Climate Change & Peak Oil
An Integrated Policy Response for Australia

Contents:

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Acknowledgements:

The core of this proposal is built around the concepts of:

Contraction and Convergence, developed by Aubrey Meyer, The Global Commons Institute, London, UK. **www.gci.org.uk**

Tradeable Energy Quotas (TEQs), developed by David Fleming, The Lean Economy Connection, London, UK. **www.teqs.net**

Of the economic and regulatory options being considered to address the looming convergence of climate change and resource shortages, particularly peak oil, the combination of C&C and TEQs stands out as the simplest, most equitable and practical alternative. My thanks to both authors for their perseverance in developing these concepts over many years.

Dr. Colin J. Campbell, Jean H. Laherrere, Kjell Aleklett, Chris Skrebowski, Richard Heinberg, Bruce Robinson and other members of the Association for the Study of Peak Oil (ASPO), internationally and in Australia, have shown great leadership in confronting a sceptical world with the inconvenient realities of peak oil. Colin Campbell was responsible for the development of the **Oil Depletion Protocol**. Again, my thanks to them for persevering with this unrewarding but essential task.

The proposals in this document, for the application of these ideas in an Australian context, are my responsibility entirely.

Author:

Ian Dunlop was formerly a senior international oil, gas and coal industry executive. He chaired the Australian Coal Association in 1987-88, chaired the Australian Greenhouse Office Experts Group on Emissions Trading from 1998-2000 and was CEO of the Australian Institute of Company Directors from 1997-2001. He has a particular interest in the interaction of corporate governance, corporate responsibility and sustainability. An engineer by qualification, he holds an MA (Mechanical Sciences) degree from the University of Cambridge, he is a Fellow of the Australian Institute of Company Directors, the Australasian Institute of Mining and Metallurgy, and the Energy Institute (UK), and a Member of the Society of Petroleum Engineers of AIME (USA). He also chairs the Australian National Wildlife Collection Foundation.

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Thought Starters:

" The economy is a wholly-owned subsidiary of the environment, not the reverse."

Herman Daly

" The future belongs to those who understand that doing more with less is compassionate, prosperous and enduring, and thus more intelligent, even competitive."

Paul Hawken

"Don't blow it – good planets are hard to find"

Quote from Time

Summary

Recent reports[i] [ii] have confirmed what has been intuitively and practically evident for many years, namely:

- carbon emission from human activity is leading to increased atmospheric carbon concentrations. This is very likely to be causing major climate change, particularly temperature increases, which will become dangerous and potentially catastrophic if carbon concentrations are allowed to continue rising.
- The evidence is sufficiently clear that urgent precautionary measures should be taken to reduce human carbon emissions if dangerous consequences are to be avoided.
- The cost of doing nothing far outweighs the cost of action to mitigate and adapt to climate change.

There is a high probability that the peak of global oil production will be reached within the next 5 years. Oil does not run out, but it is the point at which further expansion of oil production becomes impossible because new production is fully offset by the decline of existing production, irrespective of the oil price. It may take the form of a sharp peak, from which oil availability declines rapidly, or it may be an undulating plateau spread over a number of years if, for example, oil demand drops as a result of climate change impact.

Climate change and peak oil are inextricably linked. Each one is a major issue in its own right, but their convergence has received minimal attention, which is unfortunate as it is likely to have far greater impact than the sum of the individual parts. Policy must ensure that solutions to the one reinforce, and do not conflict with, solutions to the other.

Globally and nationally there must now be rapid agreement on, and implementation of, measures to stabilise atmospheric carbon concentrations by reducing emissions substantially and to prepare for peak oil. This requires clear, binding, deliverable targets against which to measure policy effectiveness.

Current piecemeal government policy is totally inadequate to meet the challenges of climate change. Emissions trading is now, reluctantly, under discussion but it is only one component of the comprehensive policy required. Peak oil is barely on the agenda, although it may be the issue which has the greatest impact in the short-term. This paper suggests a comprehensive, integrated policy, at both global and national level, which will provide a coherent response to both issues, built around:

- **Stabilising** global atmospheric carbon concentrations at 450ppm CO_2e by
- **Contracting** annual global carbon emissions from 8GTC today to 3.5 GTC by 2050
- Equitably allocating the contraction task between nations by **converging** linearly from today's unequal per capita emissions to equal per capita emissions globally by a date to be negotiated, say 2040. Australian emissions would have to reduce by 50% by 2025 and 90% by 2050.
- Using a modified **Kyoto Protocol** to provide the framework for the **contraction** and **convergence** process, and for international emissions trading.
- Meeting the national carbon reduction budget by a system of **Tradeable Energy Quotas (TEQs)** within Australia.
- Negotiating a global **Oil Depletion Protocol** to allocate available oil equitably between nations, determining national oil descent budgets and providing for international trading
- Allocating oil domestically via a similar **TEQ** concept to emissions reduction. (TEQs are also applicable to the management of scarce water resources, although this is not the subject of the current paper).

The transition to a low-carbon economy, stabilising atmospheric carbon concentrations and managing the declining availability of oil, will fundamentally alter the lifestyle of the entire community. It will only be achieved if there is strong leadership and a whole-hearted commitment to achieving these objectives. To build this commitment will require extensive community awareness programmes. Rather than a problem, it is a unique opportunity to set humanity on a new course, built on sustainable principles.

Above all, visionary, principled, long-term leadership is need from government, the community and business. Short-term political or corporate expediency is no longer acceptable; bi-partisan cooperation is essential. Action is required in the next 6-12 months, not in the 3-5 years favoured in political debate.

Perspectives

In framing this policy, the following perspectives are axiomatic:

Climate Change

- Climate change is arguably the greatest challenge facing humanity. The scientific evidence linking climate change to the increasing carbon concentration in the atmosphere, arising from human activity, is now overwhelming. Absolute proof of the linkage will not emerge for decades. However the evidence is sufficiently clear that urgent precautionary measures should be taken to reduce carbon emissions if dangerous consequences are to be avoided.

- Population as ever is the main driver. In the 60 years since WW2, world population has grown exponentially from 2.5 billion to 6.5 billion today and even with declining birthrates, the UN expects a world population of 9 billion by 2050.[iii] That growth triggered an insatiable demand for natural resources, notably water, oil and other fossil fuels. For example, oil production over this period grew from 2.5 to 30 billion barrels annually, the bulk being consumed by the 1 billion living in the developed world, with a commensurate increase in carbon emissions.

- The thought that exponential economic growth in a finite world might hit some physical limits is not new [iv] [v] [vi] ; we have experienced limits at a local level, but so far we have either side-stepped the issue or been able to find short-term solutions, in the process becoming overly confident that any global limits could be similarly circumvented.

- Today, just as the bulk of the world's population is about to step on to the growth escalator we have been ascending for the last 60 years, we are discovering that there are global limits which are both real and imminent. The weight of scientific evidence increasingly points to the fact that the globe cannot support its current human population, let alone an additional 2.5 billion, unless we radically change our concepts of economic growth [vii] [viii].

- As carbon concentration increases, and global temperatures rise, the climatic response may well be non-linear, leading to potentially catastrophic outcomes more rapidly than otherwise expected. There is increasing evidence that this is already occurring[ix] [x] [xi] [xii].

- Climate change policy is an exercise in risk management. Measures must be taken firstly to mitigate climate change to prevent it occurring and secondly, to the extent that some change is inevitable, to adapt to it, even though the potential impact will remain uncertain.

- Due to the accelerating rate of human-induced carbon emissions, now increasing at around 3-5% per annum, and the lag before any corrective measures take effect, there is little time to implement these measures. Action is required in the next 6-12 months, not in the 3-5 years still favoured in political debate.

- A global solution is essential. This may well evolve through numerous national and regional initiatives before it becomes a reality, but national initiatives must not be delayed pending global agreement.

- Policy must be structured normatively around stabilising global atmospheric carbon concentration at a maximum level which, on the best scientific advice, has an acceptable probability of avoiding dangerous climate change. Measures must be implemented, globally and nationally, to ensure that carbon emissions are contained and reduced, such that the maximum global concentration level is not exceeded. Contrary to current Australian government policy, this will require the establishment of binding targets and compliance provisions to measure policy effectiveness. Further, in the interests of global security, it implies a preparedness to cede national sovereignty to supra-national agreements and organizations.

- The developed world, having created the bulk of the problem, has a moral obligation to take the lead, but the developing world, in its own interests, must rapidly join in seeking solutions. This poses the fundamental question of global equity. It is morally indefensible and unrealistic to expect that the developed world can continue to emit at current levels, with the developing world absorbing the bulk of the climatic impact and being asked to constrain its own growth. The simplest, most equitable and practical solution is:

    - a **contraction** of global emissions in toto, and
    - a **convergence** over time toward equal emissions per capita globally.

  To achieve stabilisation of global atmospheric carbon concentration at 450ppm CO_2e, and convergence by 2040, Australia will have to reduce emission by around 50% by 2025 and 90% by 2050, far greater than the 30 – 50% by 2050 typically suggested in current debate.

- There is no single answer to climate change. The solution lies in myriad initiatives to de-carbonise and de-materialise human activity, encompassing:

    - a framework to reduce carbon emissions, via mechanisms such as emissions trading or tradeable quotas.
    - strong technology focus, for example alternative energy particularly renewables, geothermal, cellulosic biofuels, carbon sequestration, clean coal technology etc.
    - transformation in energy conservation, efficiency and resource conservation.
    - total re-think of the consumer society and related business models (eg transport, aviation, infrastructure, urban and rural environments, financial services, supply chains, marketing) in line with sustainability principles.
    - redesign and simplification of the market economy, corporate and investment regulation, governance and reward systems to deliver long-term sustainability.
    - reduction in global inequity.
    - holistic government approach to achieve policy consistency.

- In assessing alternative energy strategies, all externalities must be incorporated. In particular carbon must be fully priced into the market for competing energy projects, based on full life-cycle analysis. For example, coal, oil and gas consumption must fully incorporate the price of carbon, nuclear energy must allow for the full cost of waste disposal, power-plant decommissioning, carbon emissions in construction and fuel supply etc..

- Whilst market-based solutions are preferable, markets must operate in a framework which will achieve the desired emissions reductions and changes in community behaviour. The framework must be established by prudent regulation; markets will not achieve the change on their own. Given the multitude of possible alternative energy and conservation technologies, both known and unknown, the framework should not endeavour to pick winners but must set general directional parameters, allowing the market to determine the most effective solutions. Subsidies which encourage carbon emissions must be eliminated. Incentives to accelerate alternatives are essential.

- Trading systems must provide both short term and long term price signals to give certainty for long term investment decisions (eg for future power generation, urban and transport infrastructure etc.). Until those signals are clearly in place, all carbon emission-intensive investments should be placed on hold to avoid locking in unsustainable emission futures.

- Australia is heavily reliant, economically, on the export of fossil fuels, particularly coal and gas. There should be no further expansion of this export activity until either all exported carbon is securely sequestered on a long-term basis, or it is accounted for in the importing country by global agreements as above. In short, accounted for by a carbon equivalent to the Nuclear Non-Proliferation Treaty

- The Kyoto Protocol was designed as a first step in the above process, in providing a framework to begin reducing global greenhouse gas emissions[xiii]. It has serious limitations, but they are largely the result of political compromise during the negotiation process, not least arising from the self-interested demands of the US and Australia. It continues to provide valuable learning experience in establishing the mechanisms necessary to reduce global carbon emissions.

- Kyoto has been ratified by 165 countries, including China and India, encompassing over 86% of the world's population. In the interests of early action, rather than pursuing multiple new agreements, policy initiatives should concentrate on making Kyoto work by re-building it and consolidating global efforts behind it:

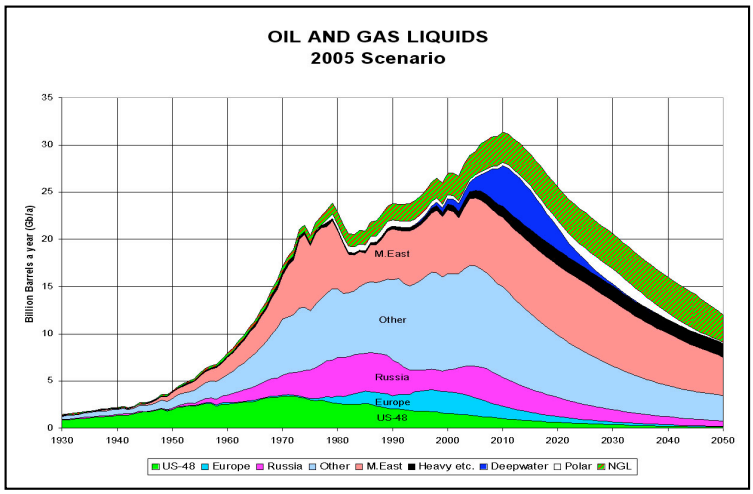
    - AP6, as favoured by Australia, is in essence complementary to Kyoto. Participation in AP6 should in no way prevent Australia from fully supporting Kyoto.
    - Kyoto already allows flexibility for differing types of national emission reduction and trading mechanisms within a framework of binding international commitments.

- There remains the possibility that the science is wrong and that climate change currently being experienced is primarily due to natural causes rather than being human-induced. The mounting evidence suggests that the probability of this being so is low, and declining. Nonetheless, in committing to the policy proposed, this scenario should be kept in mind. Prudent risk assessment, weighing the risks and their probabilities in the light of today's knowledge, suggest that it clearly makes sense to proceed with these proposals, as the potential impact of dangerous climate change may be catastrophic, while the costs of carbon emission reduction are manageable. To continue with business-as-usual implies an irreversible increase in global atmospheric carbon concentrations, which would be foolhardy in the light of the evidence available. The risk assessment should be periodically updated as the scientific evidence evolves.

Peak Oil

- There is a high probability that the peak of global oil production will be reached within the next 5 years[xiv]. Oil does not run out, but it is the point at which further expansion of oil production becomes impossible because new production is fully offset by the decline of existing production, irrespective of the oil price. It may take the form of a sharp peak, from which oil availability declines rapidly, or it may be an undulating plateau spread over a number of years if, for example, oil demand drops as a result of climate change impact.

Box 1. Peak Oil – ASPO 2005 Global Assessment



- A peaking of global gas supply may follow not long afterwards.

- Given the absolute dependency of modern societies on oil and gas, the result will be traumatic. Australia is particularly vulnerable. Whilst still 50% self-sufficient in oil, albeit steadily declining, our imports are currently 85% of daily usage, offset by high exports. Australia, in contravention to its obligations as a member, is the only IEA country not to maintain a 90 day net imports strategic petroleum reserve. It is also heavily dependent upon transport fuels[xv] [xvi].

- Global and national policies are required to handle the allocation of the available oil in times of physical shortage. A means of equitable sharing is essential, to avoid the conflict which will arise from reliance purely on unrestrained markets. Contingency mechanisms, built around an **Oil Depletion Protocol** should be put in place urgently as time is short.

- Some obvious solutions to peak oil, for example increased coal consumption or coal conversion to liquids, would be extremely detrimental to climate change solutions. Other solutions, if they involved overall reduction in fossil fuel consumption, would assist in addressing climate change. The two issues need to be treated consistently and holistically to meet both climate change and peak oil objectives. Hence the need for an integrated policy response.

Overview

- Valuable years have been wasted in denial, procrastination and deliberate obstruction of any serious attempt to arrest climate change. This has already made the solution far harder than it might have been. There is no further time for half-measures.

- Climate change and peak oil are inextricably linked. Each one is a major issue in its own right, but their convergence has received minimal attention, which is unfortunate as it is likely to have far greater impact than the sum of the individual parts.

- Globally and nationally there must now be rapid agreement on, and implementation of, measures to stabilise atmospheric carbon concentrations by reducing emissions substantially and to prepare for peak oil. This requires clear, binding, deliverable targets as the basis for policy.

- These changes will fundamentally alter the lifestyle of the entire community. Whilst policy should endeavour to minimise costs and smooth the transition to a low-carbon economy equitably, there will undoubtedly be pain, but the pain of not taking action will be considerably greater.

- In these circumstances, it is not possible to maintain industry competitiveness and economic growth as currently constituted and we should not pretend otherwise. Conventional growth is a large part of the problem. We must move to a new paradigm of a sustainable economy, which requires large structural change. But whilst some industries decline, greater opportunities open up.

- It is essential to take a proactive, forward looking view and seize these sustainable opportunities, rather than reactively defend an unsustainable status quo:

  - the former represent the future of Australia.
  - the latter guarantees our decline and immeasurable community hardship.

  It is often argued that Australia cannot afford to take a leadership, first mover, role in addressing climate change due to the risk of rendering Australian industries uncompetitive and diverting investment offshore. On the contrary, in the low-carbon world now dawning, no carbon-intensive industry is going to move to a region without carbon constraints, as constraints will inevitably be imposed before long. If Australian industry is to become competitive in a low-carbon environment, early action is required.

- Extensive community and business awareness programmes must be initiated to build understanding, consensus and support for the changes. The brain-drain of expertise in alternative energy and conservation technologies, which has been occurring for many years, must be reversed.

- **Current piecemeal government policy is totally inadequate to meet the challenges of climate change. Emissions trading is now, reluctantly, under discussion but it is only one component of the comprehensive policy required. Peak oil is barely on the agenda, although it may be the issue which has the greatest impact in the short-term. This paper suggests a comprehensive, integrated policy, at both global and national levels, which will provide a coherent response to both issues.**

- **Above all, visionary, principled, long-term leadership is needed from government, the community and business. Short-term political or corporate expediency is no longer acceptable; bi-partisan cooperation is essential. Action is required in the next 6-12 months, not in the 3-5 years still favoured in political debate.**

Policy

An integrated policy, encompassing the above perspectives is set out below:

Climate Change

1. Maximum Global Atmospheric Carbon Concentration

Current atmospheric carbon dioxide concentrations are around 380ppm CO_2, having risen from the 190 – 280ppm range in pre-industrial times. If other greenhouse gases, such as methane and nitrous oxide, are factored in, today's atmosphere contains the equivalent of 430ppm CO_2e. Concentrations are increasing at a rate in excess of 2ppm annually, accelerating. Recent scientific analysis suggests that once atmospheric concentrations of CO_2e rise into the 450-550ppm CO_2e range, the risk of dangerous climate change increases rapidly.

Whilst the Stern Review[xvii] states that stabilisation at 450ppm CO_2e is already almost out of reach, it also acknowledges that there is a high price to delay and significant dangers in the 450-550ppm range.

Further, the most recent IPCC evidence, highlighting the emergence of non-linear climatic responses, strongly suggests that, Stern notwithstanding, the target for the maximum global atmospheric carbon concentration should be 450ppm CO_2e.. This implies that we have barely 10 years before that maximum is reached, probably somewhat less.

It is proposed that 450ppm CO_2e be adopted as the maximum acceptable global atmospheric carbon concentration and the target for global climate change policy. This implies a mean global temperature increase, relative to pre-industrial times, of 2°C (range 1-3.7°C). Of this, 0.7 °C has already occurred and a further 0.6 °C is inevitable as the climate has not yet fully responded to historic emissions.

2. Contraction - a Global Carbon Budget

This maximum CO_2e concentration provides the basis for determining an annual global carbon emissions budget. Analysis indicates that achieving 450ppm CO_2e will require the annual global emissions budget to **contract** from 8 GigaTonnesCarbon (GTC) at present to 3.5 GTC by 2050, a reduction of 55%.

Periodic review should be provided, such that the global budget can be adjusted if scientific evidence of climate change dictates that it become more, or less, stringent.

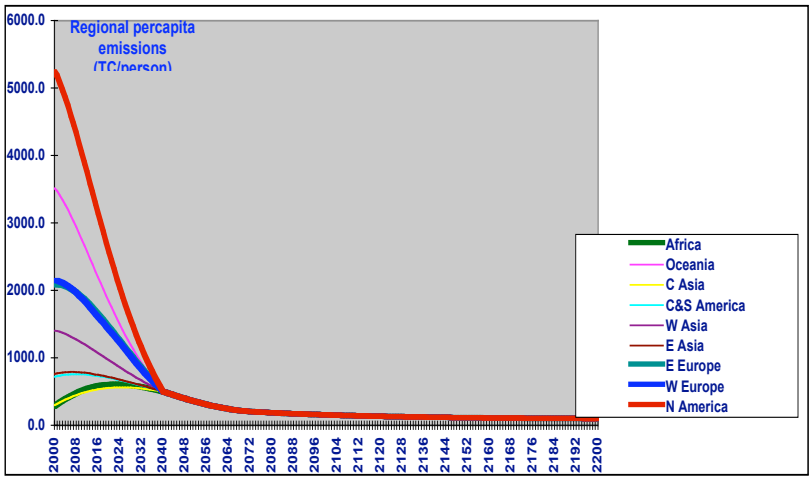
3. Convergence – a National Carbon Budget

The annual global budget must then be allocated amongst nations equitably to establish national carbon budgets. The simplest, most equitable means of doing this is to **converge** linearly from today's unequal per capita carbon emissions to equal per capita emissions globally by a fixed date to be negotiated. If that date is set at 2040, the implications for contraction and convergence of emission reductions from 2005 to 2050 are shown, indicatively, in **Box 2.** Thus Australian emissions would have to reduce by 50% by 2025 and 90% by 2050.

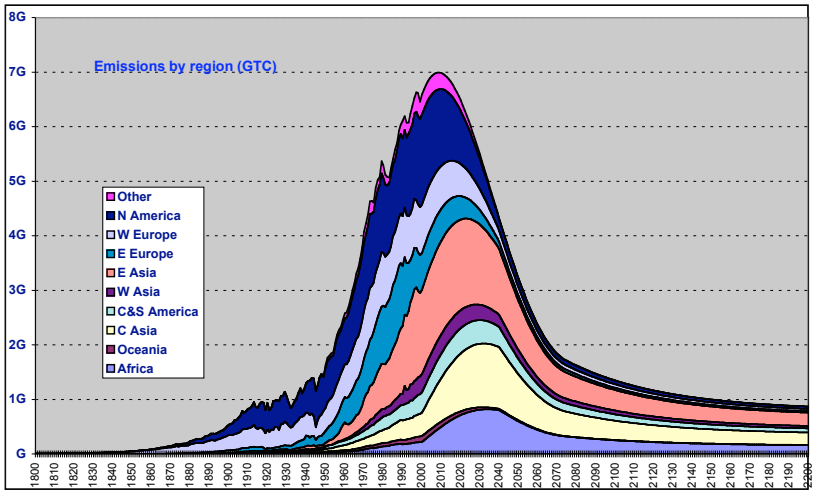
Box 2. Stabilising global atmospheric carbon concentration at 450ppm CO_2e by Contraction and Convergence[xviii] (indicative figures only)

Country	Emissions	2005	2025	2050	% Change	
					2005-25	2005-50
USA	per capita	4.85	1.95	0.37	- 60	- 92
	Total	1.45	0.70	0.14	- 52	- 90
Australia	per capita	4.57	1.90	0.37	- 59	- 92
	Total	0.091	0.044	0.009	- 52	- 90
W. Europe	per capita	2.06	1.18	0.37	- 43	- 82
	Total	0.85	0.48	0.15	- 44	- 82
World	per capita	1.23	0.85	0.37	- 31	- 69
	Total	7.91	6.69	3.55	- 15	- 55
China	per capita	0.66	0.62	0.37	- 6	- 43
	Total	0.86	0.89	0.53	+ 4	- 38
India	per capita	0.40	0.55	0.37	+ 39	- 6
	Total	0.43	0.76	0.55	+ 74	+28

Per capita emissions – metric tonnes carbon per capita
Total emissions – gigatonnes carbon
Population estimates - UN 2003 median projections to 2050



The per capita convergence and global emissions contraction, with regional variations, are shown in these diagrams.



Convergence will need to ensure fairness and consistency, for example to prevent national population numbers being boosted to amplify emission quotas.

4. Meeting the National Carbon Budget

Reductions of emissions in Australia of around 90% by 2050 implies fundamental change from current practice. Change of this dimension to be successful, must have widespread community, business and government support. Indeed it must become a cause to which everyone is committed.

Many schemes have been proposed to achieve emissions reductions, ranging from carbon or fuel taxation to emissions trading of various forms. There is general agreement that trading mechanisms, rather than taxation, provide the most efficient, least cost solution to emissions reduction and a number of alternatives have been developed. For example:

- AGO National Emissions Trading Discussion Papers[xix] – 1999
- McKibbin/Wilcoxen Hybrid Blueprint[xx] [xxi] – 1997-2006
- National Emissions Trading Taskforce Discusssion Paper[xxii] - 2006

Valuable experience is being gained from observing the operation of the EU Emissions Trading System (ETS) since its implementation in February 2005[xxiii]. Various corporations are gaining experience from operating their own internal emissions trading schemes.

Each scheme has pros and cons and, with sufficient political will, each could work. However they all suffer from two fundamental flaws. First, in the absence of binding emission reduction targets, trading of itself will not result in emission reductions, as is evident from experience with the EU ETS. Reductions will only occur when mandatory targets are set; this requires political will or, preferably, for the scheme to be established independent of the political process. Second, they tend to focus only on major emitters (eg stationary energy such as power stations) and do not cover the full gamut of emission sources, on the grounds that to do so would be too costly.

In so doing, they divorce the community from direct involvement in the emissions reduction process, which is a major disadvantage given the extent of behavioural change needed. This is a particular disadvantage as many of the profitable or low-cost emission reduction opportunities are measures that must be taken on the energy demand , as opposed to the energy supply, side at the household or individual level [xxiv] Perhaps most important, these schemes are exposed to the risk of political backsliding at any time.

Debate over emissions trading is still focused on process rather than desired outcome in terms of emissions reduction. When reduction targets are considered, thinking is in the 30-50% range rather than the 90% now required. This may have been appropriate had action been taken in the 1990's, but no longer.

An alternative to the above, which incorporates their benefits but addresses their flaws is the concept of **Tradeable Energy Quotas (TEQ s).** TEQs, unlike the other mechanisms, are also applicable to the management of shortages such as water and peak oil. The concept is summarised in **Box 3.**

Box 3. Tradeable Energy Quotas – A Summary [xxv]

TEQs are an electronic system for rationing carbon-emitting energy, and promoting sustainable alternatives, which involves every energy-user and energy-provider in a national economy.

- There are two reasons why they might be required:
  - Climate change – to reduce greenhouse gas emissions from fossil-fuel use
  - Resource supply – to maintain a fair distribution of a scarce commodity, such as oil when Peak Oil eventuates (or water during drought).

- In the case of climate change, TEQs are applied within the framework of the annual **national carbon budget** allocated under the **Contraction and Convergence** process outlined above. For Australia, the annual budget will reduce year by year to achieve the overall 90% reduction by 2050. In effect we descend an emissions staircase in a controlled manner, whilst making the transition to a sustainable low-carbon economy.

- TEQs are defined in terms of **carbon units**, that is one kilogram of carbon dioxide, representing the carbon emissions produced by use of the energy itself, plus the combustion of the other fuels that were used in its extraction, refining, generation and transport. All energy and fuel carry carbon rating in this way. Other greenhouse gases such as nitrous oxide and methane, are rated in CO_2equivalent terms – the number of kilograms of CO_2 that produce the same global warming effect.

- At the outset, a **TEQ Registrar** is established. This is a computer database which holds individual carbon accounts for all participants in the scheme, similar to credit-card accounts. The number of TEQ units issued and credited to these accounts initially is set equal to emission levels from current energy use, derived from the national budget for that year (after adjusting for non-energy emissions). The number on issue will then be reduced year–by-year in line with the national budget.

- To allocate the TEQ units, the proportion of energy consumed directly by households, for example fuel and electricity, is first assessed. Typically this might be around 35% of total energy usage. TEQ units representing this share of all emissions are then issued free to all adults on an **equal per capita basis** (Children's energy usage would be handled through the child's allowance process). The remaining share, 65%, would be issued through a tender process to all other users – companies, small businesses, public bodies/government, voluntary sector.

- When energy-users make purchases of energy or fuel, they surrender units to the energy retailer, accessing their TEQ account. The retailer then surrenders TEQ units when buying energy from the wholesaler. Finally the primary provider surrenders units back to the TEQ Registrar when it pumps, mines or imports fuel. This closes the loop on what is, in effect, a "carbon added", as opposed to a "value-added" system.

- There is embodied energy in every good and service we buy, and all uses of energy are covered by TEQs. Thus no consumer purchase is excluded from the scheme.

- When any purchaser no longer has TEQ units to offer at the point of sale, units have to be purchased on the market, the cost of the units being added to the cost of the energy purchased.

- If you use less than your quota of units, you can sell the surplus. If you need more, you buy them.

- Every week an additional number of units is issued, equivalent to one week's supply, so that at any time there is full year's supply in circulation. Allocation is made as above.

- The government receives revenue from the tender and a trading margin is earned by the market-makers who quote bid and offer prices. TEQs are bought and sold on the secondary market. Purchases and sales of units are made via the existing financial services infrastructure. The scheme can be largely automated using existing technology.

- Emission assessment and rating procedures can be readily developed from the emissions databases and expertise already established by the Australian Greenhouse Office (AGO)

- The annual budget is set by an **Emissions Policy Committee**, with a mandate to achieve the national carbon budget determined by the **Contraction and Convergence** process. It operates independent of government, much as the Reserve Bank sets interest rates.

- To provide directional certainty for long-term investment decision-making, the Committee will maintain a rolling 20 year budget comprising three periods:
    - A 5-year binding Commitment, which cannot be revised except by force majeure
    - A 5-year Intention, which is inflexible but which can be revised for sound, stated reasons at an annual review
    - A 10-year Forecast, which is a robust guideline

- The government is itself bound by the scheme. Its role is to live within it and assist, with appropriate directional policies, the rest of the community to do likewise. The scheme is thus insulated from the political process, and the government is relieved of the political need to defend the emissions reduction budget.

The transition to a low-carbon economy will be extremely challenging. It will only be achieved if there is joint common purpose and motivation across the nation. The beauty of the TEQ approach is that it creates that common purpose as everyone, and every organization, has an incentive to reduce emissions, and encourage others to do likewise.

The price of units is ultimately under the control of the people who use them, since the faster they are able to reduce their demand for units, the lower the price.

It also will lead to intelligent structural change, as the community demand that short-term political expediency be set aside and sensible long-term policies be implemented to achieve the national emissions budget and stave off the dangerous impact of climate change. The need for additional regulation and command and control systems is minimised.

The technology to establish a TEQ system is already in existence in the financial services and banking sectors, and it would build on much of the work already undertaken by the Australian Greenhouse Office (AGO) and others in developing greenhouse gas metrics, monitoring systems etc.. Accordingly a TEQ system could be established rapidly, within say 12-18 months.

Thus the process becomes a positive, collective experience for the community to restructure and rebuild the economy on sustainable principles.

There is, of course, the risk of a failure of collective will, where the community no longer attempt to meet the need for reducing emissions, the price of units rises to untenable levels,

the government's nerve cracks and the scheme could be abandoned. This would of course represent a regrettable departure from the national ethos of Australian values, but the same risk applies to any scheme.

Arguably TEQ stands the best chance of avoiding such an outcome as it places responsibility where it belongs, with the individual citizen. Schemes which take place in the remote bureaucratic uplands, where citizens are hectored and told what to do, or where arms are twisted by taxation, are far less likely to inspire willing and inventive cooperation.

Implicit in the TEQ concept is the imperative of keeping the scheme simple. **There should be no exemptions for carbon-intensive or export industries and the like**, for example such as the recent deal between the NSW Government and BlueScope Steel. Experience in implementing the GST demonstrated that allowing such special pleading immeasurably complicates the concept, leading to great inefficiency and confusion. In this case it would also lead to inequity as the community-at-large would have to absorb a larger emission reduction burden.

5. The Kyoto Protocol

The Kyoto Protocol should be recognised as the primary vehicle to tackle climate change at the global level.

Australia should immediately ratify the Protocol and initiate discussions to incorporate the **450ppm CO_2e maximum atmospheric global carbon concentration** and the **Contraction and Convergence** principles, as outlined, as the global basis for addressing climate change, managing and allocating global emissions.

This should form the framework for Phase 2 of the Protocol. Phase 2 should be initiated as soon as possible, and not await completion of Phase 1 in 2012. Phase 1 was a compromise which will not deliver substantive emission reductions and needs to be superseded without delay.

The flexibility built in to the Kyoto arrangements then allows the **TEQ** concept to be used as the Australian process for managing the national emissions budget.

Negotiating global agreement to restructure Kyoto in this way will be a major undertaking, albeit the passage may be eased by the increasing evidence that dangerous climate change is looming. Australia should take a leadership role in negotiating global agreement.

6. Directional Incentives

The TEQ system covers energy use. However some 30% of Australian carbon emissions come from non-energy use, for example land-clearing, agriculture and waste. Regulatory arrangements are needed to ensure these activities also contribute to emissions reduction.

The fossil-fuel industries continue to benefit from an enormous subsidy by virtue of the cost of carbon not being incorporated into their cost structure. As a result energy investment decisions have been distorted for decades – part of the "*greatest and widest-ranging market failure ever seen*" to quote the Stern Review. That will change under the market-based carbon pricing policy proposed.

To hasten transition to a low-carbon economy, and to capitalise on new business opportunities, further directional incentives are essential. These should aim to encourage R&D, investment and behavioural change in alternative technologies and sustainable practices. For example:

- Increase Mandatory Renewal Energy Target (MRET) to 30% share of renewables in total generation by 2020 compared with current levels.

- Introduce congestion taxing on vehicles in capital cities
- Encourage investment in, and use of, high quality, efficient public transport, cycling
- Stop further major expansion of freeway systems to constrain expanding vehicle use
- Eliminate subsidies encouraging carbon emissions. For example:
  - re-apply indexation of fuel excise
  - discontinue rebate on diesel fuel
  - remove concessional treatment of FBT on company cars
  - remove subsidy on conversion of cars to LPG.
  - increase road-user charges for heavy vehicles.
- Emphasis on energy efficiency and resource conservation
- World best practice vehicle emission standards mandated by 2012
- Emphasis on high-speed broadband access Australia-wide to speed de-materialisation and reduce travel burden
- Total re-think of the consumer society and related business models (eg transport, aviation, infrastructure, urban and rural environments, financial services, supply chains, marketing, recycling) in line with sustainability principles [xxvi].
- Redesign and simplification of the market economy, corporate and investment regulation, governance and reward systems to deliver long-term sustainability [xxvii]
- Holistic government approach to achieve policy consistency.

7. Fossil Fuel Exports

Export of fossil fuels is a substantial source of carbon leakage from the global carbon emission reduction effort unless the recipient country is part of the global programme, which hopefully will be the case before long if the above initiatives are successful.

For example, coal has the highest per unit carbon emissions of any fossil fuel. Australian coal exports last year totalled some 230 million tonnes. When consumed, this coal would have emitted around 560 million tonnes CO_2e, equal to Australia's total annual domestic CO_2e emissions.

There may well be justification for higher quality Australian coal, for example, to be used for power generation in preference to poorer quality coal in other countries. However, without carbon being fully priced, there will be substantial distortion of the future energy market if carbon-intensive projects become locked in to the energy mix whilst global negotiations are proceeding.

The Australian coal industry has belatedly acknowledged that clean coal technology and carbon sequestration is essential if coal combustion is to continue. However, despite the industry having been on notice for more than 15 years, the R&D investment devoted to this task is miniscule compared with the challenge ahead. Further, whilst carbon sequestration may work in specific circumstances, it is by no means clear that it will be generally applicable or that timely solutions will be available[xxviii xxix].

Accordingly, no further fossil-fuel export projects should be approved until either all exported carbon can be securely sequestered on a long-term basis, or it is accounted for in the importing country by global agreements as above. This will ensure that investment decisions are not distorted, and act as a spur to accelerate technological innovation.

8. Domestic Carbon-Intensive Investment Projects

As for fossil fuel exports, no further domestic carbon-intensive major investment projects should be approved until the market structure outlined above is in place, with full carbon pricing. This would apply, for example, to any new coal-fired power generation, water desalination plants, industrial plant etc..

Given Australia's dependence on existing coal-fired power generation and its associated high emissions, all existing power plants should be phased out by 2020 unless retro-fitted with clean coal technology and carbon sequestration to acceptable standards.

9. Airlines and International Sea-freight Bunkers

At present airlines are not included in emissions trading systems and do not pay fuel taxes. Airlines were excluded from the Kyoto Protocol on the grounds that the industry would develop its own trading scheme for emissions reduction by 2007, a matter currently under debate.

Airlines account for around 3% of global emissions, although this may be an underestimate as some types of emission may have a particularly damaging impact on the environment; this is still the subject of scientific investigation, but the total impact may be 2-4 times as great. What is clear is that airline emissions are growing rapidly, spurred by unsustainable cheap air travel and increasing wealth, and will become a much more significant component of overall emissions[xxx xxxi xxxii xxxiii xxxiv].

Accordingly the subsidies currently enjoyed by airlines, which encourage carbon emissions, must be removed and aviation included in the global and national emission reduction programmes. To an extent the TEQ system will achieve this domestically, but special provisions may be needed to ensure there is no aviation carbon leakage.

International sea-freight bunkers similarily are not included in current emission trading schemes. Measures are needed to incorporate them.

10. International Emissions Trading

The TEQ concept is designed to operate within a national economy, as a means of meeting the national emissions budget. It does not address international emissions trading.

International emissions trading will be essential to achieve the optimal, least cost emission reduction strategies. This should be provided for by nation-to-nation emissions trading under the auspices of the Phase 2 Kyoto Protocol via mechanisms such as the Clean Development Mechanism (CDM), Joint Implementation (JI), or a modified EU ETS system.

It would allow nations with quotas in excess of their needs to sell to those requiring additional quota, in the process easing global inequity by transferring wealth from the developed to the developing world.

Technology transfer from the developed to the developing world, to achieve low-carbon outcomes, must also be part of the process.

Peak Oil

The policy outlined above for climate change is appropriate for managing the peaking of global oil supply with the following variations:

1. Oil Depletion Protocol

The equivalent of the Kyoto Protocol and the Contraction and Convergence mechanisms would be an **Oil Depletion Protocol**, agreed globally, the intent being:

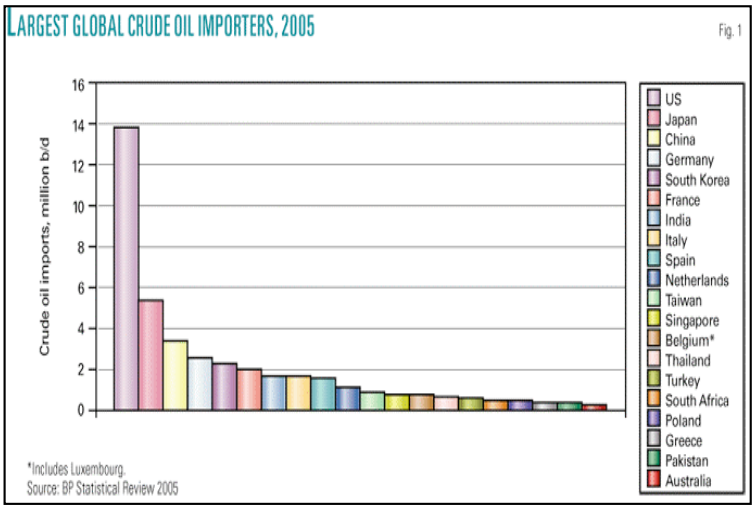
- to reduce global dependency on oil, given that the peak of physical oil availability is being reached and remaining oil reserves are steadily depleting.
- to conserve oil for premium use.
- to avoid profiteering from shortages, such that oil prices may remain in reasonable relationship with production cost
- to allow poor countries to afford their imports
- to avoid de-stabilising financial flows arising from excessive oil prices
- to encourage consumers to avoid waste.
- to stimulate the development of alternative energies
- to assist the transition to a low-carbon economy without conflict.
- to contribute to reducing carbon emissions, working in tandem with the Kyoto Protocol initiatives.

The Oil Depletion Protocol is summarised in **Box 4:**

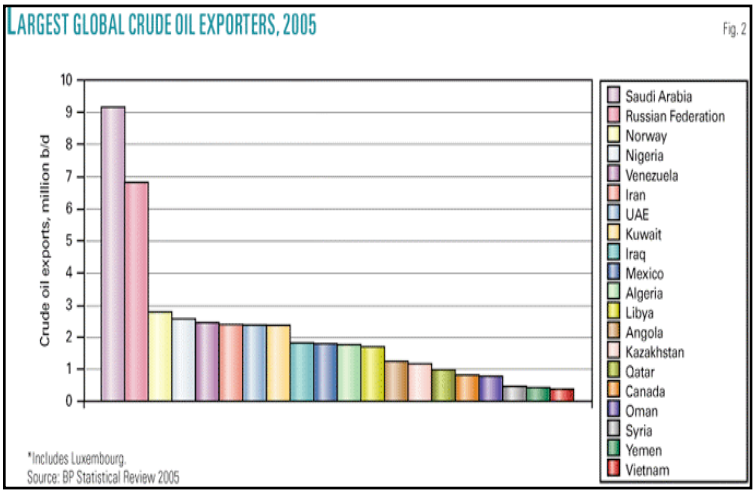
Box 4. Oil Depletion Protocol [xxxv] [xxxvi]

Oil in this context would be defined as "conventional oil", excluding non-conventional oil such as tar sands, oil shales and oil from coal conversion, the production of which have detrimental environmental consequences. The Protocol operates as follows:

- An Oil Depletion Rate is established, globally and nationally:
  - Each country has a finite endowment of oil comprising current recoverable oil reserves in existing oilfields plus discoveries yet to be identified.
  - Reserves are calculated under industry standards.
  - Discoveries can be reasonably estimated based on extrapolation of historic trends
  - The depletion rate is defined as the amount currently being produced annually, either globally or nationally, divided by the current oil reserves plus discoveries, as a percentage.
  - The world depletion rate at present is around 2.6%p.a., the US depletion rate is around 5% p.a., the Australian depletion rate is around 2.6%p.a.
- The world and every nation would undertake to reduce their oil consumption annually by at least the world depletion rate
- No country would produce oil at above its present depletion rate.
- No country would import oil at above the world depletion rate



For reference, major oil importers and exporters are shown in the diagrams.



The Protocol would result in an annual, national oil descent budget akin to the national emissions budget. However in this case there is less focus on global equity via a convergence process where, for example, developing countries might expand consumption as developed countries contract, as the intent is to ween all consumers off oil as an increasingly scarce commodity, hasten the transition to alternatives and avoid locking in new oil-dependent infrastructure.

2. Meeting the Oil Descent Budget

Having formulated the oil descent budget, it would then be implemented nationally using the TEQ system as the vehicle. In this case, rather than constraining an over-abundant commodity, carbon emissions, the system rations a scarce commodity, oil.

The TEQ unit would be defined in terms of one oil unit – for example, 1 litre of petrol or 1 litre of fuel oil, or some combination related to the product market mix[xxxvii]. An annual distribution would be determined as before, then allocated between individuals, gratis on an **equal per-capita basis**, and to industry, government etc. by tender. Trading would occur as before, dictated by individual needs.

The annual oil descent budget sets out a clear transition path to a low-carbon economy, as guidance for long-term investment decision-making.

The oil TEQ system could be administered using similar electronic and administrative infrastructure to the emissions TEQ. Ideally the two would operate simultaneously in a self-reinforcing manner. Again, the system should be kept simple, and **no exemptions should be entertained.**

3. International Oil Trading

Whilst the TEQ system would handle domestic trading, international trading arrangements nation-to-nation would be provided as part of the Oil Depletion Protocol, akin to the international emissions trading concept forming part of the Kyoto Protocol.

This would allow nations with quotas in excess of their needs to sell to those requiring additional quota, in the process easing global inequity by transferring wealth from the developed to the developing world.

Community Awareness and Commitment

The transition to a low-carbon economy, stabilising atmospheric carbon concentration below 450ppm CO_2e and managing peak oil, will fundamentally alter the lifestyle of the entire community. It will only be achieved if there is strong leadership and a whole-hearted commitment to achieving the objective. To build this commitment will require extensive community awareness programmes:

- explaining the problem
- setting out solutions
- building a consensus for action

This integrated policy would minimise costs and smooth the transition as equitably as possible. However, there is a real danger, given the extent of change required, that global and national leaders, along with the populace, become fixated by pessimism and paralysis, moving directly from denial to despair.

An alternative view is that we now have a unique opportunity to set humanity on a new course, built on sustainable principles. Undoubtedly there will be pain in the short term,

probably much of it, as conventional politics, economics and business models are turned on their head, for we have left it late in the day to change direction. However the tools and technologies to solve these problems are already available, the cost is less than we have been led to believe, and the benefits are greater [xxxviii] [xxxix]. Further, change can be achieved rapidly given the right impetus.

Accordingly, consensus building, whilst not underplaying the extent of the challenge ahead, must focus on the positive and the opportunities it presents.

Afterthoughts:

"There is nothing more difficult to handle, more doubtful of success, and more dangerous to carry through than initiating change. The innovator makes enemies of all those who prosper under the old order, and only lukewarm support is forthcoming from those who would prosper under the new. Their support is lukewarm partly from fear of their adversaries, who have the existing laws on their side, and partly because men are generally incredulous, never really trusting new things unless they have tested them by experience."

Niccolo Machiavelli
The Prince 1514

"Depend upon it, Sir, when a man knows he is to be hanged in a fortnight, it concentrates his mind wonderfully."

Dr. Samuel Johnson

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