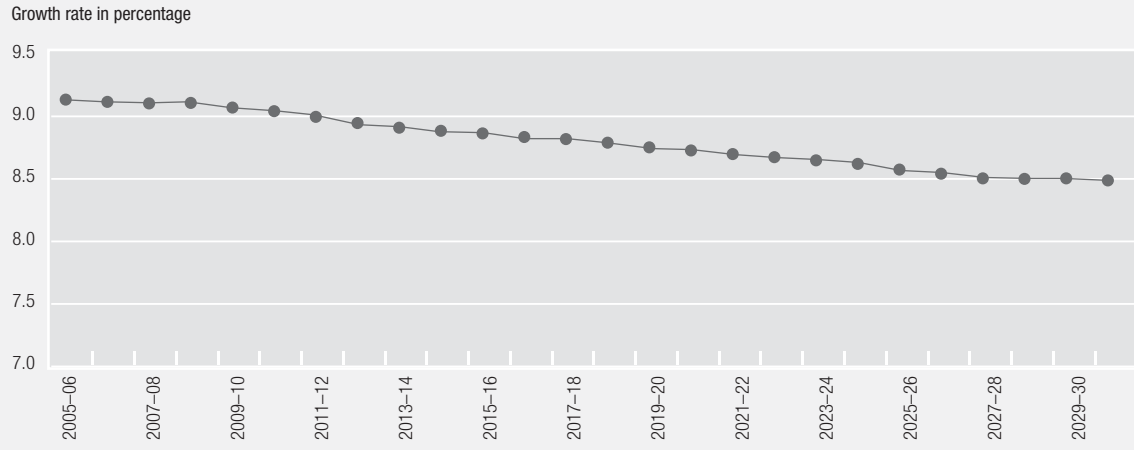
^ In 1985 US $.
* Industrial, transport and residential sectors, respectively for the study by MK, a composite index of pollution including 63 environmental indicators has been used as the dependent variable.

TABLE 4:
ENERGY INTENSITY OF GDP: EKC TURNING POINTS FOR INDIA AND SEVERAL OTHER COUNTRIES

	SPECIFICATION	SHAPE	TURNING POINT	CURRENT INCOME*
Bangladesh	Quadratic	EKC	$1,377	$1,827
India	Country	EKC	$501	$3,072
Japan	Quadratic	U	$22,675	$27,817
Netherlands	Linear	Monotonically decreasing	–	$29,078
Norway	Quadratic	EKC	$10,274	$36,849
Pakistan	Linear	Monotonically decreasing	–	$2,109
Sri Lanka	Quadratic	U	$4,092	$4,088
Sweden	Linear	Monotonically decreasing	–	$28,936
Switzerland	Quadratic	EKC	$26,122	$31,701
UK	Linear	Monotonically decreasing	–	$29,571

*GPD per capita at constant 2000 international $, PPP 2005
Note: Where the EKC curve is stated to be 'monotonically decreasing', sufficient past data has not been available to estimate the turning points.
Source: TERI Study (2008).

FIGURE 14:
TREND OF GDP GROWTH RATE TO 2030: CGE MODEL SIMULATION

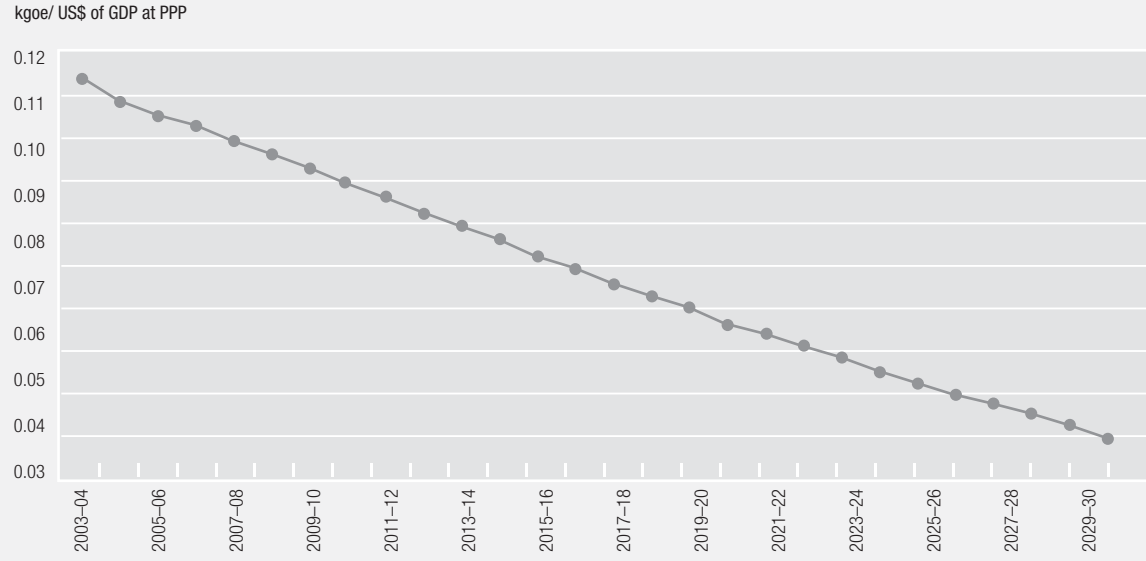


Source: NCAER Study, 2009

Myth 5: Never mind the past, in the future India's GHG emissions will grow uncontrollably

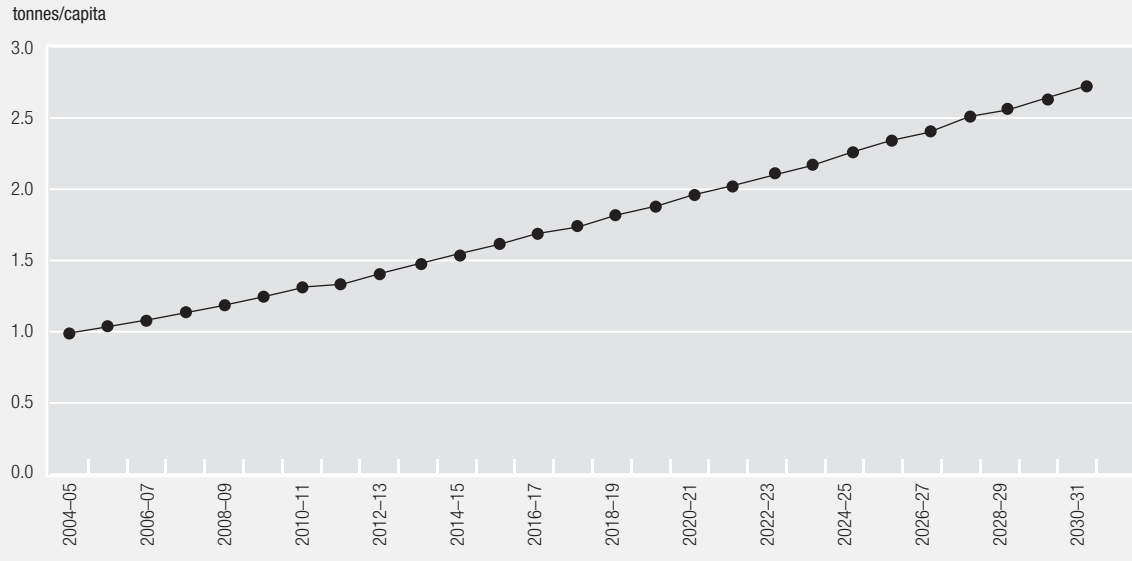
The fact of India's recent high GDP growth rate (approximately 7 to 8 per cent per annum for the last decade, prior to the global economic downturn) makes some people in developed countries nervous that over a generation, this would result in extremely high levels of GHG emissions. Some modelling studies carried out by institutions in developed countries, which essentially extrapolated the experience of the developed countries in an earlier era, indeed seem to suggest that this might be the case. Essentially, these studies neglect the fact that the rapid decline of India's energy intensity (and all modelling results show that the energy intensity of the

FIGURE 15:
TRENDS IN ENERGY INTENSITY OF GDP TILL 2030: CGE MODEL SIMULATION



Source: NCAER Study (2009).

FIGURE 16:
TRENDS IN PER-CAPITA CO_2 EMISSIONS TILL 2030: CGE MODEL SIMULATION

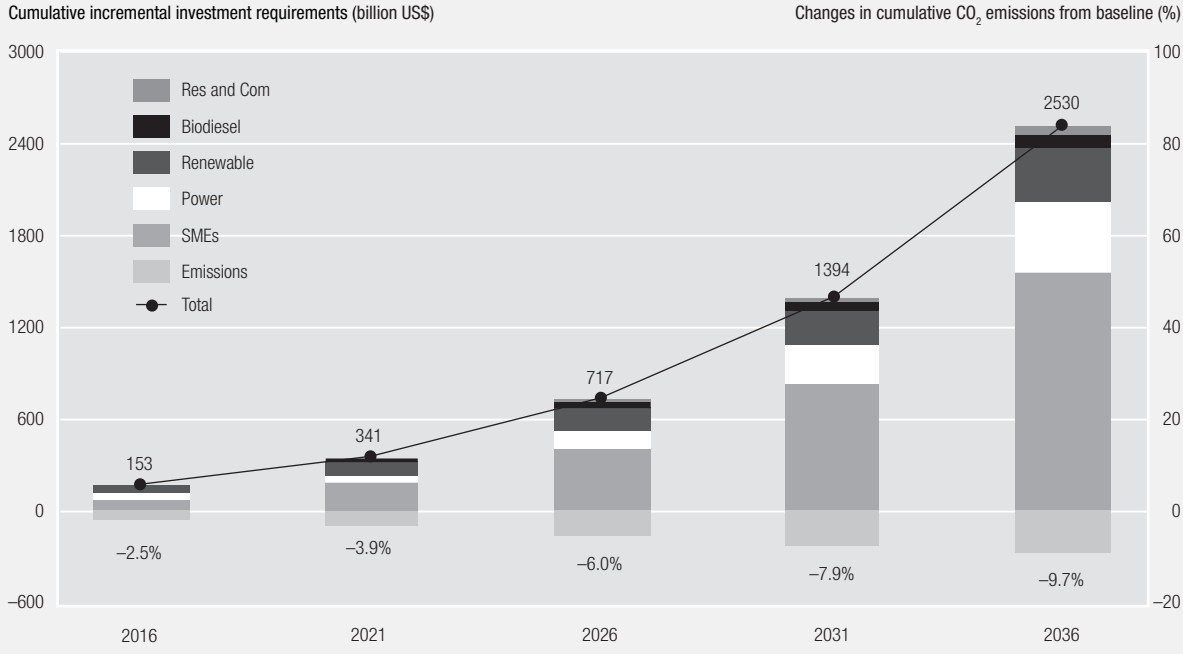


Source: NCAER Study (2009).

economy will continue to decline), will result in a GDP growth rate of 8 per cent per annum being accomplished at no more than 3.7 per cent increase in energy use. This will significantly moderate the growth of energy use in India.

A Computable General Equilibrium (CGE) modelling study by the National Council of Applied Economic Research (NCAER), New Delhi, which accounts for the observed increasing energy efficiency (as well as increased efficiency of production sectors generally) provides some interesting results. First, in the period till 2030–31, the trend rate of GDP growth remains in the range of 8.5 to 9 per cent per annum, assuming that recently observed annual energy efficiency increase[14] of 1.5 per cent and overall efficiency of resource use[15] continues at 3 per cent per annum. This is shown in Figure 14. At the same time, under these assumptions, GDP energy intensity continues to decline, from

FIGURE 17:
MARKAL SIMULATIONS OF COSTS OF GHG EMISSIONS MITIGATION IN FIVE SECTORS



Source: TERI study (2005).

0.11 kgoe/US$ GDP[16] in 2003–04 to 0.04 kgoe/US$ GDP in 2030-31. This is shown in Figure 15.

Further, far from a runaway growth of CO_2 emissions,[17] the Indian per-capita CO_2 emissions grow only modestly, from 1.0 tonnes per-capita in 2004–05 to 2.77 tonnes per-capita[18] in 2030–31. This may be compared with the 2005 global average CO_2 emissions of 4.22 tonnes per capita in 2005 (Figure 16). In other words, even after a whole generation of high growth, India's per-capita GHG emissions would be well below today's global average.

If this result seems implausible, it may be added that a recent World Bank study[19], *India: Low Carbon Growth*, using a different model, has arrived at virtually identical results.[20]

Myth 6: What is all the fuss about? Reducing GHG emissions pays for itself or, at best, is low cost

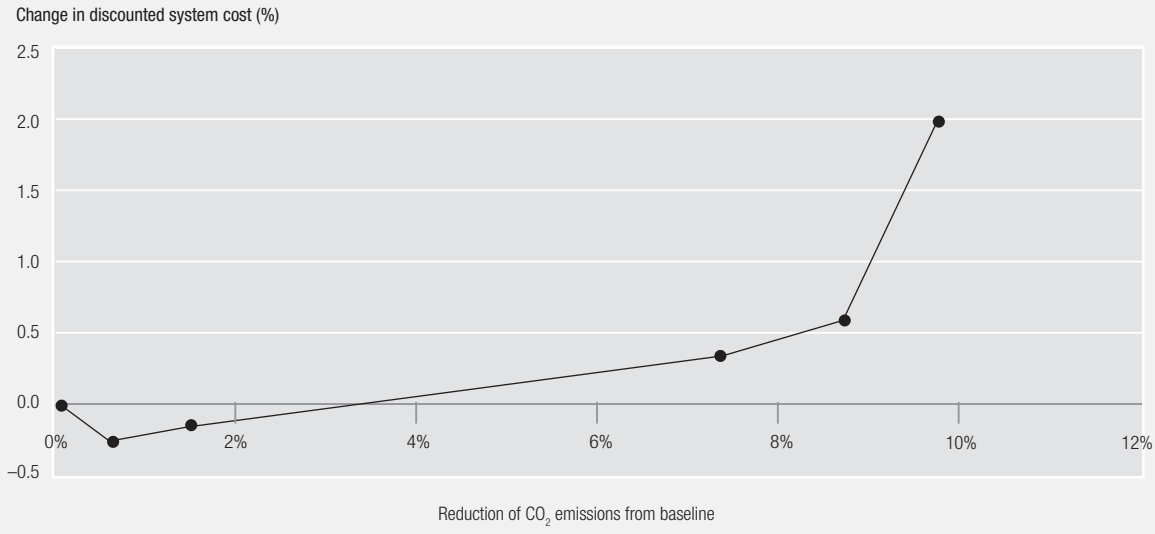
There is a widespread view that developing countries in general, and India in particular, are under a serious misconception that reducing GHG emissions, or at least limiting their growth rates, will adversely impact their economies. What does actual empirical research say on this issue?

Figure 17 presents the result of simulations of the MARKAL[21] model to evaluate the potential and costs of GHG emissions mitigation in five sectors, (small and medium enterprises (SMEs), (conventional) power, renewable energy, residential and commercial, and biodiesel) in the period 2016–36. The maximum GHG emissions reductions from the baseline that are feasible are just 9.7 per cent. The incremental investment costs of doing so are US$2.3 trillion. The only way India could meet this additional increment cost on its own is by diversion of development resources – from schools, hospitals, village roads, railways, mass transport, immunisation, child nutrition, maternal mortality, and so on.

What of the increased energy costs, if any, of the 9.7 per cent from baseline GHG emissions mitigation accomplished? Figure 18, gives the results of the same simulation in this respect. About 3 per cent GHG emissions reductions from the baseline (far left of graph) may be accomplished with reduced energy costs. For the aggregate 9.7 per cent GHG emissions mitigation from baseline in 2036, the discounted economic costs are US$180 billion.

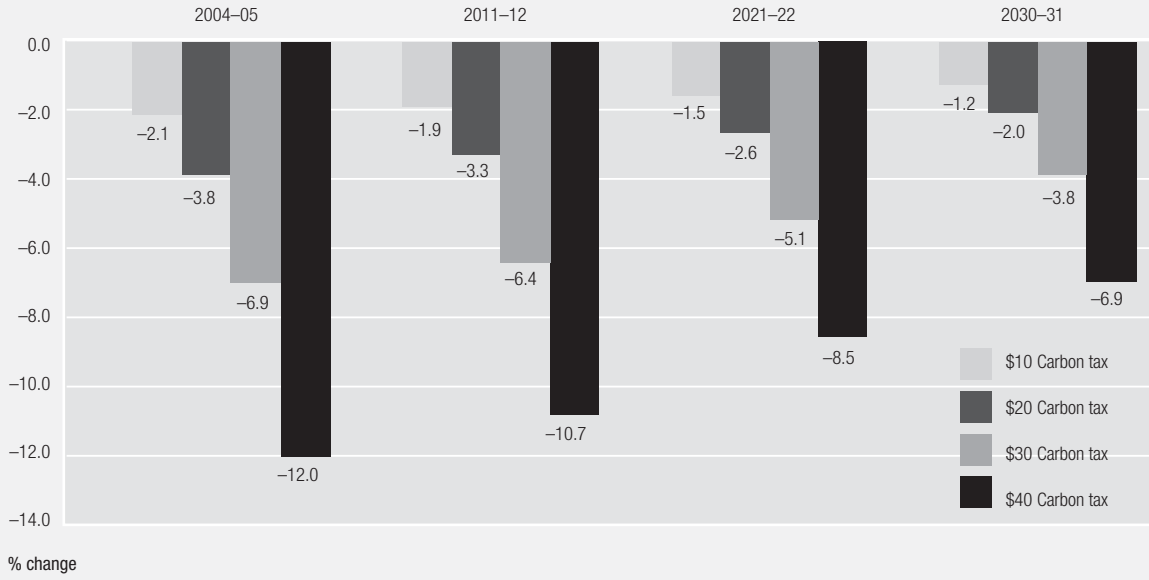
The diversion of investment resources to GHG emissions mitigation from other sectors has adverse implications for economic growth, as well as for poverty levels. Figure 19 presents the results of the simulation

FIGURE 18:
DISCOUNTED INCREMENTAL ENERGY COSTS OF MARKAL SIMULATIONS OF GHG EMISSIONS MITIGATION IN FIVE SECTORS



Source: TERI study (2005).

FIGURE 19:
IMPACT OF A REVENUE POSITIVE CARBON TAX ON GDP



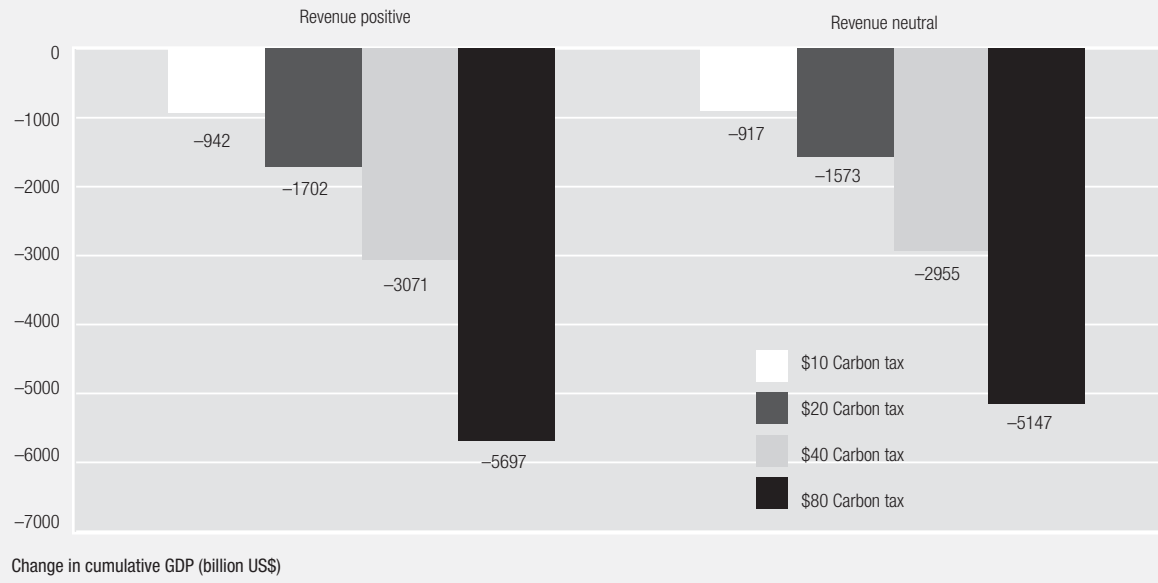
Source: NCAER Study (2009).

of the CGE model (referred to above) in respect of imposing a revenue positive carbon tax, generally recommended in the environmental economics literature as an efficient policy instrument, on GDP growth, in the period 2004–05 to 2030–31. There is GDP reduction of 8.1 per cent from the baseline with a carbon tax of US$80 per tonne of CO_2. The cumulative GDP loss (undiscounted) with the CO_2 revenue positive carbon tax at the US$80 per tonne level is US$5.7 trillion (Figure 20).

How much GHG emissions reductions are accomplished by this level of tax? Just 2.6 tonnes per-capita with a US$ carbon tax from 2.8 tonnes per capita without tax in 2030–31 (Figure 21).

Suppose, however, the carbon tax were revenue neutral, an option favoured by many public finance economists. That is, the carbon tax revenue was balanced out by an equivalent reduction in direct taxes. In that case, the GDP reduction with a US$80 per tonne CO_2 carbon tax is marginally reduced to 6.9 per cent in

FIGURE 20 :
CUMULATIVE (UNDISCOUNTED) GDP LOSSES WITH CARBON TAX



Source: NCAER Study (2009).

2030–31. The (undiscounted) cumulative GDP losses at the US$80 per tonne CO_2 tax level is also marginally reduced to US$5.1 trillion (Figure 20). At this tax level, the impact on GHG emissions per capita in 2030–31 is unchanged at a reduction of 2.6 tonnes per capita.

Clearly, confronted with these results, no Indian policymaker can view with equanimity the prospect of uncompensated aggressive action to mitigate GHG emissions beyond the current policy and regulatory regime. The World Bank's Low Carbon Growth study,[22] referred to above, has also come to the conclusion that any GHG mitigation actions by India, beyond the current development plans, would seriously impact GDP growth and poverty alleviation.

The way forward – India's perspective

Given this background, the following discussion examines what India's proposals are so far, for moving forward on the key issues in the global climate change agenda.[23] For the sake of convenience, this paper looks at India's approach in terms of the 'building blocks' and some other key elements of the Bali Action Plan (BAP).

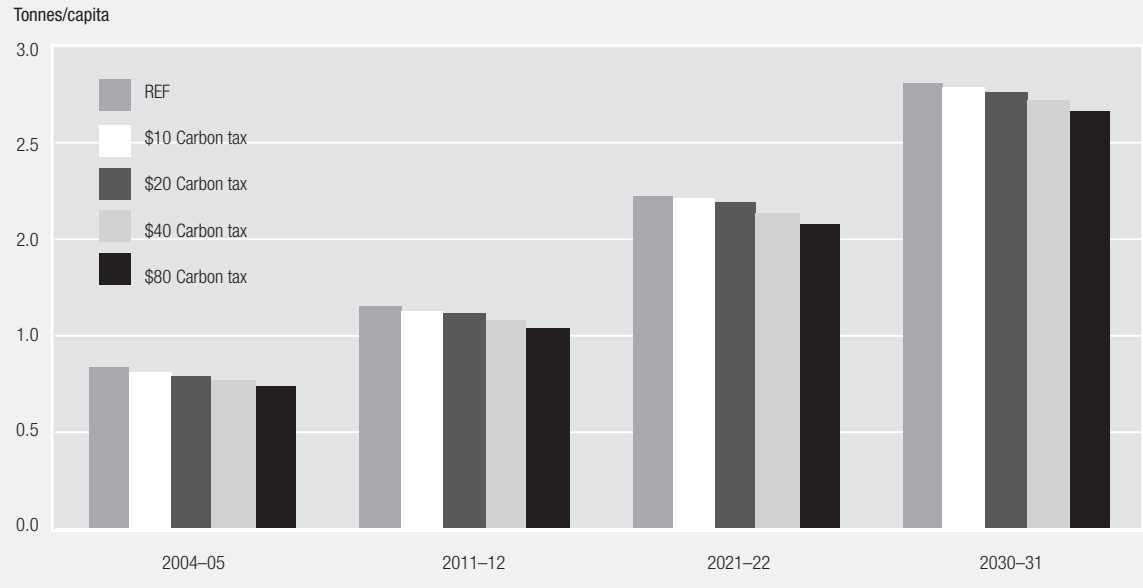
GHG emissions mitigation

In India's view, developed countries need to commit to deep, long-term, legally binding GHG emissions reductions, consistent with the espoused level and time-frame of GHG stabilisation. GHG emissions mitigation actions by developing countries must be enabled and compensated by financial transfers and technology from developed countries. There can be no differentiation of 'key developing countries' from other developing countries.

Figure 1 revealed the extent of historical responsibility of several developed countries. Without a meaningful discharge of this responsibility, based on an explicit recognition that all humans have equal rights to the atmospheric resource, besides terminating their current unsustainable GHG emissions levels, no climate regime would be seen to be fair or solve the problem. On the other hand, significant GHG emissions mitigation actions by developing countries beyond the efforts that they are even now making, will lead to major diversion of their resources away from development and poverty eradication, unless these are adequately compensated and the necessary technology is provided at low cost.

The so-called 'key developing countries', shown in Figure 1, have provided all the environmental space used by all the developed countries together. Their development challenges are typical of other developing countries. They cannot be penalised by abridging their development on the argument of 'size', when they have, in fact, enabled the developed countries to industrialise, and their energy or CO_2 intensities are no different from those of developed countries in general.

FIGURE 21:
GHG EMISSIONS REDUCTIONS PER-CAPITA FROM IMPOSITION OF A REVENUE POSITIVE CARBON TAX



Source: NCAER Study (2009).

Sectoral targets

In India's view, sectoral emissions targets by developing countries in line with externally imposed norms will only create a market opening for technologies closely held by a few developed country firms. These may be inappropriate to the situations in developing countries and will involve high, uncompensated technology costs due to cartelisation by the suppliers. In any event, no 'sector' can be defined unambiguously, after taking into account vintages, technology pathways, differences in raw materials, finished products, transport linkages etc, and as such, sectoral norms are in practical terms, a non-sequitur.

Externally imposed sectoral targets are an inefficient and impractical means of GHG emissions mitigation. Primarily, they are intended to gain market access and in any event are not permissible under the BAP (see para 1(b) (iv)), which speaks only of enhancing implementation of paragraph 4.1(c) of the UNFCCC. This, in turn, speaks only of promotion and cooperation in development, application and diffusion of technologies, and practices and process for mitigation of GHG emissions in relevant sectors.

Nationally Appropriate Mitigation Actions

The BAP requires developing countries to formulate and implement Nationally Appropriate Mitigation Actions (NAMAs), supported and enabled by finance, technology and capacity building, that are 'monitorable, verifiable and reportable' (MRV). In India's view, 'nationally appropriate' signifies that the plans must be prepared by the countries themselves, without external dictation or 'adjustment of ambition'.[24]

Mitigation actions by developing countries should proceed on this basis, and the actions themselves, provided they are supported by finance, technology and capacity building, and are accountable in the MRV sense. Actions carried out by developing countries on their own, without support, cannot be subject to MRV accountability.

Financing

In India's view, financial support for NAMAs of developing countries are not 'aid', but a discharge of responsibility by developed countries, scaled both by their historical responsibilities for climate change and the capabilities they thereby, have acquired.

The 'aid' paradigm involves discretion by 'donors' in relation to the volume of resources; the purposes for which they may be used; the sources of skills; the equipment and technologies to which the aid may be applied; the countries and organisations within them that may receive the aid; and the institutions through which the aid may be provided.

On the other hand, the responsibility based approach, signifies that the resources must be 'new and additional' (ie not diverted from 'aid'), assessed and not discretionary, and be administered by a financial mechanism answerable to the parties (CMP) with a unique governance structure. Financial resources amounting to 0.5–1.0 per cent of aggregate GDP of developed countries are necessary to address GHG emissions mitigation in developing countries.

Technology

In India's view, technology is the key to addressing climate change in both mitigation and adaptation. It comprises three elements.

First, a global effort on R&D, including adaptive R&D to enable deployment of available technologies in developing countries and the development of new, cost effective clean technologies. This will involve significantly stepped up public as well as corporate financing on R&D in developed countries. In addition, R&D efforts should involve partnerships between institutions in developed and developing countries, with sharing of Intellectual Property Rights. These collaborative R&D efforts may be financed through the UNFCCC.

Second, existing and new clean technologies must be available to developing countries for their climate change actions on non-commercial terms. This signifies that: (a) the existing social contract on intellectual property rights must be tempered to balance the rewards to the innovator while addressing the global imperative of saving the climate, involving negotiated or regulated[25] rather than monopolistic license fees (as the international community has agreed to in the case of drugs needed for HIV/AIDS); and (b) that where particular clean technologies are of wide applicability in developing countries, the financial mechanism may purchase the technology rights for their use in the context of their climate change actions.

Third, a network of regional technology innovation centres should be set up in developing countries to catalyse collaborative R&D; provide reliable information on available technologies, and their costs and performance; and enable capacity building on deployment of clean technologies and their further innovation.

Adaptation

Adaptation has been the Cinderella of the climate change regime. It is clear from various studies, as well as country experience. For example, India's experience discussed above, that the resource, and technology needs for adaptation are of the same order as for mitigation. 'Mainstreaming' adaptation actions into development programs must not involve a diversion of development resources to adaptation, whether the country's own or externally provided. All vulnerable regions, not only the least-developed or small-islands, must receive adaptation funding from the financial mechanism, as indeed the UNFCCC and BAP contemplate.

Sustainable production and consumption

High per-capita GHG emissions in developed countries are the inevitable outcome of unsustainable lifestyles, comprising unsustainable patterns of production and consumption. These need to be addressed in future climate change arrangements and it must be recognised, on the one hand, that human well-being is not conditional on unsustainable life-styles[26] and, on the other, that an argument that the present lifestyles of certain countries are sacrosanct, is untenable.

Conclusion

First, India was not, in the past, is not now, nor likely to be in the future, part of the climate problem. Rather, it has always been responsible in terms of energy use and environmental concerns.

Second, India's concerns (and those of all developing countries) about economic growth and poverty eradication are legitimate, and must be fully respected in any global climate regime, as indeed stated unequivocally in the UNFCCC and the BAP.

Third, the cause of climate change, and one which is continuing, is the unsustainable GHG emissions of developed countries. They have to take leadership to drastically reduce their GHG emissions, and this will involve modification to their life-styles, but no-one is suggesting they become poor.

Finally, the proposals made by India (and other developing countries) in respect of the future climate regime are constructive and must be given serious consideration in any discussions on global climate actions.

Endnotes

1 Data sources: Population: Human Development Report 2007-08; area: World development Report, 2009.

2 HDI ranks: Brazil: 70, China: 81, India: 128, South Africa: 121. Source: HDR 2007–08.

3 A 'positive responsibility' would signify that the country has exceeded its sustainability limit of 2 tonnes per capita-year aggregated over the period 1850-2010. Similarly, 'negative responsibility' would mean that the country has emitted less that its sustainability limit of 2 tonnes/per-capita-year over the same period.

4 Population in 2007: 1,123 million.

5 Source: Human Development Report, 2007–08.

6 Indians face the highest energy prices relative to income in the world. The price of 1 million kWh of electricity to per capita income is more than 100, compared to c. 3 in the US and 5–10 for most of Western Europe. Similarly, the ratio of the price of 1 million litres of gasoline to GDP per capita is nearly 2000 in India, compared to 20 in the US, and 60–100 in most of Western Europe.

7 Indian policymakers assert that the IEA, in fact, overestimates India's energy intensity, by imputing to Indian coal the calorific value typical of European coals, while the Indian coal calorific values are significantly lower due to much higher ash content.

8 Each calorie of food of animal origin requires c. 10 times the energy required for producing the calorie equivalent of plant-based food.

9 Repair and reuse is not included in the data presented.

10 This may be seen in advertisements for cars and two-wheelers. Even luxury vehicle manufacturers are careful to point out the fuel mileage of vehicles.

11 Visitors to India observe that at night there are virtually no lights left on in office and commercial buildings. This contrasts with what one observes in almost all developed countries.

12 The first edition of the Greendex, in 2008, jointly placed India and Brazil as the world's most environmentally sustainable societies.

13 Sufficient past data was not available to estimate the turning points in respect of the other countries studied (Netherlands, Pakistan, Sweden, UK).

14 Called 'Autonomous Energy Efficiency Improvement' (AEEI) parameter.

15 Called 'Total Factor Productivity Growth' (TFPG) parameter.

16 The model uses the actual calorific values of Indian fuels, and accordingly, the energy intensity given by the model is somewhat lower than given by the IEA, which employs European norms.

17 Due to fossil fuels and industrial emissions.

18 While India's population is large in absolute numbers, ie,1,123 million in 2007, the rate of increase is c. 1.4 per cent per annum, a rate typical of Latin American countries which are much richer. The CGE model uses population growth projections of India's Registrar General of Census.

19 K M Gaba, 2009, *Low Carbon Growth Study*, Washington: The World Bank.

20 Both the NCAER and World Bank modeling studies may be presented to a wider audience shortly.

21 MARKAL: 'Market Allocation' – a bottom-up engineering-economic linear programming model developed by the International Energy Agency, Paris, widely used worldwide for identifying optimal energy technology choices, and evaluating costs of GHG mitigation.

22 K M Gaba, 2009, *Low Carbon Growth Study*, Washington: The World Bank.

23 In fact, India's approach to the global regime is entirely consistent with the United Nations Framework on Climate Change Conference, the Kyoto Protocol and the Bali Action Plan. Most elements also have the endorsement of the group of G77 and China.

24 It is sometimes argued by developed country policymakers that without such external oversight, a developing country's supported NAMA actions may be negated by actions outside the supported NAMAs. This demand is unreasonable on three counts. First, a country's public policies, legislations, regulations and budgets are always public knowledge. Second, it would be irrational for a developing country to deviate from a baseline action to an economically suboptimal action outside the supported NAMAs. Third, would any developed country accept such external oversight in respect of its own policies, legislation, regulations and budget?

25 There is a wide-spread misconception that developing countries are asking for technology to be provided 'free'. A regulated license would be no more free nor provide insufficient incentive to the innovator (entrepreneur), than regulated tariffs for any natural monopoly, say, electricity.

26 For example, an assertion that commuting to work everyday in a SUV with single occupancy, facing traffic congestion arising from everybody else doing the same, as opposed to commuting by safe and efficient mass transport, enhances well-being, is risible.

Dr Hubertus Bardt is the Head of the Research Centre for Energy and Environmental Economics and the Deputy-Head of Economic Policy and Social Policy at the Institut der deutschen Wirtschaft Köln (Cologne Institute for Economic Research) in Germany. He studied economics and business administration in Marburg and Hagen and his doctorate at the Philipps University in Marburg. He has published numerous papers on the environment, climate, resources and policy. He is also the editor of the IW-Environment Service.

Future climate policies: A European experience

2.5

A future global framework

Climate change is a global challenge. The Kyoto Protocol was the first document with binding reduction targets until 2012 but the future of international climate policies is highly disputed. Today, after the latest conferences in Bali and Poznan, no results have been found and negotiations will continue up to the conference in Copenhagen in December 2009. Future principles of international climate policies, instruments and reduction targets – all the components of a new climate protection treaty – are still disputed. Members of the European Union (EU) urge other nations to continue with the logic of the Kyoto Protocol and further develop its emissions caps and flexible mechanisms.

In contrast, the United States (US) did not sign the protocol and so far has not accepted binding reduction targets. It fears potential economic costs and also that emerging countries like China and India will not accept emissions caps (Holdren 2003). China's and India's emissions should not grow without limit, while costly climate protection would harm the US economy and lead to competitive disadvantages. So far, the argument of US officials has followed the logic of a common good, which is valid for international climate protection (Bardt 2005). The US has strongly argued that emerging countries have to commit themselves to reducing greenhouse gas emissions (Müller 2003). This claim resulted in the Byrd-Hagel-Resolution, adopted unanimously by the US Senate in 1997 (US Senate 1997). The new Obama administration is supposedly shifting climate policies towards stronger efforts to reduce emissions. However, even if the US should agree to reduction targets, it is still doubtful that they would be as strict as the European targets.

The US position is only one reason why fast-growing emerging countries have to be part of a new international climate regime. Today, China is reported to be the world's largest emitter of greenhouse gases. Climate protection is simply not possible without a Chinese commitment. Other emerging countries including India, South Africa, Mexico and Brazil are also among the larger emitters. Any successful climate policy depends crucially on greenhouse gas emissions reductions in emerging countries. According to the Intergovernmental Panel on Climate Change (IPCC), carbon dioxide emissions from fuel combustion could

rise by 45 to 110 per cent until 2030 without further global measures. Developing and emerging countries (Non-Annex-1-countries) will be responsible for two-thirds to three-quarters of these additional emissions (IPCC 2007).

Guidelines for a new climate protection agreement

Global climate protection should be organised as efficiently as possible. Measures to reduce emissions should be realised wherever abatement costs are lowest. This is the only way to get maximum climate protection for every dollar or euro. This simple economic principle must be a guideline for international efforts to reduce greenhouse gas emissions. Many of the most efficient options are located in developing and emerging countries. On the other hand, most of the cheap potential of those industrialised countries with active climate policies has already been realised. A new international climate agreement has to make sure that the most efficient mitigation measures will be realised on a global level. Therefore, the flexible instruments of the Kyoto Protocol – Joint Implementation (JI), Clean Development Mechanism (CDM) and Emissions Trading (ET) – have to be strengthened.

The underlying principle of the project-based mechanisms, CDM and JI, is that an investment in greenhouse gas mitigation projects in developing or emerging countries and financed by industrialised countries or private companies, will be rewarded with additional emissions rights. These incentives promote private initiatives towards efficient global climate protection. So far, more than 1200 CDM projects have been approved by the United Nations (UN). The price difference between emissions rights from CDM and the allowances of the European emissions trading scheme (ETS) proves that there is significant cost-cutting potential in a more economic international approach. Massive research and development of climate friendly technologies that can be sold on world markets should contribute to climate protection as well. Using different measures flexibly in order to fulfil reduction commitments can promote more efficient allocation of resources in order to limit global warming. Flexibility must be ensured, no matter how national targets are distributed.

To ensure a significant effect on global greenhouse gas emissions, a post-2012 agreement has to be ratified at least by the group of 15 countries, or country groups, which are responsible for 80 per cent of worldwide emissions. This includes the most important industrialised countries as well as upcoming emerging countries. Others should not be excluded, but the 15 largest emitters seem to be essential. The levels of commitment should depend on the economic situation of each country which should help emerging countries to accept a new agreement. A classification into at least three groups of countries according to their gross domestic product (GDP) per capita – as an indicator of wealth levels – seems to be appropriate. In this respect, the 15 largest emitters of carbon dioxide can be grouped as shown in Table 1.

TABLE 1:
15 LARGEST EMITTERS OF CARBON DIOXIDE

HIGH-INCOME ECONOMIES	UPPER-MIDDLE-INCOME ECONOMIES	LOWER-MIDDLE-INCOME AND LOW-INCOME ECONOMIES
Australia	Mexico	Brazil
EU	Russia	China
Japan	South Africa	India
Canada		Indonesia
Korea		Iran
Saudi-Arabia		
US		

Source: Own compilation based on IEA (2006).

A new international agreement has to give the participating nations flexibility to decide how to fulfil their respective commitments. Global instruments such as a global carbon tax are unlikely to be endorsed. Further commitments – including research and development initiatives – should become part of a future climate protocol. Existing elements such as regional climate protection initiatives or research cooperation should be integrated as well, even if they do not focus directly on reducing greenhouse gas emissions. International sectoral agreements could be very promising as they create a level playing field within a sector or industry. With special agreements for certain sectors, mitigation cost could be similar for an industry in different countries. Carbon leakage could be less probable as it is today with very different climate regimes and very different cost burdens for the industries. A new global agreement has to be a composite of various targets as there is no single solution; no silver bullet for global climate protection. There are various options for future types of reduction targets for greenhouse gases; all of them have very specific advantages and disadvantages.

From a European perspective, absolute emissions caps seem to be necessary in order to reduce greenhouse gas emissions, at least for the economically successful high-income economies. However, decentralised measures should play a more important role as they did in the Kyoto Protocol. Although the US has

TABLE 2:
POSITIVE (+), NEGATIVE (–) AND NEUTRAL (0) IMPACTS OF DIFFERENT EMISSIONS TARGETS

	ECOLOGICAL EFFECTIVENESS	FLEXIBILITY OF COMPLIANCE	INFLUENCE ON ECONOMIC GROWTH	COST CONTROL
Absolute reduction target	+	+	–	–
Indexed target	0	+	0	0
Conditioned target	0	+	0	+
Sector-specific target	0	0	0	–
Financial target	0/–	+	0	+

Source: Own compilation.

opposed binding reduction targets for years, interest in climate protection is rising (Dröge 2007). At state level, various climate initiatives have been implemented and different instruments developed. The main challenge is to find appropriate reduction targets that fit the preconditions of the respective country. The mix of targets has to be flexible, but must contain fair, international burden sharing. For example, in order to avoid unforeseeable costs, national targets agreed on in an international protocol could be linked to certain conditions. Specific GDP levels could be used as a condition for reduction targets. As a variation of conditional targets, a safety valve could be integrated. This could mean, for example, that reduction obligations are suspended if reduction costs exceed a certain percentage of GDP.

Finding appropriate targets for emerging countries will be even more difficult. Upper-middle-income economies could agree on absolute caps that are higher than current emissions and on reducing emissions per unit GDP by a specified rate. This will not endanger economic growth but be a first step towards reduction of emissions. Lower-middle-income economies and low-income economies could commit themselves to reduce emissions per GDP unit. This will not necessarily reduce their emissions, but could lead to more efficient wealth creation and progress in separating economic growth and greenhouse gas emissions. After several years, stricter reduction targets for emerging countries could be introduced as well.

A core element of a new agreement must be the improvement of market-based flexible instruments. These instruments are already part of the Kyoto Protocol. This is the only way to ensure that reductions will be implemented with minimum costs. Instruments like the JI, CDM or ET lead to efficiency in reducing greenhouse gas emissions. In an ideal world, these instruments guarantee full flexibility and efficient allocation of resources, while distribution of reduction targets is nothing more than distribution of costs. However, the real world is not an ideal one. There are restrictions for CDM projects, limited emissions trading systems, different regulations and a focus on national reduction targets. Therefore, existing efficiency reserves must be realised in order to make climate protection as cheap as possible.

Distribution scenarios

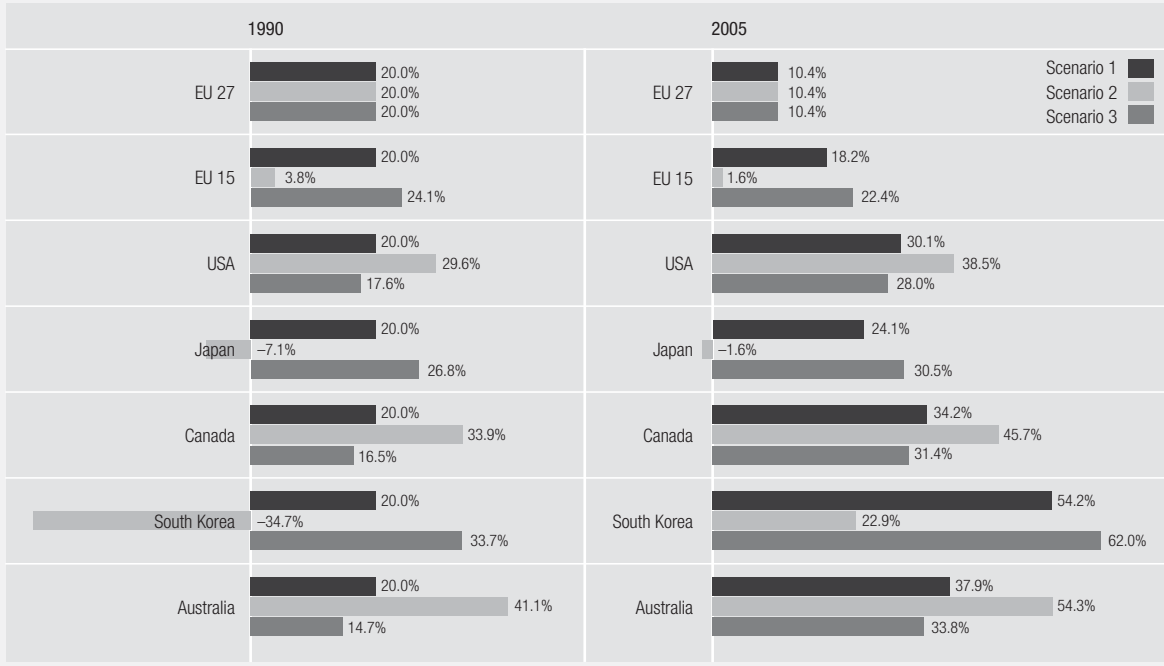
Binding targets to reduce greenhouse gas emissions may be a result of intense negotiations and can hardly be predicted. However, even if there is an agreement on decentralised elements, such as promotion of technological development without any binding reduction targets, an implicit burden sharing will result from those commitments. Clear reduction targets make this burden sharing explicit. The following scenarios show three options for possibly resulting distribution effects (Bardt et al 2008). The scenarios vary in the basic distribution rule for reduction targets:[1]

- Scenario 1: reduction of greenhouse gases by 20 per cent
- Scenario 2: harmonisation of greenhouse gas intensities
- Scenario 3: definition of reduction targets according to GDP.

Scenario 1

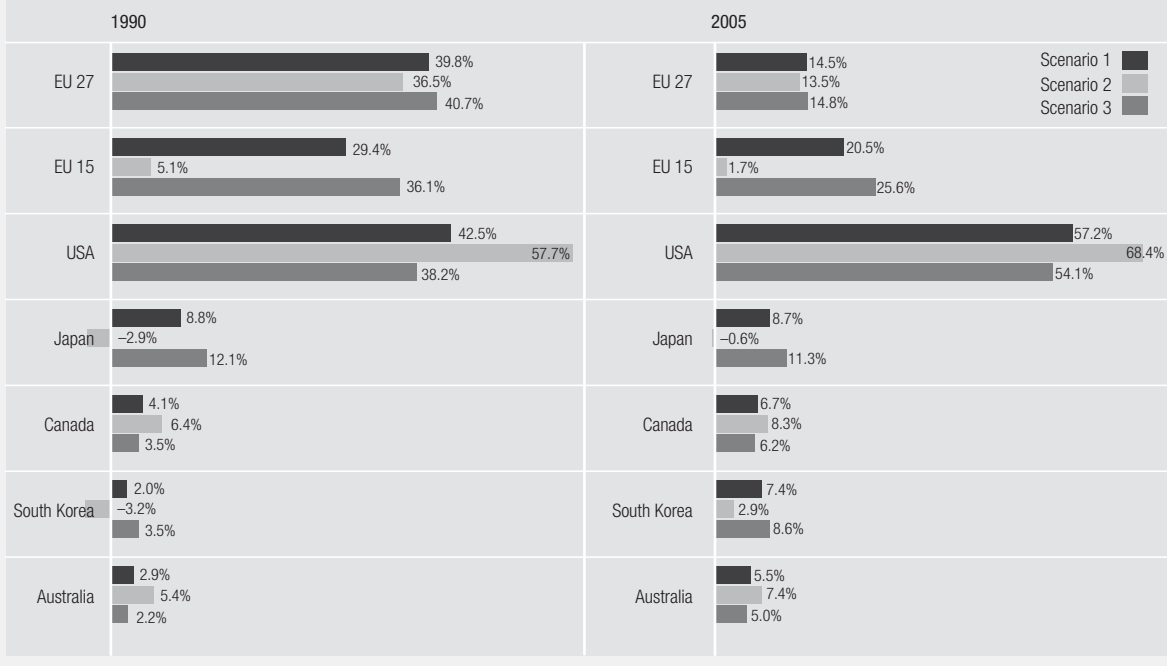
At their council meeting in spring 2007, the EU heads of state decided to reduce greenhouse gas emissions by at least 20 per cent until 2020 compared to 1990. Emissions could even be reduced by 30 per cent, provided that other industrialised countries commit

FIGURE 1:
REDUCTION OF GREENHOUSE GAS EMISSIONS, COMPARING 1990 WITH 2005



Sources: UNFCCC (2006), Second national communication of the Republic of Korea (2003), own calculations.

FIGURE 2:
SHARE OF TOTAL REDUCTION OF GREENHOUSE GAS EMISSIONS, COMPARING 1990 WITH 2005



Sources: UNFCCC (2006), Second national communication of the Republic of Korea (2003), own calculations.

themselves to comparable reductions, and that economically more advanced developing countries contribute adequately according to their responsibilities and capabilities. If all countries of the first category (high-income economies) agreed to a 20 per cent target, all countries have to reduce much more than 20 per cent by 2005, except the EU. This is the result of stable emissions in the 'old EU' (EU-15) and significant reductions in the transition countries of central and eastern Europe, while there has been a massive increase in emissions from most other countries since 1990, whether they signed the Kyoto Protocol or not.

Scenario 2

Another fair rule for reduction targets is to harmonise emissions intensities, that is, greenhouse gas emissions per unit GDP. While the EU follows its 20 per cent target, other high-income economies could commit to reduce emissions until the European emissions intensity is reached, based on today's GDP. In this case, most countries will have much stricter reduction targets than in scenario 1, while Japan could even increase emissions until 2020.

Scenario 3

The third option for a distribution rule is to use the current GDP. The idea is to let richer countries reduce more emissions than less wealthy countries. Therefore, in the third scenario, shares of the 2005 GDP equal the shares of total greenhouse gas emissions reduction compared with 1990. Again, the EU is supposed to reduce its emissions by 20 per cent until 2020. In effect, the results are quite similar to those of scenario 1: Canada, Australia and the US have slightly less ambitious reduction targets, while Japan and Korea have to reduce more.

Although the scenarios show higher reduction targets for most countries than for the EU compared with 2005, the EU has to accept a very high share of the total reduction burden. According to scenarios 1 and 3, the European share is about 40 per cent of total reductions since 1990. The relatively low value in scenario 2 is a result of the lower carbon intensity of the European economy. Compared to 2005, further reduction duties are distributed differently. The European share of future reduction is significantly lower because of its climate protection efforts over the last years.

All three scenarios demonstrate different potential results of international climate negotiations. These results are based on 'fair' underlying distribution rules. The results also describe the necessary commitment of other countries as a precondition for the EU to increase its reduction target to 30 per cent compared with 1990, as the European Council indicated in March 2007.

The European framework

Since the beginning of global negotiations on climate policies, Europe has played a mayor role. Today, the European share of global greenhouse gas emissions is less than 15 per cent. However, per capita emissions are relatively high compared with other world regions due to greater European prosperity. Europe wanted to accept responsibility for reducing emissions significantly. All 15 countries of the EU-15 signed the Kyoto Protocol in 1998 and have reduced greenhouse gas emissions by 2.2 per cent since 1990. Although Europe wants to be a frontrunner in reducing greenhouse gas emissions, it could not fulfill its targets. According to the Kyoto Protocol, the EU is supposed to reduce its emissions by 8 per cent. Nevertheless, the European Commission is eager to force the member countries to make further progress. Therefore, a suite of new climate policy targets was adopted in 2007:

- Emissions of greenhouse gases are reduced by 20 per cent until 2020 compared to 1990. Provided that other industrialised countries commit themselves to comparable reductions and economically more advanced developing countries contribute adequately according to their responsibilities and capabilities, the EU will reduce its emissions by 30 per cent until 2020.
- Energy efficiency is increased by 20 per cent until 2020.
- Twenty per cent of all energy consumption comes from renewable energies by 2020.
- A minimum of 10 per cent of all transport petrol and diesel consumption comes from biofuels by 2020.

However, European climate policies are more than setting targets. Various measures have been implemented in recent years. Some of the most important are:

- Energy consumption standards for energy-using products are being developed. The European Commission is considering whether a stricter energy efficiency regulation like the Japanese Top Runner Approach should be introduced. A tight regulation for standby energy losses has already been announced.
- Vehicle carbon dioxide emissions will be restricted. Although there is already a voluntary agreement signed by European car manufacturers, it is planned to force them by law to reduce the average emissions to 120 grams of carbon dioxide per kilometer.
- Research and development for climate protection technologies has been increased. Reducing greenhouse gas emissions in a global perspective cannot be achieved without technical progress. Furthermore, new technological developments should strengthen the export capacities of the European manufacturing sector.

- The core instrument of the European climate policies is the Emissions Trading Scheme (ETS) which started in 2005.

The ETS was introduced after extensive discussions about environmental taxes. However, there has not been a European consensus on coordinated carbon taxation in order to reduce greenhouse gas emissions. Therefore, there are different national taxes, mostly on energy consumption instead of carbon emissions, but not a level playing field for all energy consumers in Europe. The basic idea of an ETS is to create a market for environmental goods. Total emissions should be restricted; emissions rights could be traded on markets. This 'cap-and-trade' system should lead to better and cheaper climate protection.

Market forces should lead to more efficient efforts to reduce emissions. If the market price for emissions rights is higher than the cost of a certain measure to reduce emissions, the rights could be sold and the emissions could be reduced. If reduction is more expensive, additional emissions rights must be acquired.

While a carbon tax sets a price for greenhouse gas emissions, the cap-and-trade system sets the amount of emissions. Markets find an efficient price. Nevertheless, the ETS does not implement a market, it simulates a market. The main difference is that there are no supply-side reactions on price movements. On normal markets, supply can rise when prices are high. This normal reaction leads to more moderate prices on 'normal' markets. The market simulation for emissions is different. Supply of emissions rights is fixed, no matter how much the prices may rise. There is no supply-side reaction leading to moderate prices. This is one of the problems of the European ETS.

The ETS in the EU has been in operation since 2005. In addition to the concept of cap-and-trade, it is based on several fundamental construction principles.

- The system is divided into trading periods. The first one ran from 2005 until 2007 and was intended to be a testing period to gain experience with the new instrument. The second period, from 2008 to 2012, should lead to the reduction of emissions necessary to fulfill international commitments. A third trading period will last from 2013 to 2020 and should cover reduction obligations agreed on in a new international treaty.
- Emissions are allocated on plant level. In total, about 11,000 power and production plants are involved in the system. Most emissions allowances are allocated to the power generating sector. Production of electricity is the most important industry involved. Others are refineries, glass, cement, pulp and paper, ceramics, lime, coke and steel production. Additionally the aviation sector will be included into the ETS, commencing in 2012.
- One of the main problems of all ETSs is how to allocate emissions rights. So far, most of the emissions allowances have been allocated for free by the national governments. In order to ensure similar allocation rules in all member states, the national allocation plans had to be approved by the European Commission. The main allocation principle has been free grandfathering. Emissions allowances have been distributed according to historic emissions, early emissions reduction measures and emissions benchmarks. As there is no uniform allocation rule in Europe, criteria and standards were different among member states. The alternative allocation mechanism – auctioning – has been used for up to 10 per cent of the respective national allowances but will become the dominant instrument in the future.
- The European ETS is linked to the flexible instruments of the Kyoto Protocol. Additional allowances can be produced through JI and CDM projects. This brings some flexibility to the supply curve of the carbon market. As mitigation projects are still significantly cheaper in China, India and developing countries, the linkage of the European system and the Kyoto-mechanisms helps to ensure more efficient climate protection on a global level.

The ETS gives carbon dioxide emissions a price. The allowances are traded like shares on the markets. This raises the question: Does the price really reflect the cost of alternative measures to reduce emissions? When trading started, most analysts expected a price of about €10 to €15 per allowance. However the price rose steadily up to about €30. One reason was the rising price for natural gas. As natural gas became more expensive, more coal was used to produce electricity. This fuel shift led to higher emissions and higher allowances prices. Additionally, uncertainty about future emissions and the availability of emissions rights led to higher prices. In April 2006, the price dropped sharply. The emissions allowances lost half their value within a week. This occurred when new data on actual emissions indicated that more allowances than needed had been issued in several countries. After this shock, prices remained stable until autumn 2006.

A steady decline in prices was observed in 2007. At the end of that year, an allowance was not worth more than a couple of cents. The reason for this development was a detail of the ETS. In the first trading period, banking of allowances was not permitted, which meant that the allowances of 2005–07 could not be used anymore in 2008. As there were plenty of emissions rights in the markets to balance all emissions, the remaining allowances were in fact worthless. In the first year of the second trading period, allowances prices usually were close to €20.

Unfortunately, market results can lead to negative consequences for many market players. There are direct and indirect cost effects. Direct cost increase results from the use of valuable allowances and the need to buy some of them. Indirect effects result from

TABLE 3:
IF ALL EMISSIONS ALLOWANCES HAD TO BE PURCHASED, A PRICE FOR CARBON DIOXIDE OF BETWEEN €30 TO €60 WOULD LEAD TO DIRECT AND INDIRECT COSTS FOR ENERGY INTENSIVE INDUSTRIES IN 2025 (IN € MILLION)

	INDIRECT COSTS		DIRECT COSTS		TOTAL	
	€30	€60	€30	€60	€30	€60
Metal production and processing	717	1.433	2.041	4.082	2.758	5.516
Chemical industry	711	1.423	1.350	2.700	2.061	4.123
Refineries	27	54	728	1.456	755	1.510
Cement	62	124	617	1.235	679	1.359
Pulp and paper	283	567	244	488	527	1.055
Lime	9	18	279	557	288	575
Glass	80	159	121	242	201	401
Ceramics	31	62	59	119	90	180
Total	1.920	3.840	5.439	10.879	7.359	14.718

Sources: Federal Statistical Office, Federal Environment Agency, sector data, Insitut der deutschen Wirtschaft Köln.

higher electricity prices due to the costs for emissions rights. Although the allowances have been allocated for free, they have a value. Using them while producing energy leads to opportunity costs because the electricity suppliers could have sold the allowances instead of producing electricity. As there is no world market for electricity, opportunity costs can be passed on to consumers.

However, many energy intensive industries produce goods for world markets. European companies compete with firms from other parts of the world. Their competitors do not have to buy carbon dioxide allowances and do not have to pay electricity prices which have been raised due to an ETS. However, customers on world markets for steel or aluminum do not accept higher prices because of environmental regulations. They can buy from cheaper producers outside Europe.

Therefore, for some industries the ETS is a disadvantage on international markets. Other sectors have to face additional real indirect and direct costs. In fact, the net cost increase which companies have to bear in the first trading period is up to 1.7 per cent in the steel industry, 6.2 per cent for pulp and paper producers, and 3.8 per cent in the cement industry (Ecofys/McKinsey 2006). New capacities for cement production are being planned and built in northern Africa, not in Europe. Aluminum producers are affected even more severely; while costs for producing secondary aluminum have risen by 0.5 per cent only, costs to produce primary aluminum rose by 11.4 per cent.

The ETS after 2012

The European Commission plans to introduce stricter rules for emissions trading in the third trading period after 2012. The most important and expensive element of the reform is the new allocation principle. Beginning in 2013, more and more allowances have to be purchased by auction. Energy producing companies will have to buy their emissions rights as from 2013; for other industries there will be a phase-in period until 2025. Although details of the regulation and potential exceptions are still being discussed, consequences of this political decision might be dramatic. Additional cost for energy intensive industries will amount to billions of euros. Additionally, emissions caps will be reduced by 21 per cent compared with 2005 and international projects (JI/CDM) will be restricted. As a result, rising prices for allowances must be expected.

Auctioning carbon dioxide emissions allowances is a very interesting opportunity from the point of view of public budgets. If all emissions rights are auctioned

TABLE 4:
DIRECT AND INDIRECT COSTS OF EMISSIONS TRADING AT A PRICE OF €60 IN RELATION TO VALUE-ADDED AND EMPLOYMENT

	COSTS AS SHARE OF VALUE-ADDED	COSTS PER EMPLOYEE
Lime	267.0%	239883
Cement	181.2%	172025
Refineries	not available	74256
Metal production and processing	26.1%	22337
Chemical industry	9.2%	9424
Pulp and paper	11.3%	7794
Glass	12.3%	7512
Ceramics	7.7%	4240
All	17.9%	15553

Sources: Federal Statistical Office, Federal Environment Agency, sector data, Insitut der deutschen Wirtschaft Köln

for a price of €30, almost €12 billion will be transferred from the private to the public sector in Germany alone. Within the whole EU, the value will amount to more than €54 billion. On the other hand, if the price rose to €60 per metric ton, €24 billion would be paid for by German industry, more than €108 billion in Europe in one year. This huge sum of money is a good explanation for the considerable support of auctioning given by politicians wanting to spend the money for different purposes. A dangerous side effect is that with this mechanism working, politicians must be interested in higher emissions prices in order to raise as much money as possible. However, if one wants to bring more efficiency into climate protection, the opposite is necessary. And on the other hand, there is no positive effect on the climate. Emissions caps remain the same whether the allowances are auctioned or not.

The price for this political decision has to be paid by private households and private businesses. As the opportunity costs for emissions allowances are – more or less – transferred into electricity costs, an increase in allowances prices will lead to higher electricity bills. If the price for a metric ton of carbon dioxide jumps from €20 to €45, a standard household will have to pay another €50 a year. However, the bill for energy suppliers will be much higher. As auctioning converts opportunity costs to real costs, a massive reduction in margins will be the effect.

In Germany, energy-intensive industries like the chemical, metal production and processing, pulp and paper, cement, glass and refineries will be severely affected. They will face additional direct costs of auctioning and indirect costs of energy price increases due to emissions trading. If the industries involved in the ETS had to purchase their emissions rights for €30 per metric ton, direct and indirect costs would amount to €7.4 billion. If the price reaches €60, which is not improbable, the costs will rise to €14.7 billion. Of this, €1.9 to €3.8 billion is an indirect cost. This can rise to €1.4 billion each for the chemical and metal industries.

Future direct costs will be even more important. Purchasing their own emissions rights will cost industries between €5.4 and €10.9 billion in 2025. Companies involved in metal production and processing will have to pay between €2.0 and €4.1 billion, and the chemical industry between €1.4 and €2.7 billion.

Burden for industries

The significance of these costs can be demonstrated in relation to some common performance indicators. Assuming a price for an emissions allowance of €60 per metric ton, a large part of value-added will be consumed and transferred to public budgets. On average, the industries within the ETS will have to pay about 18 per cent of their value-added for emissions rights and higher electricity prices. Total burden for the cement producer will be twice the value-added and three times the value-added for the lime industry. In 2025, an average of more than €15,000 will have to be spent per employee in the eight sectors: more than 240,000 in the lime industry, €170,000 for every employee in the cement industry. Although these industries may be extreme examples, an ETS burden of €22,000 per employee in the metal industry and €9000 in the chemical industry will also not be negligible.

The core of the problem for these industries is the fact that the companies can hardly pass the costs on to their consumers. As they have to compete on world markets, competitors outside an ETS have a significant competitive advantage. As a result, production of energy intensive goods in Germany and Europe will be endangered. The industries mentioned above are responsible for 22 per cent of all investments in the production sector, 23 per cent of exports and 16 per cent of employees. As the manufacturing sector in Germany is responsible for a large share of GDP and as world market exposure of these industries is very high, additional costs must be avoided.

Significant costs

One solution is to continue the free allocation of emissions allowances or at least make exceptions for energy intensive sectors. Another idea discussed in Europe is to introduce tariffs for imports from countries outside the ETS. As these trade restrictions would not be accepted by other trade partners, free trade would be endangered and the threat of new trade wars could arise.

Conclusion

The only solution to reduce greenhouse gas emissions on a large scale and to create a level playing field for all competitors is a global climate agreement with fair burden sharing. Climate protection is a global common good which can be organised on a global level. This is the only way to avoid free-rider behaviour on one hand and massive competitive disadvantages on the other. Therefore, the result of the climate negotiations in 2009 will be crucial for the future of the European manufacturing sector.

Endnotes

1. Because of insufficient data, Saudi Arabia will not be considered in the scenario calculations.

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National Office
Level 13, 440 Collins Street
Melbourne 3000 VIC
GPO Box 2117
Melbourne 3001 VIC
Telephone 03 9662 3544
Fax 03 9663 7271

New South Wales and the ACT
Level 14, The John Hunter Building
9 Hunter Street
Sydney 2000 NSW
GPO Box 2100
Sydney 2001 NSW
Telephone 02 9299 7022
Fax 02 9232 7559

Queensland
Level 22, 333 Ann Street
Brisbane 4000 QLD
GPO Box 2900
Brisbane 4001 QLD
Telephone 07 3229 9955
Fax 07 3229 8166

South Australia and the Northern Territory
Level 7, Qantas House
144 North Terrace
Adelaide 5000 SA
PO Box 8248, Station Arcade
Adelaide 5000 SA
Telephone 08 8211 7222
Fax 08 8211 8222

Victoria and Tasmania
Level 13, 440 Collins Street
Melbourne 3000 VIC
GPO Box 2117
Melbourne 3001 VIC
Telephone 03 9662 3544
Fax 03 9663 7271

Western Australia
Suite 1, 8 Colin Street
West Perth 6005 WA
PO Box 886
West Perth 6872 WA
Telephone 08 6104 7100
Fax 08 9228 2166

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