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Beyond Kyoto — innovation and adaptation

The Australian Prime Minister's Science, Engineering and Innovation Council (PMSEIC) recently released a report on opportunities to develop greenhouse emission reduction technologies for Australia's electricity sector. However, it has some major flaws, particularly as it assesses the benefits of geosequestration. Iain MacGill and Hugh Outhred explain.

The Australian Prime Minister's Science, Engineering and Innovation Council (PMSEIC) report *Beyond Kyoto – Innovation and Adaptation* recognises the growing risks that climate change poses for Australia. It agrees on the need for significant reductions in climate change emissions (50 per cent of present levels by 2100), a move away from conventional coal-fired power stations and the need for government to promote technical innovation to achieve this.

Beyond Kyoto identified geosequestration as Australia's key emission reduction strategy. However, it relies on cost estimates for CO_2 capture geosequestration from coal-fired power stations that are less than one-fifth of cost estimates made by the IEA, IPCC and US Department of Energy. This therefore undervalues the crucial role that end-use energy efficiency, distributed generation and renewable energy can play in responding to climate change.

Stationary energy sector characteristics

The stationary energy sector is responsible for nearly half Australia's climate change emissions and is thus an important policy target for emissions reductions. Consideration of emission reduction options for the sector must start at the point of end use. For example, the aluminium smelting industry consumes almost 15 per cent of Australia's electricity generation yet contributes only 0.15 per cent of Australia's GDP or around A$1 billion. It also receives electricity price subsidies that may exceed $250 million a year. Continuing to subsidise and promote energy-intensive industry should occur only after full consideration of its economic and climate change implications.

Beyond Kyoto fails to discuss important climate policy measures such as the Mandated Renewable Energy Target (MRET) and makes no attempt to assess the success or otherwise of this and other programs. Furthermore, there is no discussion of present government R&D funding in the energy sector. We now have separate CRCs for black coal, brown coal, geosequestration and ecosystem sequestration yet none for renewable energy. Direct government support for sustainable energy R&D is low by per-capita standards compared with most developed countries. In terms of market-based policy measures, the target for renewable energy is also low in comparison with many other developed countries.

Long-term projections of electricity consumption generally assume no significant change in energy policies and measures, major technology developments or other possible "surprises" over the

period. This is not a sensible assumption as in the medium to longer term, particularly given the climate challenge we face, more emphasis is likely to be given to policies that reduce electricity demand.

Technology options for abatement

Some technologies appear to be misclassified — for example, lighter weight and more efficient wind turbines and new PV materials are deemed to be 50 years or more away, whereas integrated gasification combined cycle coal generation plants are classified as a "current" option. More generally, the report does not appear to adequately measure the technical maturity or commercial feasibility of different options.

It is very difficult to estimate future costs of technologies that are in early development or that are yet to achieve economies of scale. The risk profiles of technology options should also be considered. Furthermore, *Beyond Kyoto* makes no reference to wider societal and environmental values that may influence longer-term energy choices including energy security, regional development, job creation, other pollutants and broader resource management questions. For example, recent work has highlighted the regional development and job creation of wind and biomass energy projects.

Conventional coal

Beyond Kyoto makes a strong case that no more coal-fired generation should be built in Australia unless it incorporates CO_2 capture and geosequestration.

A 1000 MW coal-fired power station will emit nearly seven million tCO_2 each year — nearly 280 million tonnes of CO_2 over a 40-year operating life. Furthermore, retrofitting CO_2 capture and geosequestration to existing power stations is expected to be more expensive than "new build" options.

Natural gas

Beyond Kyoto suggests that the cost of electricity from gas-fired combined-cycle (CCGT) plants is almost 50 per cent higher than conventional coal plants. The recent CoAG Market Review disagrees, estimating current CCGT generation cost at only 20 per cent greater than black coal and less than brown coal. CCGT plants have lower capital costs and shorter construction lead times than coal-fired units, less than half the greenhouse emissions when fuelled with natural gas, more flexible siting and more flexible operating characteristics — none of this is acknowledged in the *Beyond Kyoto* report.

Distributed energy systems

B*eyond Kyoto*'s "emerging" categorisation for distributed generation is curious given the widespread international application of cogeneration technologies. In addition, cogeneration has the advantage of reduced network losses, increased security of supply and possibly network investment savings compared to remote generation.

Renewables

While most renewable technologies are currently not cost-effective (excluding greenhouse costs) in comparison with fossil fuel generation in Australia, the difference is narrowing. The cost of wind energy has fallen 20 per cent in real terms over the last five years. Renewable energy can offer other valuable benefits, such as job creation and synergies with other environmental objectives.

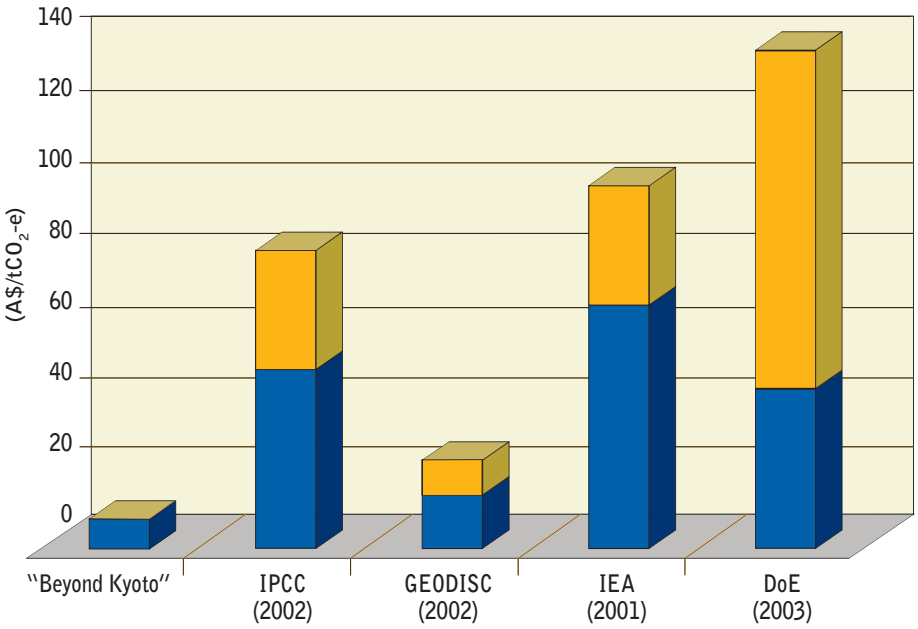
The growth rates of some key renewables technologies are an order of magnitude greater than those for fossil fuels or nuclear power. While this is from a small base, it is worth noting that oil met only 2 per cent of world energy demand in 1900; a level that wind energy is now close to meeting.

Coal IGCC and geosequestration

The report gives IGCC "current options" status and geosequestration for coal-fired generation as an emerging option that "will happen within 10 years". This assessment of IGCC seems overly optimistic. For example, the IEA notes that "IGCC has been successfully demonstrated but the capital cost needs to be reduced and the reliability and operating flexibility needs to be improved to make it widely competitive in the electricity market".

It will require considerable technical progress in order to capture CO_2 from electricity generation and then sequester it in the geological formations available to such power stations. There are a number of technical unknowns and risks associated with this. While there is general agreement

Figure 1



Estimated abatement costs (A$/tCO$_2$) for CO$_2$ capture and geosequestration from coal-fired electricity generation from Beyond Kyoto *and other published studies. The uncertainty range in these estimates is shown. Note that the GEODISC estimate does not include CO$_2$ capture.*

as to the technical feasibility of at least some geosequestration, its potential wide-scale application with coal IGCC technologies is currently unproven.

One key question for IGCC with capture and geosequestration is how its cost would compare with other abatement options. *Beyond Kyoto* quotes cost estimates ranging from A$10 to $50 per tonne of CO$_2$ abated. The report uses the A$10 figure in its technology comparisons. Figure 1 shows this estimate falls well below other international estimates and Australian estimates for the CO$_2$ sequestration.

The IEA reports that future IGCC with sequestration will likely have CO$_2$ emissions per MWh some 40 per cent of gas-fired CCGT plant — hardly a zero-emission technology. Moreover, the term "zero emissions coal" implies that geosequestration of CO$_2$ is equally secure as carbon sequestered in coal — hardly likely in the long term.

Beyond Kyoto refers to the GEODISC program, which has made an important contribution to our understanding of geosequestration potential in Australia, including matching of potential geosequestration sites to regions with high greenhouse emissions. It suggests Australia may have the potential to store a maximum of 25 per cent of its total annual net emissions, or approximately 100–115 Mt CO$_2$ per year, and that some of the major existing electricity generation regions are unsuitable for geosequestration. For example, NSW black coal-fired power stations appear to be far from suitable sites and are predicted to face high sequestration costs.

Comparison of energy abatement options

Beyond Kyoto concludes, "within the foreseeable future only carbon capture and geosequestration has the potential to radically reduce Australia's greenhouse signature". Also, "existing renewable alternatives can only be expected to make up a small proportion of the total energy mix in the near future". However, IGCC with geosequestration has yet to be shown to be technically feasible and some major Australian coal generation regions appear to have poor potential. By contrast, there is already widespread deployment of some renewable energy generation and energy efficiency technologies.

Further, there is broad consensus that mixed approaches combining energy efficiency, distributed cogeneration, renewable energy and low-emission fossil-fuelled generation hold perhaps the greatest potential for large-scale emission reductions.

***Beyond Kyoto — Innovation and Adaptation: A critique of the PMSEIC assessment of emission reduction options in the Australian stationary energy sector* by Iain MacGill and Hugh Outhred is available at www.ergo.ee.unsw.edu.au**

BCSE

conference a huge success

The first national conference of the new Australian Business Council for Sustainable Energy (BCSE) was held in Brisbane in April and attracted some 300 delegates.

Dr Sharman Stone, Parliamentary Secretary to the Federal Minister for Environment and Heritage, told delegates to the BCSE national conference that the Government welcomed the formation of the BCSE.

"I want to congratulate the BCSE. You came together as two separate industry bodies, you formed a single national peak body for sustainable energy and that's a landmark step for the energy industry in Australia," said Stone. "It's an indicator of the sector's emerging identity and growing maturity.

"It's very hard for a government to listen to lots of scattered voices; it's easier for us to engage with an industry that has got its own act together, so to speak, in terms of understanding from its own membership, where their priorities are and what they wish the government to do to assist.

"So, I congratulate you on this amalgamation and I welcome the industry consolidation that it signifies. Dr Kemp and I really look forward to doing business with you."

At the conference Dr Stone announced a grant to the BCSE for $250,000 to employ an industry development manager.

New BCSE Board

A record 20 candidates stood for election to the BCSE Board of Management at our AGM in Brisbane. The new Board for 2003/2004 is:

President — Andrew Stock (Origin Energy)

Vice President — Jeff Harding (Pacific Hydro)

Bill Lazarus (Energy Developments), Fiona O'Hehir (Power Solutions), Franz Grasser (Distributed Power), John Wright (CSIRO), Mark Twidell (BP Solar), Mike Westwood (Embedded Generation), Pat Lennon (NEG Micon), Paul Beeren, (AGL), Peter Szental (Energy Conservation Systems).