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‘Clean coal’ and other greenhouse myths

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Myths, folklore and lies

There is no longer any doubt that rising concentrations of greenhouse gases are leading to dangerous change in the global climate. In Australia, public and political opinion finally shifted in late 2006, with record droughts and an early start to the bushfire season. The Stern Review in October 2006 and the Fourth Assessment Report of the Intergovernmental Panel on Climate Change in February 2007 reinforced fears about global warming.

The debate has now shifted to the best means of reducing greenhouse gas emissions, and to the need for adapting to the level of climate change that now appears inevitable. Not surprisingly, the confusion and deliberate misinformation which formerly surrounded the debate on climate change has now shifted to the debate on how to tackle it. If there is to be an effective response (and the odds do not look good at present) very large changes are required in the global economy, and especially the global energy system. There will be both winners and losers among industries and companies. The potential losers are fighting to retain their advantages and privileges. Others are positioning themselves to profit, in some cases from ineffective or even counter-productive ‘solutions’.

Part of the strategy of potential losers and winners is to influence the public debate through myths and half-truths. Governments and oppositions are also attracted to convenient half-truths to mask inaction or lack of effective policy. Even among the many who sincerely support a reduction in emissions, there is much confusion.

The scope for misinformation is especially high in 2007, with climate change already a major issue for the Federal election later in the year. This paper addresses some of the most widely repeated myths about reducing emissions, which are sure to get a thorough workout in the coming months. The 16 most common myths are as follows.

1. ***Coal can be part of the solution.*** In reality, coal is the main problem, and curtailing its use is essential. There is no such thing as 'clean coal' at present, and there is a chance there will never be.

2. ***Carbon sequestration can be the centrepiece of policy.*** This technology is unproven and expensive.

3. ***Nuclear power can be the centrepiece of policy.*** This technology is expensive and risky and, if pursued, is unlikely to have any significant impact for 15-20 years.

4. ***Renewable energy is always benign.*** All forms of energy have advantages and disadvantages, and not all renewables are completely 'clean'.

5. ***Renewable energy can support our current level of energy use.*** In reality, we cannot make the transition to a renewable energy system without first relying on natural gas and greatly increasing the efficiency of energy use.

6. ***Renewable energy cannot provide baseload power.*** An electricity system that uses a mix of geographically dispersed renewable technologies, with some gas-fired power and energy storage, will have just as much ability to supply reliable baseload power as the current coal-based generation system.

7. ***Voluntary 'greenpower' schemes can make a difference.*** Experience shows that they have had little effect.

8. ***Buying carbon offsets is the same as actually reducing emissions.*** In fact, buying offsets is too often just a smokescreen for large emitters who intend to operate on a 'business as usual' basis. A reduction in emissions requires a reduction in emissions, plain and simple.

9. ***We can plant enough trees to get us out of trouble.*** We can't.

10. ***We need to wait for new technology.*** In reality, if the technology is not already available, it will come too late.

11. ***The hydrogen economy will save the day.*** Energy is required to produce hydrogen, so the hydrogen economy would be only as greenhouse friendly as the energy system which supports it.

12. ***Expanding public transport is the answer.*** Cars are here to stay and reducing emissions from them must be the primary focus of policy.

13. ***It won't cost anything***. Tackling climate change will mean the end of the era of cheap energy.

14. ***Higher energy prices mean lower living standards.*** In fact, with good policies energy bills could come down while energy prices go up.

15. ***Australia will meet its Kyoto target.*** We won't.

16. ***There is no point ratifying the Kyoto Protocol.*** Australia's interests would be best served by having a seat at the table. The G8 summit endorsed the Kyoto process under the UNFCCC.

This paper exposes these greenhouse myths, and reiterates the basic principles of an effective greenhouse policy:

- no new coal-fired generation until it meets the criteria for at least half-clean use;
- encouragement of renewable and gas-fired generation;
- an increasingly stringent cap on emissions supported by a tradeable permit system; and
- stringent minimum energy efficiency standards for vehicles, buildings and appliances.

In the meantime, Australia's emissions continue to rise inexorably, despite the outlay of considerable amounts of private and public money, most of which has been wasted. What is needed above all is a near-term policy that causes emissions to peak in the next few years then fall over the next decade. If we succeed in that, the future will take care of itself.

Myth 1: Coal can be part of the solution

There is no such thing as 'clean coal' for climate change. The description is a marketing triumph for the coal industry, like 'safe cigarettes' for the tobacco industry.

While some coals have lower non-greenhouse pollutants (eg. sulphur), the greenhouse pollution produced by burning *any* coal is higher than burning other fossil fuels. Almost all the energy released from burning coal comes from the oxidation of carbon (producing CO_2) whereas part of the energy released from burning natural gas and petroleum comes from the oxidation of hydrogen (producing H_2O).[1] Typically, producing 1 gigajoule (GJ) of thermal energy from Australian coal produces 91 kg of CO_2, whereas the equivalent value for petroleum is 68 and for natural gas 52.

Based on these differences alone, generating electricity from coal gives 75 per cent more greenhouse gas emissions than generating from natural gas. The difference is even greater for Victorian brown coal, which consists of more than 50 per cent water. In 2005, the average emissions intensity for Australian black coal-fired power stations was 0.95 kg carbon dioxide equivalent per kilowatt-hour sent out. For brown coal power stations it was 1.34 kg/kWh and for natural gas power stations it was 0.55 kg/kWh.

The only way that coal's greenhouse pollution can be reduced is by techniques that are highly energy intensive (eg. drying, liquefaction or gasification of the fuel) or which capture and then securely store the emissions (carbon capture and sequestration, or CCS).

[1] Although water vapour acts as a global 'greenhouse gas' the change in natural water vapour concentrations in the atmosphere from fossil fuel combustion is negligible, whereas CO_2 concentrations have increased sharply from pre-existing natural levels, since the start of large-scale fossil fuel use.

The most valid comparison of the greenhouse intensity of electricity generation options is the net kWh sent out of the power station (taking into account all energy use for drying, liquefaction or gasification, capture, pumping and injection) per kg of CO_2 released to atmosphere (taking into account all emissions along the fuel supply and preparation chain, less any emissions recovered at the power station and securely sequestered).

Only when a commercial coal-fired power station achieves a value of 0.55 kg/kWh on this indicator – similar to natural gas – can it be said to be 'half-clean' in greenhouse terms. (The probability of achieving near zero emissions from coal is low, given that almost any conceivable technical alternative would be cheaper).

Even if these objectives could eventually be achieved for new power stations, the emissions from an existing power station cannot be significantly reduced, at reasonable cost, once it is built. Therefore the only prudent course of action is to ensure that no new coal-fired power stations be built until they can achieve greenhouse emissions no higher than natural gas, which is plentiful and readily available throughout Australia. Of course, natural gas is currently more expensive than coal, but only because there is no carbon price signal.

The coal industry, not the public purse, should fund the cost of developing the technology to enable coal to be burned at lower greenhouse-intensity. The immediate adoption of an absolute cap on the emissions intensity of new power stations of 0.55 t CO_2-e/kWh sent out (on a full fuel cycle basis) would no doubt focus the efforts of the industry to use coal in a way which is at least half-clean.

This should be a genuine emission-intensity limit, not one that can be circumvented by planting trees or buying 'credits' or 'offsets'.

Myth 2: Carbon sequestration can be the centrepiece of policy

Carbon dioxide sequestration means the capture and permanent (or at least long term) retention of CO_2 that would otherwise be released to atmosphere. The technology is not particularly new. The petroleum industry has been capturing naturally occurring CO_2 from the hydrocarbon stream for decades to ensure that the CO_2 concentration in pipeline gas is low enough to meet the required technical specifications, and reinjecting it into the oil reservoir - not because the industry valued CO_2 sequestration but because it helped the overall economics of oil production.

The Australian gas industry has also started to investigate the sequestration of naturally occurring CO_2 from the gas stream, but only because the taxpayer is funding it.[2]

The large scale capture and sequestration of combustion CO_2, as distinct from CO_2 occurring naturally in gasfields, is unproven.[3] There are several demonstration projects

[2] In November 2006 the Commonwealth Government committed $60 m to the Gorgon natural gas project in WA to be operated by Chevron, to support the cost of stripping and reinjection of 125 million tonnes of CO_2 over the project's life. This was reported to be two thirds of what would otherwise go to atmosphere. This represent a major taxpayer subsidy to Chevron: under the 'polluter pays' principle the company should be made liable to purchase CO_2 emission permits to cover the full 190 Mt of fugitive emissions, and would then no doubt find that reinjection was more cost-effective.

under way, including some in Australia, but there is no immediate prospect of commercialisation.

The successful sequestration of CO_2 from a coal-fired power station requires a combination of preparation (possibly gasification), combustion (possibly using oxygen rather than air), capture technology, CO_2 transport technology and a safe nearby reservoir for re-injection. If these become feasible at all, it will only be for new power stations in particular locations – modifying existing power stations would be prohibitively expensive.

Sequestration is unproven for combustion CO_2 capture from new power stations, and entirely irrelevant to existing power stations. Oddly enough, these facts are often omitted when sequestration is discussed as a means for making coal use 'clean'. If sequestration should become practical and safe, and can help new coal-fired power stations to achieve an emissions-intensity of 0.55 t CO_2-e/kWh or less, and the costs are included in the price of the electricity produced, then it may be acceptable.

Myth 3: Nuclear power can be the centrepiece of policy

The Commonwealth Government appears to have adopted nuclear power, along with 'clean coal' as the centrepiece of its greenhouse gas reduction strategy. Unlike coal, however, there is no nuclear power industry in Australia, so it would take considerable lead time and effort to establish one.

Even the advocates of nuclear energy conclude that it could make, at best, a limited, delayed and expensive contribution to reducing emissions:

> Nuclear power is likely to be between 20 and 50 per cent more costly to produce than power from a new coal-fired plant at current fossil fuel prices in Australia. This gap may close in the decades ahead, but nuclear power, and renewable energy sources, are only likely to become competitive in Australia in a system where the costs of greenhouse gas emissions are explicitly recognised. Even then, private investment in the first-built nuclear reactors may require some form of government support or directive.
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> The earliest that nuclear electricity could be delivered to the grid would be 10 years, with 15 years more probable.[4]

If nuclear power were the only or the cheapest option for reducing greenhouse gas emissions it would have to be considered seriously. However, there are many alternatives which are cheaper, safer, immediately available and with far more public support. Even if the special problems of nuclear power could be put to one side, its central *economic* problem is that it can only be cost-competitive with a carbon price, and once that is introduced almost every other option will be more attractive than nuclear (except possibly carbon sequestration and 'clean coal' technology).

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[3] 'Geosequestration' means pumping captured CO_2 underground, into cavities or into permeable rock strata. Pumping captured CO2 to the ocean floor has also been suggested – this would presumably be 'hydrosequestration'.

[4] Uranium Mining, Processing and Nuclear Energy — Opportunities for Australia? Final Report to the Prime Minister by the Uranium Mining, Processing and Nuclear Energy Review Taskforce, December 2006.

The obstacles to developing nuclear power in Australia are formidable. We list here only the main ones.

- Power station dismantling and site cleanup costs, not usually included in cost comparisons with other forms of electricity generation, are higher than for any other technologies.

- Nuclear power will create environmental risks in some of the most sensitive ecosystems in Australia.

- The costs of insurance against accidents tend to be so high that governments are usually required to indemnify or limit the risk exposure of nuclear plant operators. This is another form of public subsidy.

- There are substantial risks associated with uranium mining, including the retention and disposal of tailings; politically or criminally motivated sabotage or terrorist attack on nuclear power stations; risks associated with storage of nuclear waste; and the dangers of proliferation of nuclear weapons.

- Cooling water consumption during operation is higher than coal-fired power stations of similar output.

- Lifecycle and fuel cycle greenhouse gas emissions which, though significantly lower than fossil fuels, are still 3 to 4 times as high as for renewables per unit of energy.

- The community is opposed to nuclear power. A December 2006 survey found that 50 per cent of Australians opposed the construction of nuclear power plants in Australia, 35 per cent are supportive and 15 per cent uncommitted. However, 66 per cent were opposed to a nuclear plant sited in their own area, 25 per cent supportive and 9 per cent undecided.[5]

Myth 4: Renewable energy is always benign

Energy production involves a large range of systems and technologies along a spectrum from pure fossil carbon (i.e. coal-based) to those with very low fossil carbon content and very high use of ambient energy flows such as wind or solar flux. All of them have different characteristics, and none of them are free of economic or environmental cost. Even the most benign and least greenhouse-intensive technologies, such as wind power, contribute to emissions in a small way through the manufacture, transport and assembly of their components. They also have some negative impacts (visual impacts, the occasional bird kill) which, though infinitesimal compared to any fossil-fuel technology, are sufficient to be exploited by those opposed to them.

While the ‘renewable/sustainable’ and ‘fossil/unsustainable’ ends of the spectrum are easy enough to identify, the point at which one merges into the other is vague. Hydro power, which accounts for most of Australia’s so-called ‘renewable’ energy, involves

[5] Andrew Macintosh, *Who Wants a Nuclear Power Plant? Support for nuclear power in Australia*, Australia Institute Research Paper No. 39, January 2007
http://www.tai.org.au/documents/downloads/WP95.pdf

large-scale destruction of natural rivers and ecosystems and relies on water flows that are increasingly unreliable and subject to competing use. Biomass energy and ethanol production can rely on, and give economic support to, destructive logging and agricultural practices, some of which are heavy users of fossil fuel and petroleum based fertilisers, or result in net loss of carbon from land clearing. Other technologies such as landfill gas use are only 'renewable' so long as wasteful materials use and disposal practices persist.

At the most benign end of the spectrum of renewable technologies in actual commercial use in Australia (as distinct from those which are speculative, such as hot rocks or limited in application such as wave power) are wind energy, photovoltaics (PV, in which solar energy is converted directly to electricity) and pure solar-thermal technologies, which capture solar energy as heat and use no fossil fuel backup.

For these highly renewable technologies the greenhouse emissions involved in manufacture are low and the emissions in operation and maintenance are close to zero.

Myth 5: Renewable energy alone can support our current level of energy use

The great disadvantage of most 'pure' renewable energy forms is that they only produce energy when the sun shines or the wind blows, and this limits their economic value. By contrast there is no natural limit on the rate at which fossil fuels can be used, provided they can be mined or produced from wells fast enough.

The inputs of 'pure' renewable energy systems – sunshine, wind and tide – obviously cannot be stored, but their outputs can be. Electrical energy can be stored in batteries, rotating flywheels, used to pump water uphill for later release ('pumped storage' is a common part of fossil-fuel systems) or perhaps, in future, used to make hydrogen fuel.

Unfortunately, no storage method is cheap. At present the most economical way to use renewable energy is not to store it but to use it when it is available and to use fossil fuel the rest of the time (there may be more options when renewable forms of baseload energy are better developed – see next myth). The problems associated with the variability of energy sources can be minimised by strategically siting the renewable generators across a large geographical area, ensuring a significant proportion of the generators will always be producing electricity. Although there are theoretical limits to the balance between unregulated and regulated generation before the stability of the system is endangered, we are far from these limits in Australia and will be for decades. In any case, if there is a commitment to maximising the renewable share of the system, it can be planned accordingly.

Another poorly understood difference between renewable and fossil generation technologies is one of scale. The annual energy output of domestic rooftop 1 kilowatt (kW) photovoltaic array, about 1,400 kilowatt hours (kWh) per year, is equivalent to only 20 per cent of the electricity use of the average Australian household. A typical 2 megawatt (MW) wind turbine produces over 3,000 times as much energy as a household PV array. However, a typical 660 MW coal-fired generation set produces 3.3 *million* times as much electric energy as a household PV array, and over 1,000 times as much energy as a wind turbine.

The 2006 census found that there were 6.1 million occupied houses and town-houses in Australia. If every single one were equipped with a 1 kW rooftop PV array, the total energy output would be equal to just two coal-fired generation sets, or one power station of the size of Mt Piper in NSW. There are 27 large coal-fired power stations in Australia.

Advocates of renewable energy are fond of stating the energy output of renewable generators in terms of 'number of homes that would be supplied with electricity'.[6] An equally relevant measure is the number of industrial users that could be supplied. For example, while a wind turbine might be able to supply the equivalent of 626 homes (leaving aside the problem of what happens when the wind is not blowing) it would take the energy from 1,000 wind turbines to supply a single aluminium smelter.

Therefore the issue is not *either* renewables *or* fossil, but the optimum combination of the two, with safeguards such as absolute emissions intensity limits to reduce the negative impacts of the fossil fuel use. Until Australia's economy and industrial structure change radically, the renewable share of our energy needs will be limited.

While renewable energy is an important contributor to reducing emissions, the idea that it can be the centrepiece of emissions reduction, at least over the next two to three decades, is a myth. Fossil fuels cannot be phased out overnight, and will not be phased out even in the long term without a careful transition strategy. The centrepieces of that strategy must be massive increases in energy efficiency and preference for natural gas (the cleanest of the fossil fuels), with renewables playing a growing supporting role.

Myth 6: Renewables cannot provide baseload power

The demand for electricity in a modern electricity supply system never falls below a minimum level, which is typically around 40 per cent of maximum demand. This minimum constitutes what is termed baseload demand. However, to leap from this undoubted fact to the assertion that renewables cannot provide baseload power depends on a series of misconceptions and downright falsehoods.

While it is true that large coal fired generators are most efficient when operating continuously at a fixed level of output, any single generator is always subject to unexpected stoppages. The electricity supply system deals with such stoppages by having a large number of different generators available and by maintaining at all times a reserve margin of unutilised generating capacity that can be brought into operation at short notice to cover the shortfall in supply. In terms of system operation, there is not a great difference between an unexpected shut down of a large coal fired generator and a sudden fall in wind speed at a wind farm. In fact, the shut down of a 660 MW coal fired generator is a much larger problem than the shut down of a wind farm, few of which exceed 100 MW in size. If many windfarms were located close together, the problem would be greater, and this has occurred to some extent in South Australia where wind currently supplies over seven per cent of electricity demand. Even there, however, there have been no problems in maintaining reliable supply at all times.

[6] Another measure commonly used to exaggerate the scale of renewable energy sources or greenhouse reductions is 'cars off the road'. In emission terms one 'home' equals about two 'cars off the road'.

In fact, the great geographical extent of the National Electricity Market Grid, stretching from far north Queensland to southern Tasmania and far west South Australia, combined with the many favourable sites for wind generation, increases the reliability of wind generation as a whole. There are almost no occasions when South Australia, Tasmania and New South Wales are simultaneously experiencing low wind weather conditions. Mathematical modelling has shown that when the share of wind in total electricity supply exceeds about 15 per cent, reliability may decline. However, this can be overcome at relatively low cost, either by the installation of a limited amount of open cycle gas turbine generating capacity, or by greater use of pumped storage (see below).

The baseload power myth is also used to attack solar electricity, which of course is only available during daylight hours. This myth is also based on misconceptions. Firstly, not all forms of electricity generation are required to supply baseload and there is a very valuable place for technologies that can supply during the day when demand for electricity is greater than overnight. Secondly, solar thermal electricity generation, producing steam to drive a turbine and generator, can be and has been easily combined with natural gas fuelled boilers which produce steam during the night. Australia is very well placed to deploy this technology, because there are many locations where major gas pipelines run through very sunny regions of inland Australia. Thirdly, should it be considered necessary for photovoltaic electricity to be available overnight, there are very good prospects for the commercialisation within a few years of several different energy storage technologies that could make this possible, including the vanadium redox and zinc-bromine batteries, both of which are being developed in Australia and have recently received Commonwealth government financial support for demonstration installations.

For other types of renewable generation, the supposed inability to supply baseload energy is simply a falsehood. 'Storage hydro', based on large dams across natural rivers is the most responsive of all forms of electricity generation – large generators can be brought from stationary to full power in just a few minutes, allowing the generators to be run when the electricity is most needed (and can be sold at the highest price). With relatively modest additional investment it can be converted to pumped storage, in which water is pumped uphill when there is surplus power from other generators on the grid, and is released to generate electricity when there is a deficiency elsewhere in the grid. There are currently three major pumped storage schemes in Australia and more could be built. Biomass can also be stockpiled to cover daily and weekly fluctuations in demand, but usually limited for longer periods by the needs of the associated production processes such as forestry or sugar cane crushing. Electricity from hot rock geothermal sources, if and when it is commercially developed, will be readily available at all times and in this respect be virtually identical with a coal fired power station.

In summary, an electricity system that uses a mix of different renewable and low emission (gas-based) fossil fuel generation technologies, with some energy storage and a geographical dispersion of wind and solar generation, will have just as much ability to supply reliable baseload power as the current coal based generation system.

Myth 7: Voluntary 'greenpower' schemes can make a difference

'Green energy' or 'green power' is a very flexible concept. It can be used to mean 'renewable energy' in general, although the point on the spectrum where 'green' merges

into ‘black’ tends to be very subjective. Even some advocates of nuclear power have taken to calling it ‘green’, perhaps an even greater leap than ‘clean coal’.

GreenPower on the other hand is the trademarked name for a scheme where electricity users can choose to contribute to a fund which benefits electricity generators who use certain forms of renewable energy. The marketing of *GreenPower* to electricity users, the criteria for generator participation and the auditing of the scheme are supervised by a national accreditation program controlled by government agencies.

While increasing the renewable share of electricity generation makes a worthwhile contribution to reducing emissions, the actual and potential contribution of ‘green energy’ and of voluntary programs such *GreenPower* is much overstated. *GreenPower* sales in Calendar 2006 were on track to reach about 1,500,000 MWh, and so would have increased the so-called ‘new’ renewable share of national electricity generation by about a third, from about 2.2 per cent to 2.8 per cent - an admirable but small contribution.

Unfortunately, this benefit comes at the cost of deferring more effective action on greenhouse emissions. *GreenPower* helps perpetuate the myth that individuals can and should take the lead in addressing the problem, and diverts attention from the power industry, large energy users and government. There are also signs that the imperfect public understanding of *GreenPower*, and its interactions with the Mandatory Renewable Energy Target (MRET) and the ‘renewable target’ schemes proposed for Victoria and NSW, are being used to justify continued increases in fossil fuel generation which greatly exceed the modest contributions of these programs to emissions reduction.

If it hasn’t already, ‘green energy’ is in danger of becoming a smokescreen for carbon-emitting activities, in the same way as many other ‘credit’ and ‘offset’ schemes. Public statements claiming that specific greenhouse-intensive projects, even coal mines, can be ‘offset by green energy’ are becoming common. Even *GreenPower* is being marketed as a way of masking the energy impacts of sporting and other events[7] and governments themselves have begun to claim that unpopular electricity-intensive developments such as the proposed Sydney desalination plant will be powered by *GreenPower*.[8]

The share of Australia’s electricity generation that is produced from renewable energy sources is increasing, albeit painfully slowly and from a low base. These positive trends are in danger of being swamped by the growth in emissions from fossil fuel generation. Indeed, the Government’s own projections show the share of renewable energy *falling* between 2010 and 2020. If *every* new project and every new home were forced to purchase 100 per cent *GreenPower*, and the funds were directed to new rather than old projects, this would have some effect in curtailing fossil carbon emissions. As long as this is not the case, ‘branding’ a share of renewable energy production (much of it from old sources) as belonging to a specific company, event or project does little to slow the general growth in fossil carbon emissions.

[7] http://www.greenpower.gov.au/pages/Events.php

[8] http://www.deus.nsw.gov.au/news/news.asp#P9_539 The first phase of the plant would consume about 450,000 MWh per year (and twice as much if it is built up to full capacity). This alone would require a 30 per cent increase in current national GreenPower output.

Like the myth of 'clean coal', the myth of the magic pudding of 'green energy' is being used to mask and justify ever-rising emissions.

Myth 8: Buying carbon offsets is the same as actually reducing emissions

'Offsetting' is the practice of supposedly compensating for the greenhouse gas emissions of a particular activity – such as travelling by air or building a desalination plant – by purchasing 'credits' or by paying an intermediary who promises to fund some activity which supposedly improves performance by someone, somewhere, compared with some arbitrary baseline.

The only reliable way to limit greenhouse gas emissions is by a properly designed and enforced emissions permit system. If every creator of emissions (eg the suppliers of fuel to the airline, and the suppliers of power to the desalination plant) were subject to such a system there would be no need for air travellers or the plant operator to purchase 'offsets'. The price of the energy embodied in the service would already reflect the cost of the greenhouse gas emissions.

In the absence of a permit system, the effectiveness of 'offsets' is usually unknown by the purchaser and in many cases unknowable. The *best* that can be hoped for is that the 'credits' are created from an activity with known emissions or zero emissions (eg. a 'pure' renewable generator such as wind) and the value is estimated against a credible baseline. However, the baseline will always subjective.

The uncertainties of establishing a reasonable greenhouse face value for offsets are compounded by problems of accountability and deliverability. Many offset promoters rely on poorly defined and never evaluated activities in less developed countries.[9] Even offset programs that rely on activities solely within Australia, and which have reasonable levels of accountability, have had trouble meeting their obligations, especially if they rely on biomass sequestration.[10]

At best, credits and offsets are legitimate indications of real activity, but they should not be confused with the activity itself, and the value of that activity is always uncertain. On the other hand, they can divert attention and funds to projects that are unlikely to reduce emissions and could do more harm than good. At worst, they can divert funds from actual emissions reduction to fund corruption in developing (and developed) countries.

Permits relate to actual emissions, not mythical 'reductions'. A well designed and enforced permit regime is the most effective way to ration the right to emit. Trading in permits is useful and necessary to operate the market and ensure that permits go to the parties that value them most.

Trading in 'credits' and 'offsets' on the other hand further muddies the link between those claiming to have taken the abatement action and those claiming the benefit. Too often, the benefits of an action are counted more than once, and in some cases every party whose hands the 'credits' pass through claims the benefits.

[9] See for example case studies in *New Internationalist* July 2006.
[10] Christian Downie, 'Carbon Offsets: Saviour or cop-out?', Research Paper No. 47, The Australia Institute, July 2007

Mixing the markets for permits, credits and offsets (as advocated for the proposed state-based National Emission Trading Scheme) corrupts the market and undermines its effectiveness in actually reducing emissions, as distinct from exaggerating mythical reductions.

Myth 9: We can plant enough trees to get us out of trouble

The myth that large scale planting of trees can offset the growth in Australia's fossil fuel emissions is still raised occasionally. The problems are scale, permanence and – as is now obvious – risk from drought, fire and other factors, which will all be exacerbated by climate change itself. Even if a landowner wishing to produce a saleable 'carbon sink' certificate undertakes in good faith to plant trees and maintain or replace them for an agreed period (typically 100 years, but often less), there are many physical risks, including drought, pests and wildfire. The land may also pass to a new owner who is unaware or dismissive of any previous undertakings.

It is possible to develop complex systems of carbon pooling and caveats on land title to try to reduce these risks, but if these are to be effective they will be so onerous that in effect only large corporations (or aggregators) with large carbon stocks, monitoring resources and secure long term land tenure (or forestry rights over other's land) could take part.[11]

Even so, there is still a risk that the sinks behind the permits will be deficient, and that the entities creating and selling the permits will no longer be around when this is discovered. If proper insurance of the risk were mandatory, the returns from biomass sequestration credits may well be so low that they could not compete with the market price of excess permits.

Although broad-scale tree planting is very valuable for a range of other environmental reasons, and should be encouraged, ultimately the only reliable and cost-effective way to reduce greenhouse gas emissions is to leave the carbon in the ground.

Myth 10: We need to wait for new technology

It is a myth that we have to develop new technologies before we act. This argument is invariably advanced as an excuse to defer action. Given the long development cycles of new technology, the first round of serious reductions must rely on technologies and products that are already available or near commercialisation.

Fortunately, we already have many at our disposal. There are more expensive options such as renewable energy, but the cheapest and most widely available options are natural gas (for electricity generation and direct use) and energy efficiency.

If emissions are to be reduced on the massive scale necessary it is important to use the most cost-effective means possible, on a vast scale and at the optimum time. The most cost-effective point of intervention is when capital equipment is first installed, or when it is refurbished or replaced. Abandoning serviceable capital equipment before the end of its working life (eg closing existing coal-fired power stations) is very expensive, so

[11] The only known program which imposes these requirements is the NSW Greenhouse Gas Abatement Scheme.

once decisions about capital equipment are made they lock in emissions for years or decades. Therefore we need to develop rules and incentive systems to ensure the right decisions for the *very nex*t power station or house built, and the next car bought – not the one after.

Signalling future carbon prices is a necessary but not sufficient condition. It will not affect decisions fast enough, and in many cases will not affect decisions at all, because the designer or builder of an asset is not the same as the ultimate owner or operator, or is insulated from carbon price signal by other distortions in the price or task regime.

We need to set two additional policy criteria to ensure we get the quantum of reductions we need at the least cost, after which the technology should be allowed to take care of itself.

1. A maximum emissions criterion such as: a maximum of 0.55 kg CO_2-e/kWh sent out for new power generation; a maximum of 7 litres/100km for new vehicles; and maximum design greenhouse intensities (kg CO_2-e/m^2) for new buildings.

2. No covert public funding for technologies, energy forms or fuels on the basis of favouring local economies, regions or electorates. If economic losers of changes are to be compensated (even those who took deliberate commercial risks to ignore the inevitabilty of reducing emissions) this should be done transparently and in the most efficient way.

Cost-effectiveness criteria alone would ensure that the economic cost is minimised, but the emissions may not be adequate. Technical criteria alone may lead to the use of unnecessarily expensive options, especially those which most profit politically influential groups such as the fossil fuel, mining and agricultural industries.

Myth 11: The hydrogen economy will save the day

The myths of the hydrogen economy and electric car exemplify two of the central weaknesses of the 'new technology' argument.

The critical issue of what energy sources produce the hydrogen in the so-called hydrogen economy is commonly glossed over. Certainly, hydrogen is a clean-burning fuel, especially when oxidised in a fuel cell, but it does not occur as free hydrogen on earth. It tends to be combined with oxygen (H_2O) or with carbon in compounds such as CH_4, which is methane or natural gas.

The only way to manufacture hydrogen in large quantities is by using fossil fuels or by splitting water molecules using electricity. To minimise the release of greenhouse gases it is necessary to use non-carbon or low-carbon forms of generation. The ideal would be renewables, but as we have seen, the growth of renewable energy in Australia is barely making a dent in electricity sector emissions, so its diversion for making hydrogen would simply reduce the overall greenhouse benefits of its use, from replacing coal to replacing lower-emissions transport fuels.

Nuclear energy is another possible prospect for manufacturing hydrogen on an industrial scale, as its advocates have begun to realise. However, one of the limitations

of nuclear energy as a greenhouse response is the fact that governments would have to impose a high degree of systemic change, both in terms of public under-writing of economic and environmental risk and in terms of over-riding the objections of perhaps a majority of their own citizens. The prospect of then going even further, to the degree of micro-management of energy policy and massive public subsidy required to introduce the elements of a hydrogen-rich economy, seems fanciful, especially when so many cheaper and less politically divisive options are available.[12]

Similarly, the electric car simply shunts the emissions problem from one part of the energy system to another. The mains-recharged electric was introduced in the USA as a short-lived experiment mainly aimed at reducing air pollution in Los Angeles. It was conceived before greenhouse was on the policy radar, so the fact that it increased emissions overall compared with a petrol car did not matter – provided the emissions were from a power station outside the LA airshed.

The mains-rechargeable electric car is now being promoted (along with hybrids) as part of the US motor vehicle industry's belated recognition of the greenhouse issue. At the 2007 Detroit Motor Show, GM unveiled the prototype of an electric-traction car which would rely mostly on charging from the mains, but with a small on-board generator, powered by a range of fuels, for top-up charging.[13] When asked about the emissions impact of charging the car from coal-fired power stations, a GM executive said:

> Obviously solar energy and wind energy are better than coal burning. If people want an electric car, we'll hopefully one day give them an electric car. But how that electricity is generated is out of our hands.[14]

Myth 12: Expanding public transport is the answer

Australian cities tend to be reasonably dense at their centres, tapering down to very low densities at their peripheries. Their light rail, rail and road networks developed at a time when most economic activity was concentrated in the city centre, and are essentially radial in form. Housing, economic and social activities are now distributed over very wide areas, and a growing proportion of travel needs no longer follow the old radial routes, although there has been some effort to concentrate and intensify new development at transport nodes.

Our high levels of car use have not developed by accident. It is partly a rational response to the internal form of our cities (which of course the car has itself influenced) and the large distances between our towns. People like the privacy and flexibility of using their own cars and are willing to put up with high costs in expenditure, time and risk in order to have them. The decision rests on convenience and cost, especially time cost, rather than any moral commitment to one form of transport over another. In fact many people use public transport for the daily work trip, drive for some trips and walk for others. Travel to and from work, where the opportunities for transfer to public transport are highest, accounts for only a quarter of car use.

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[12] The country of Iceland, which is said to be developing a hydrogen economy, is a unique case in that it has a small population, large reserves of hydro and geothermal energy and imports all of its petroleum.
[13] http://www.chevrolet.com/electriccar/ The engine for the top-up generator is to be a 1.0 litre 3 cylinder turbocharged petroleum engine – as large as the engine in many of European and Japanese compact cars.
[14] *Sydney Morning Herald*, 12 January 2007.

Public transport is necessary for a wide range of reasons, including mobility and access for those who cannot afford cars or prefer not to use them, and limiting private vehicle congestion in cities. While improving and extending public transport is necessary and desirable on many grounds, it will have a negligible effect on car use and hence vehicle emissions. Even if *half* of all car trips to and from work were transferred to public modes – a target that is unattainable with present urban form – urban passenger transport emissions would probably fall by less than 10 per cent, and overall transport emissions by less than 5 per cent.

The primary focus of road passenger transport should be cutting emissions from cars rather than attempting to bring about a wholesale shift to public transport. Emissions from cars can only be controlled by:

- limiting and rationing road space – *not* building new freeways - and charging for road use, as in London (the technology for this is already widespread, thanks to the introduction of electronic tolling in Melbourne and Sydney);
- increasing fuel prices with a carbon tax or emissions permit costs; and
- raising the fuel efficiency of the car fleet, by mandatory means if necessary.

The Australian motor vehicle industry has remained largely exempt from pressures to increase the energy efficiency of their products, such as those faced by the electrical appliance industry. Although the industry and the Commonwealth government have operated a so-called National Average Fuel Consumption (NAFC) program since 1978, this has been embarrassingly ineffective, to the extent that the results have not even been made public since 2002. Although there has probably been some improvement in the past few years, this has occurred because car buyers now prefer smaller imported cars to the large and thirsty models which local manufacturers continue to make.

Myth 13: It won't cost anything

Australia's electricity supply is among the cheapest *and* the most carbon-intensive in the world. This means the gap between what we are paying and the greenhouse damage from our energy use is very wide.

If we are to reduce emissions, the price of electricity must rise to reflect the costs associated with greenhouse pollution. Producing energy from renewable technologies costs more than from fossil fuels, and the least greenhouse-intensive fossil fuel (natural gas) costs more than the most intensive (coal). Brown coal, which must be phased out most quickly, is both the cheapest *and* the most CO_2-intensive fuel we use, so brown coal users (i.e. Victorian electricity consumers) will be hit hardest.

The debate about carbon permits and carbon taxes is simply about the means by which we signal the cost of greenhouse damage to the market and so change the behaviour of both energy producer and energy consumers. The way in which carbon is priced, and how rights to emit are allocated, will determine how much reduction we can achieve for a given increase in energy price, and how the cost is shared.

A system of saleable permits to emit, up to a finite annual ceiling each year, is likely to be the most cost-effective response. The penalties for emitting above the level of

permits held must be high enough to act as a deterrent (eg. fines could be graduated from 3 to 10 times the market value of the permits, depending on the magnitude of the breach). This would make emitters plan their business activities to achieve, in aggregate, the level of reduction agreed by the national policy, and reflected in the declining number of permits issued each year. Electricity suppliers, for example, would develop pricing schemes with very high marginal tariffs, so that that high energy users paid far more per kWh than lower users.

Most economists and businesses agree that 'cap and trade' permit systems, with permit allocations signalled some years in advance, are the most effective as well as the easiest to plan for. Such a system has been recommended by the Prime Ministerial Task Group on Emissions Trading.

After the setting of targets, the most controversy is over the distribution of the costs. Large carbon emitters argue that they should be given free permit entitlements, and large energy users argue that they should be exempt. The atmosphere is a common resource, and every individual has an equal interest in the stability of the earth's climate. Those who undertake and profit from activities which emit greenhouse gases should purchase the rights to emit from governments. Every free permit to emit represents a transfer of wealth from public to private. Not surprisingly, companies and industries are positioning themselves to obtain as much of this common wealth as possible, and governments seem all too susceptible to their arguments. There may be some justification for *reduced* exposure to energy price rises for the small number of industries whose competitors operate in countries not (yet) forced to share the burden, but they should not be excused from responsibility altogether.

For every company or industry that obtains exemption from the cost of reducing emissions, some other party will have to bear a higher cost. Industries such as aluminium, which have become skilled at obtaining special concessions and subsidies out of all proportion to their value to the Australian economy, are set to continue to do so. If they succeed in avoiding the burden of adjustment, the energy price rises for others will be that much greater.

Myth 14: Higher energy prices mean lower living standards

Higher energy prices do not necessarily mean lower standards of living. There is enormous technical potential to use energy more efficiently, but little of this has been realised because energy prices have been too low. Once greenhouse costs are 'internalised', we will quickly start to build more efficient homes and workplaces, drive more efficient (and smaller) cars and buy more efficient appliances, and the market will be competing to provide them.

Thus while energy prices will go up, energy bills could come down.

We cannot continue to have cheap energy. We can, however, get much more from what we pay for by using it more efficiently. If one of the consequences of reducing greenhouse gas emissions is increased energy costs then this is long overdue. Energy has for too long been underpriced and has been wasted accordingly. Policy will need to focus not on cheaper energy, but on getting the most out of it.

Myth 15: Australia will meet its Kyoto target

Despite a generous target and a special concession which allows the effect of *past* reductions in land clearing to be taken into account, Australia will not meet its 108 per cent Kyoto target.

After some years of claiming that the 108 per cent target would be met, the Government first conceded in December 2006 that emissions will average 603 million tonnes (Mt) CO_2-e over the Kyoto period (2008-2012), or 109 per cent of 1990 levels (552 Mt) and possibly higher.[15] The main reason is that energy-related emissions are projected to keep rising rapidly, while the cushion from reduced land clearing emissions has been used up.

More disturbingly, there is no sign that the peak in Australia's emissions is approaching: emissions in 2020 are projected to reach 127 per cent of the 1990 level and still rising.

The critical objective now is to reach the peak of emissions as quickly as possible (certainly by 2015) and then to reduce emissions in absolute terms as quickly as possible. As a developed country, which has benefited enormously from the use of fossil fuels, to the extent that it has one of the highest levels of per capita emissions in the world, Australia cannot in all conscience claim special exemption from this obligation.

Myth 16: There is no point ratifying the Kyoto Protocol

Although the Kyoto commitment period is due to start in 2008, most measures to limit emissions over the five year period to 2012 should have been implemented by now. Although some ratifying countries will not reach their targets, the existence of the protocol has prompted participants (including non-ratifiers like Australia) to make more effort than they otherwise would have.

Certainly, the Kyoto Protocol remains the only credible global framework for a common approach to containing greenhouse gas emissions. The so-called 'AP6' grouping of the USA, Australia, Canada, China, India and South Korea is not a serious alternative. It was largely set up as a diplomatic fig-leaf for the non-ratifiers of Kyoto, and has failed even in that limited objective.

A decision by Australia to ratify Kyoto at this late stage would be partly symbolic – marking Australia's return as a full participant in the coming global effort – but it would also have great practical value. The focus is now moving to the next stage of agreement after Kyoto, and accepting the UNFCCC as the framework will save many valuable years of the negotiations, which will be difficult enough.

It is important to note that, at their June meeting in Heiligendamm, the G8 countries explicitly acknowledged that any future agreement should be negotiated within the UN Framework Convention on Climate Change, the mother treaty of the Kyoto Protocol that has been ratified by both Australia and the United States. G8 Chair Angela Merkel summarised it:

[15] http://www.greenhouse.gov.au/projections/pubs/tracking2006.pdf

> To address the urgent challenge of climate change, it is vital that the major emitting countries agree on a detailed contribution for a new global framework by the end of 2008 which would contribute to a global agreement under the UNFCCC by 2009.[16]

This contradicts the claims by some in the media and the Government that the G8 meeting marked out an alternative path to Kyoto, and that the Bush Administration somehow got its way.

Australian participation in Kyoto negotiations would be a sign of good faith and would shore up the international consensus which Australia and the USA have been deliberately undermining. There would be no penalty in missing the 108 per cent target, and there could in fact be opportunities for businesses to access emissions permit trading and other mechanisms established under the Protocol.

The real value of Kyoto is not that participants will meet their targets (Australia, for one, will not) or that the targets are at all adequate (they are not) but that it is the only real international mechanism and is the first step to concerted international action. The key defect of Kyoto is not that China is exempt from targets but that the USA is. If Australia joins now, the pressure on the USA may well become irresistible. Developing countries will never commit to reductions until rich countries demonstrate good faith. Australian ratification of Kyoto would go a long way to breaking the international deadlock.

So, what are the answers?

If we are serious about reducing emissions, something which no Australian government or opposition has yet demonstrated, we will need both a short term and a longer term strategy.

We must immediately cease actions which will lock in high emissions for many years, such as building new coal-fired power stations, industrial plant or car-dependent transport infrastructure. This is not anti-coal but anti-emissions: once it is demonstrated that coal can be used more 'cleanly' – say with an emissions intensity matching natural gas - it can be considered again.

We must implement an emissions permit system covering all emitters, including agriculture, forestry and waste, for which new methodologies and measurement techniques may be necessary. The sum of annual permits (reflecting total allowable emissions) must peak no later than 2015 and then trend down. The downward trend should be driven by medium term caps and point to a long-term (2050) target of cutting Australia's total emissions by at least 80 per cent. The burden could be reduced for some sectors provided the net benefit to the economy warrants it, but as a matter of principle no sector, industry or company should be entirely exempt. Permits should be auctioned, not given free.

The emphasis must be on the physical reduction of emissions (as evidenced by the surrender of permits) not on 'credits', 'offsets' or 'sinks'. If the creation of additional

[16] http://www.g-8.de/nsc_true/Content/EN/Artikel/__g8-summit/anlagen/chairs-summary,templateId=raw,property=publicationFile.pdf/chairs-summary

permits through sink activity is to be permitted, it should be fully priced and insured for risk of destruction of the sink.

In addition to a comprehensive emissions trading system, there should be an immediate increase in the mandatory renewable energy target designed to give renewable industries an opportunity to reach the scale necessary to compete effectively with existing energy industries.

Because energy price signals alone are inadequate, there should be mandatory maximum emissions standards for all new power stations, greenhouse benchmarks for new buildings, efficiency standards for appliances, and fuel efficiency targets for motor vehicles. There should also be a set of supporting measures to overcome the many so-called non-price barriers which inhibit energy consumers, faced with higher energy prices, from increasing the energy efficiency of their existing homes, buildings and equipment.

Australia should ratify the Kyoto Protocol, not for what it has achieved in greenhouse gas reductions to the present, but as a commitment to the future global effort.

None of these things will happen until we acknowledge the scale of the challenge and the extent of change needed to address it. They will certainly not happen if we continue to distract ourselves with greenhouse myths.