Confused about carbon pollution reduction schemes?

Background

The vast majority of the world's climate scientists (including those advising government from the CSIRO and Australian Bureau of Meteorology) now believe that we will experience potentially catastrophic climate change if worldwide action is not taken to limit further human contribution to “greenhouse gas” concentrations in the atmosphere.

Greenhouse gases [the major substances are carbon dioxide (CO_2), methane (CH_4) and oxides of nitrogen (NO_X)] have always occurred through natural processes such as decay of organic material, wild fires and volcanic eruptions. These naturally derived gases are a vital part of our environment as we and all other living things have evolved to thrive in the climatic conditions that have resulted from their presence. Various natural processes exist to remove excess quantities from the atmosphere and return (“sequestrate”) them to the ground in solid form . The problem is that in the last several hundred years, human activity has so rapidly increased greenhouse gas production that natural sequestration can no longer keep up.

Our current difficulties started in the early 18th century when Thomas Newcomen devised a commercial machine that converted the chemical energy in coal into motive power. Fifty years later James Watt refined Newcomen's steam engine and the “Industrial Revolution” took off – with the necessary steam being raised by burning fuels containing the element carbon (initially in coal and wood then followed in the 20th century by oil and natural gas).

Coal, oil and natural gas are substances chiefly made up of carbon (C) and hydrogen (H) atoms. When burned with oxygen (O) the products of combustion are primarily carbon dioxide and water (H_2O). The reaction releases a lot of useful heat but also a great deal of carbon dioxide (indeed 3.67 tonnes of CO_2 for every tonne of C). Coal is mainly carbon.

Prior to the industrial revolution the world's total production of greenhouse gases was in balance with the world's ecosystems, but from the mid 18th century onwards not only was

mankind dramatically increasing his emission of greenhouse gases but at the same time was also reducing the environment's ability to remove them (a consequence of wholesale removal of natural vegetation worldwide). The end result has been an inexorable increase in atmospheric greenhouse gas concentration that now shows a very alarming upward trend.

Increased concentrations of these gases cause the atmosphere to trap more of the sun's heat hence causing: higher temperatures, altered rainfall patterns, increased evaporation rates, melting glaciers and ice caps, ever more destructive storm behaviour, and rising sea levels. The ramifications are potentially immense.

Fortunately in the last forty years we have developed tools that make it possible to model (albeit imperfectly) what will likely happen if the world community fails to take action to stabilize its greenhouse emissions.

The UN sponsored Intergovernmental Panel on Climate Change (IPOCC) has brought together teams of scientists from around the world to pool their research and come to a consensus view. Their modelling shows unequivocally that without measures to stabilize emissions, at best most nations will require very serious structural adjustment, but much worse, there is an unacceptably high probability of truly catastrophic climate change.

Responsible government reaction

The earth's climate has changed many times in the past through natural events: slight cyclic variation in the earth's tilt and orbit, changes in the sun's energy output, movement of continental plates, periods of intense volcanic activity and cataclysmic eruption, asteroid impacts, etc. These factors are reasonably well understood and taken together at the moment they suggest (if anything) that the earth should currently be cooling.

Measuring the earth to establish whether it's heating or cooling is a very complex technical matter. Climate is inherently highly variable. Establishing long term trends requires very long data records from a great many locations and very careful statistical analysis. While

so called “climate sceptics” get plenty of media coverage sharing with us their pet contrary opinions, the fact remains that the consensus view of climatologists best qualified to offer advice is that the planet is warming and will continue to do so at an alarming rate if action is not taken to reduce greenhouse gas emissions.

Few human actions could bring bigger national risks than globally meddling with the earth's climate. It takes no great insight to appreciate the upheaval in human affairs that could result. And if change occurs essentially it will be irreversible. Under these circumstances no responsible government can afford to ignore its own scientific advisors. Absolute certainty is not a prerequisite for action.

By joining other nations around the globe to wind back emissions, we may only be buying “insurance” and that insurance may come with a sizeable economic cost, but this has to be viewed in context. For example, at very substantial annual cost we pay for a highly capable defence establishment to provide “insurance” against notional threats that are highly unlikely to eventuate (at least in the operational life of the resources involved), but no sensible Australian would ever argue for dissolving the military because we “can't afford it”.

Economic arguments about alternative uses of the money involved are also irrelevant. If the whole fabric of our society is at serious risk (and the best scientific evidence suggests that it is), government simply must take action to mitigate that risk.

The only real economic issues are:

1. What is the least cost method of reducing our greenhouse gas emissions to a sustainable level?
2. What is the appropriate timetable?
3. What transitional arrangements are required?

Economic studies

Answering these questions is why the UK and Australian governments (and doubtless

many others) have commissioned eminent economic teams to examine the issue in detail. Stern (UK) and Garnaut (Aust) have developed sophisticated economic models to assess the most appropriate strategies to adopt.

Their modelling indicates that starting to tackle the problem early and with vigour offers the least cost option (by a large margin). An additional level of detail for the local economy has been developed by the Australian Treasury.

Tackling the problem

With a couple of notable exceptions, governments around the world have already recognised that it is a problem that must be addressed and hence almost all have signed onto the UN sponsored Kyoto Treaty. The object of this treaty is to limit the world's annual total emissions of greenhouse gases such that atmospheric concentrations of them stay below a specified level and then gradually reduce over time.

The first step has been for individual countries to agree to “cap” their total annual emissions to a set level and then reduce the level of the cap over time.

Because every nation across the world is at a different level of industrial development (and has historically made a very different contribution to the cause of the problem), a great deal of complex negotiation remains to finalise worldwide implementation.

The simple truth is advanced countries like our own emit (on a per capita basis) vastly more greenhouse gases than our neighbours in China, India, Indonesia, etc. Furthermore as already noted it is countries that industrialised early (like ourselves) that have substantially created the problem in the first place. Understandably (and reasonably) the rest of the world now expects those that led the 19th century charge that created the problem should now lead the charge to clean it up! Fortunately the advanced countries are in a good position to do so (and doubtless the more entrepreneurial among them will convert an early start into highly profitable business opportunities).

Agreeing to a cap means that existing processes that emit greenhouse gases must be

either:

1. phased out over time, or
2. modified to clean up its emissions,

or the owners of such processes must:

3. purchase some form of “green offset” or “carbon-sink” (such as a new forest planted specifically to absorb CO_2).

What it boils down to is this; old industry, new industry and indeed the community as a whole, has to “clean up its act”.

Governments have at their disposal a number of potential mechanisms to encourage businesses and consumers to do so. To cut total emissions by the amount indicated necessary by the science, a very challenging undertaking, it is highly probable that all of them will be necessary in some form.

At the moment polluting is without financial penalty - hence there is no financial incentive to refrain from doing so. Indeed there is a financial imperative to not change - we live in an open market society and “doing the right thing” without legal obligation may simply hand one's competitors a commercial advantage. And publicly listed companies are obliged by company law to maximise shareholder funds - not solve societies' perceived problems.

Therefore establishing a “price signal” in some form to encourage new investment that reduces emissions has to be part of an overall strategy.

Government could provide a price signal by applying an excise on all carbon based fuels (ie: a “carbon tax”). This method is currently used on both alcohol and tobacco to discourage consumption but as is readily evident for those products, as a strategy it is likely to be only partially effective.

Government could within specific industry sectors simply issue annual licenses to pollute up to some limit but it would then need some sensible method of allocation to competing

claimants – a far from trivial task. Total national greenhouse emissions would then be wound back over time by: widening the number of industry sectors; gradually reducing the number of licences issued in each sector; and reducing the volume of greenhouse gas attached to each licence. This would be in effect “carbon rationing”.

As we live in a market-based capitalist society economists generally hold the view that the optimum method of annual license allocation would be to auction them and then allow licence holders to trade licences between themselves according to the prevailing circumstances of each particular business. This is the “cap and trade” strategy recommended by Garnaut and currently favoured by our government and most others.

Both “carbon tax” and “cap and trade” mechanisms raise revenue that government can plough back into assisting the transition. The government has already indicated that it intends to do so one hundred percent.

Besides putting “a price on pollution” other strategies could and should be employed to directly reduce emissions. For example:

1. Mandatory emission standards on new motor vehicles could be readily tightened. For example current high efficiency “common rail” diesel engines (as fitted to many new European vehicles) produce approximately 25% less CO_2 than their petrol stable mates while delivering essentially identical performance. Particulate filters can readily remove smoke.
2. Technology exists to further reduce NO_X emissions for both engine types and standards could be readily tightened.
3. Mandatory fuel consumption standards on new vehicles could be imposed.
4. Public transport especially electrified forms could be much expanded.
5. Access fees to city roads could be imposed to discourage single occupant journeys and to improve traffic flow.
6. Property owners may be offered incentives to shade, double glaze and in all other

ways reduce their heating/cooling energy consumption.

7. Property owners may be offered incentives to use solar hot water panels to fully or partially meet their hot water needs.
8. Mandatory electrical efficiency standards may be imposed on new electrical appliances.
9. Property owners may be offered incentives to “co-generate” electricity from solar panels installed on building roofs and connected to the grid.
10. Municipal waste authorities may be offered incentives to capture methane from landfill sites and use it to co-generate electricity for the grid.
11. Research may be intensified to find ways to reduce methane emissions from our herds of cattle and flocks of sheep.

In addition to slowing the rate of harmful emissions, it is also desirable to implement strategies that help nature geo-sequestrate existing atmospheric carbon dioxide. Programmes such as reafforestation of degraded agricultural land and encouraging use of bio-char for improving soil health come to mind.

Some transition issues

Time-lines

Much of the debate to date has revolved around start dates for a trading system and how much it all will cost. What does not seem to be appreciated is that going from “dirty” to “clean” involves a massive new engineering infrastructure program, the timeline of which will primarily be driven by engineering resource considerations.

Power stations, factories, commercial buildings, private residences, indeed our entire physical infrastructure cannot be “cleaned up” overnight. Thermal power stations alone can be neither replaced nor retrofitted with the necessary carbon capture technology (on the scale required) in less than a decade and given the nation's finite engineering construction

force almost certainly much longer. Converting to natural gas (which offers a big emissions reduction and initially is likely to be widely adopted) will require the construction of massive new gas pipeline infrastructure right across the continent. Solar, geothermal, nuclear or any other cleaner energy source is almost certain to require major new transmission lines and major enhancement of the whole electricity grid.

The purpose of applying a “price signal” is to encourage investment in cleaner technology. But if the technology takes years to install, applying the price signal (in full) before it's physically possible to install it, simply adds costs for no benefit.

It is the certainty of high future licence costs if immediate action is not taken down the pollution abatement path, that will drive change. For business the crucial issue is a “rock-solid” timeline for reducing total emissions and a “cast-iron” guarantee that government won't have “second thoughts”.

As many billions of dollars will be involved, serious investment decisions will be delayed until this is resolved!

Commentators like to focus on the $$ figure that's likely to be associated with a unit of greenhouse gas pollution (the “carbon price”). But this is largely a furphy. The major polluters are well able to estimate the cost of reducing their emissions. Once the physical reduction regime is established, the price polluters will be prepared to pay for licences will be no more their estimated annual capitalised cost of abatement measures available to them. Given the desirable physical targets in contemplation (20% reduction by 2020 – 60% by 2050), once such targets (or similar ones) are mandated with an annual licensing regime, the business case for ensuring every new project is as close to emission-free as possible will become overwhelming - as will retrofitting abatement measures to existing plant .

Trading arrangements per se could commence as soon as an appropriate regulatory environment can be established using a relatively low nominal carbon price. But not much will happen until the physical emission reduction program and timeline is fixed.

Market

A “cap and trade” market has many theoretical attractions but as is evident elsewhere, achieving an undistorted market is easier said than done. A great deal of money is involved, it's highly complicated and hence will be a magnet for the very smart and unscrupulous. “Gaming” if it occurs can have very serious consequences for whole communities (cf: Enron's impact on the State of California in the 1990's). There is a very good case for taking enough time in the development stage to ensure it doesn't allow unanticipated shenanigans.

Reducing emissions – why some sectors see it as a serious threat to business

Electricity generation accounts for a large proportion of Australia's greenhouse emissions. Most Australian electricity is generated by coal fired power stations.

Coal as a fuel has a very limited future unless a way is found to firstly separate the CO_2 and NO_X from the stack gases and then permanently sequestrate them deep underground. The volumes involved are enormous and suitable underground geological formations within reasonable proximity of the power station are required. While sequestration has been successfully undertaken using exhausted oil and gas fields, such geological structures are not that common.

But the real rub for coal fired generators is that installing such technology will very likely remove much of the cost advantage they currently enjoy over their cleaner competitors. Natural gas, coal seam gas, geothermal, wind, direct solar (for hot water), nuclear and in time solar, potentially all become red hot competitors for the energy dollar.

The largest single users of electricity are aluminium smelters (so much so that the industry flippantly calls the metal “solid electricity”). An increase in unit electricity costs to metal smelters doesn't mean the end of the aluminium industry but it does mean its competitiveness in some market segments will reduce due to product substitution by current customers.

All business legitimately does what it can to limit any reduction in its competitive position and these industries have very deep pockets and access to the very best lobbyists and PR specialists. Expect the very sophisticated spin campaign to influence public and political opinion towards their preferred position to intensify.

Notwithstanding spin campaigns, in reality coal fired power stations could not be fully phased out in less than ten to twenty years as total replacement capacity could not be physically built faster. Additionally aluminium smelters almost invariably have long term contracts (drafted by the smartest legal minds in the country) to ensure they run their course and can not be overturned without massive compensation.

With respect to our export coal industry, the speed at which their markets are effected depends on actions taken by the countries to which they export. However eventually their product will be phased out unless carbon capture and sequestration measures can be fully developed and on the industrial scale required, competitively implemented.

While change on this scale is disruptive at the individual level, the impact is no more so than that already experienced by millions of Australian workers who have had to change career direction with other earlier (and arguably less critical) national “economic reforms”.

The UK and Europe have already demonstrated that coal fired electricity generation for aluminium or any use is not an essential part of a modern hi-tech economy.

On the flip side, these changes will unleash the biggest infrastructure program nationwide since WW 2 and a raft of new business and career opportunities.

Meeting “base load”

Energy industry spokesmen like to dismiss the contribution that alternative energy sources could make to overall energy supply. “Base load”, they opine, “can only be met by thermal power stations and in particular the coal fired variety and if you don't like that it would have to be nuclear.”

Nonsense.

Base load is simply the minimum daily “demand” on the entire grid (where “demand” means the total number of kW s that generators must supply to the grid at every instant to prevent the voltage falling at the consumer's power point). Every unit of electrical energy being supplied off the electrical grid at every instant is in part supplied by every generator of every type, connected to the grid at that moment – the type of generator and the end use of the electricity, be it heavy industry or making one's coffee, is irrelevant.

What really happens is that via a bidding process for rights to supply (for every 30 minute time period in the 24 hour cycle), system control operators connect sufficient generators to the grid to meet instantaneous total system demand. As demand changes, the system voltage rises or falls and the automated control systems at every connected power station adjusts the flow of steam (or gas, or water in the case of hydro) to bring the voltage back to system standard. For larger changes system operators drop off or add another generator to match system demand.

If the sun is shining or wind is blowing, solar and wind generators are adding energy to the grid and are hence replacing coal fired thermal generation. At night solar generators don't bid into the market. Wind generators don't bid into the market in still weather conditions. Additional gas, hydro and coal fired units simply get scheduled on to meet the total system load. The input of energy from alternative energy sources means that over the year a lot less greenhouse gas is released.

It is a bit more complicated than outlined here, as there are some esoteric electrical engineering reasons why wind and solar sources alone cannot fully supply an electrical grid, but they can undoubtedly supply a substantial portion of the total daily energy market.

Conventional coal fired thermal plants run at their most efficient when they are operated at full output twenty four hours per day. Alternative energy sources have the potential to intermittently but regularly reduce the thermal operators' slice of the energy market. On both counts they are thus seen as a commercial threat.

So what's the bottom line?

1. Human activities are adding greenhouse gases to the atmosphere and it is highly likely (estimated at better than 90% chance) that they are altering the earth's climate.
2. Even if that ultimately proves to be wrong, the risk that it is right is sufficient to mandate action by every responsible government. Neither denial nor delay are sensible options.
3. As we are already a dry hot country (and every model suggests we will get still hotter and dryer), unlike some other countries we are very unlikely to benefit from increasing temperatures.
4. Our country was one of the first to industrialise and we are one of the world's highest per capita greenhouse gas polluters. We will have to join the rest of the fully developed world in the charge to stabilise and then reduce greenhouse gas concentrations. We will need to assist the less developed world with technology and systems to help them not repeat our mistake (and bring us all down in the process).
5. Economic studies already show that action taken early is by far the least cost option.
6. Government will need to implement multiple strategies to reduce our per capita emissions. The science indicates that very large cuts are needed and as fast as possible.
7. Putting a price on pollution is an essential strategy to spur the necessary capital investment to install greenhouse gas abatement measures.
8. Imported goods manufactured in regions operating outside the agreed international carbon abatement protocols should attract an assessed carbon tax here.
9. There are physical limits to how fast abatement measures can be implemented.

There is no point financially “whacking” emitters during the phase-in period.

10. The key is a defined and certain physical reduction program with certainty that licences to pollute will steadily contract in number and volume (and hence potentially steeply increase in cost at auction).
11. A market to trade licences could be established as soon as the rules and administration can be finalised. But it is a complex matter and likely to be prone to gaming.
12. The transport sector will unavoidably run on fossil fuels for quite some time. A modest carbon tax on this sector may provide a small spur to change. Tougher vehicle standards and measures to reduce encourage use of public transport are likely to be more effective. Carbon offsets may be the only way to deal with emissions from the aviation sector.
13. Initially concentrate on the “low hanging fruit” but every body needs to “clean up their act” on an every day and every thing basis.