Centre for Energy and Environmental Markets

Some draft comments on "Integrating the many dimensions of sustainability: energy systems" for the *National Academies Internet Forum on Integrated Sustainability Assessment*, 2005.

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Summary:

This paper first establishes the two major sustainability objectives for our energy systems – provision of energy services to enable ongoing development and societal welfare, and transition to environmentally appropriate energy resources that don't threaten our collective future. There are many challenges in developing integrated sustainability assessment tools to help guide this transformation – almost every decision we make has energy implications, and these implications are economic, social and environmental. They also have global and intergenerational dimensions. A brief review of some Australian sustainability assessment efforts begins by examining some recent economy-wide energy policy processes. The paper then considers sustainability assessment efforts starting from the other direction – project based environmental impact assessments (EIAs). The achievements and limitations of these efforts to date are explored. In conclusion, the complexity of energy systems and their associated impacts means that integrated sustainability assessment tools will inevitably have both errors, and more general inadequacies. Their policy value depends, then, on whom applies them, for which questions and using whay assumptions. Transparent and open stakeholder consultation is necessary yet not sufficient to counter this. Results remain highly susceptible to the intent of the users.

Energy's key role in sustainability:

Human development to date has been greatly shaped by our growing expertise in harnessing and transforming energy to extend our capabilities. Readily available and affordable energy has given many of us near unprecedented material comfort, mobility and opportunity. Energy also has a key role to play in further progress – particularly for the two billion energy poor people amongst us. Our existing energy systems, however, seem almost certain to have to change. Energy's central place in society means it can be expected to have adverse impacts. Our present energy systems, however, appear to have such dire environmental outcomes as to threaten our collective future. The role of energy in sustainability therefore appears to be:

- Available and accessible energy provision to meet our needs and enable ongoing human development and welfare
- The use energy systems that don't threaten the prospects of future generations or the integrity of our ecosystem.

The challenges of sustainability assessment for energy systems:

Developing the sustainability assessment frameworks necessary for delivering on these objectives, however, is an enormous challenge as highlighted in Professor Lowe's paper. Economic, social and environmental drivers are tightly bound. Also, nearly every decision our society makes, from those of individuals through to their governments, has energy implications. Certainly, all technologies are energy technologies – our end-use technology choices will likely have a more important role to play in sustainability than the supply-side technologies we tend to focus on. All technology decisions are therefore energy decisions[1] yet many end-user decisions are made by people with little understanding or interest in these associated energy implications. Given that everyone is a stakeholder, sustainability assessment will have to support meaningful yet wide participation. It will also have to manage the pressures of the large and well entrenched incumbent stakeholders who currently play such a major role in policy directions.

Furthermore, energy systems are the ultimate 'integrators' over both *space* – for example, the economics of the international oil industry or the global nature of climate change – and *time* – for example, the slow capital stock turnover of most energy supply industries, and the inter-generational equity aspects of global warming.

Finally, there is the radical transformation of our energy systems that is likely required to achieve sustainability. Perhaps one third of the world's people do not currently have adequate access to energy services. At the same time, climate change science suggests that avoiding dangerous global warming requires that we reduce global greenhouse emissions by more than half over the coming century. Incremental changes to present energy systems in the developed world will therefore be inadequate, particularly given the long capital stock turnover of many of the most important energy technologies.

The objective of this paper:

Integrated sustainability assessment methodologies and tools for energy systems must attempt to deal with all of the complexities and challenges noted above. This brief and necessarily incomplete review of some notable sustainability assessment efforts within Australia begins by examining some recent economy-wide energy policy processes. This review broadly follows the *Quality of Life Capital* methodology[2] – identifying relevant national and regional energy policies, development of 'benefit' indicators associated with these policy objectives, base-lining the present situation with regard to these, evaluating the relative significance of these benefits and then assessing how they might be managed from national to potentially local circumstances. We then consider sustainability assessment efforts starting from the other direction – project based environmental impact assessments (EIAs) and a number of specific government programs.

The framework for energy policy development

The Australian Federal and State governments agreed national energy policy objectives are[3]:

- Encouraging efficient provision of reliable, competitively-priced energy services to Australians, underpinning wealth and job creation and improved quality of life, taking into account the needs of regional, rural and remote areas;
- Encouraging responsible development of Australia's energy resources, technology and expertise, their efficient use by industries and households and their exploitation in export markets; and
- Mitigating local and global environmental impacts, notably greenhouse impacts, of energy production, transformation, supply and use.

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[1] For example, the most transformative technology of the Australian electricity industry over the last decade is arguably the domestic reverse cycle air-conditioner due to its impact on peak demand growth.

[2] See www.qualityoflifecapital.org.uk for more information on this methodology. See also its application for *Sustainability Assessment of Renewable Energy Projects*, prepared for ETSU and TCA by Land Use Consultants and Ecotech Research and Consulting, DTI Pub URN 02/853, July 2001.

[3] *CoAG Energy Policy Details*, June 2001.

These objectives, however, have not been coherently translated into key indicators by which policy success or failure may be assessed. The costs of the different energy sources for end users are a key focus, yet the real question is the cost of delivered energy services to these people. Energy reliability, better termed energy security, has short and longer-term perspectives and risk factors that are hard to capture. It's not clear what responsible development of our energy resources means in practice – perhaps expanding coal and LNG exports? The efficiency of energy use is difficult to measure, certainly in an economy-wide context. Water and regional air quality measures are very location specific, while considerable effort is going into accurate assessments of greenhouse gas emissions that include life-cycle considerations.

In terms of baselines for these various indicators, Australia has some of the world's lowest energy costs; growing risks to short-term energy security in the stationary energy sector (largely from growing peak demand); longer-term security of supply questions with oil for transport and gas in the eastern states yet large resources of coal; very significant energy exports of coal, LNG and uranium; a highly energy intensive economy with generally low end-use energy efficiency; significant energy related air quality issues in some regions; and the highest per-capita greenhouse emissions in the world – more than double the average for *developed* countries.[4]

The relative priorities of Australia's state national energy policy objectives over the last decade seem clear. Significant and ongoing restructuring of the stationary energy sector has seen generally falling prices (although this may be about to change). Rapid demand growth is raising security concerns and driving significant supply-side investment. Energy exports have grown strongly. By some measures the energy efficiency of the economy has fallen.[5] Energy related greenhouse emissions have also risen by over 20% over that time.

Recent economy-wide energy policy processes

Recent energy related policy efforts by the Federal and a number of State Governments continue to highlight the themes of 'prosperity, security and sustainability'[6] yet it is unclear whether they signify a substantial change of direction from the business-as-usual efforts of the last decade.

The Federal Energy White Paper of 2004 was, in the view of some observers including this author, a disappointing effort at providing a coherent and consistent Federal energy policy framework. In particular, there was little focus on establishing key indicators, establishing targets for these and exploring the different possible policy approaches to achieve this. The consultation process used in developing the paper provided few opportunities for public participation and appears to have focussed largely on invitation-only industry stakeholder forums.

Some more focussed national energy related policy processes appear to have been better structured. The National Framework for Energy Efficiency (NFEE) has used both technical bottom-up and top-down economic modelling to attempt and estimate the available technical and economic energy efficiency potential in the Australian economy, explore the potential economic and environmental impacts of different possible targets and consider different policy approaches to achieving these.[7] The outcomes of this process to date include some modest but valuable program initiatives agreed by the Ministerial Council on Energy (MCE). The process itself has included several opportunities for public input, and considerable public reporting.

The Victorian Government's Greenhouse Forward strategy has also involved a public consultation process built around a Government discussion paper followed by a position paper, drawing upon scenario analysis of possible energy and greenhouse futures, and modelling of the

[4] See the Australian Government's (2004) Energy White Paper, *Securing Australia's Energy Future* for a discussion of some of these issues. The per-capita greenhouse emissions estimate is from the Australia Institute's (2002) report, *Updating per capita emissions for industrialised countries*.
[5] ABARE (2003) *Trends in Australian Energy Intensity*.
[6] This expression is used in the Australian Energy White Paper.
[7] More details on the NFEE are available from the Sustainable Energy Authority of Victoria (SEAV) website – www.seav.vic.gov.au.

potential economic and environmental impacts of different policy options.[8] The effectiveness of this process in delivering an appropriate policy framework is yet to be determined.

The NSW government now has its own *energy directions* strategy under development, although it is not clear what role modelling and analysis will play.[9] There are numerous other government, industry and NGO efforts to explore possible energy futures. ABARE presents regular energy and greenhouse projections for Australia and has provided occasional reports with scenario analysis of possible energy and greenhouse futures, including estimates of their economic impacts.[10] The MCE recently commissioned some high level energy futures scenario work from NIER.

COAL 21 has presented analysis of possible emissions targets for coal generation, abatement scenarios and policy directions to drive innovation.[11] The Clean Energy Future group, a consortium of industry associations and environmental NGOs, recently released a detailed scenario study of how Australia might achieve major emission reductions by 2040.[12]

Common themes for these efforts to date:
None of the efforts noted above have explicitly attempted an integrated sustainability assessment for Australia's energy systems. They have, however, claimed to address some aspects of what such an assessment would involve.

Most of the assessments involve the use of scenario analysis – some studies analysing only a single scenario, while others consider a range of scenarios in order to better explore possible policy choices. These scenarios have generally included bottom-up technical models of currently available and possible future energy technologies. Time frames have varied from a decade to five decades or even more.

A number of studies have also used top-down economic models to assess the overall economic impacts of different scenarios, and even different policy approaches. These, however, have to some extent actually served to highlight the present limitations of such models. There are considerable difficulties in reconciling technical bottom-up with standard CGE economic models – the latter generally have only coarse representations of specific energy technologies, and possible technical innovation over time. Their modelling of the energy demand-side is also problematic. For example, CGE models generally start with an assumption of economically optimal levels of production of goods, including energy efficiency, within the economy; this despite abundant evidence to the contrary.

Top-down tools do offer the potential to explore some possible social impacts of different policy choices including job creation and possible 'energy poverty' considerations, as well as economic and environmental outcomes. They can also potentially allow exploration of the impacts of different types of policy approaches. Unfortunately, their present capabilities and the many assumptions – some built in and others determined by the modellers – that are required to use them do not engender much confidence in the results. An additional concern is the lack of transparency, and limited public input, into the chosen assumptions for many of these studies.

In terms of future efforts, the recently formed Australia's Energy Futures Forum, initiated by the CSIRO's 'Energy Transformed' Flagship, is now developing a range of scenarios and their potential implications for the nation's energy and transport future out to 2050. The modelling approach aims to "…integrate technology development, economics and environmental

[8] More information on this process can be found at www.greenhouse.vic.gov.au. The author had a small role in technology assessment for the Allen Consulting Group consortium that undertook much of this scenario and policy analysis.
[9] See the NSW Department of Energy, Utilties and Sustainability website for more information – www.deus.nsw.gov.au.
[10] See, for example, their 2005 report *Near Zero Emissions Technologies*, eReport 05.1.
[11] See www.coal21.com.au for more details of this work.
[12] See the WWF website for more details – www.wwf.org.au.

considerations as well as social attitudes" in order to provide a "…tool to enable rigorous and insightful strategic planning and inform policy development…"[13] This shows promise although, again, the usefulness of its outcomes may well hinge on the transparency and opportunities for wider stakeholder input that are built into the process.

EIA driven integrated assessment:
Pope (2003) identifies three approaches to sustainability assessment[14] – EIA driven integrated assessment, objectives-led integrated assessment and overall assessment for sustainability. The efforts described above fall somewhat within the latter two approaches. Now, we consider some examples of the environmental impact assessment (EIA) approaches being used in Australia. Improving the sustainability of energy systems hinges much more on investment choices than operational decisions so the planning process is key.

In Australia, planning policy largely falls upon State governments. For the case of NSW, projects with environmental risks must undertake an environmental impact assessment (EIA) under the Environmental Planning and Assessment Act 1979. If these risks are significant, the proponent must undertake an environmental impact statement (EIS) that includes "…a justification for the project, taking into consideration biophysical, social and economic factors, together with principles of ecologically sustainable development (ESD). Accordingly, the EIS should consider the life cycles of the project and the resources utilised by the project, the environmental risks posed by the project, the proposed mitigation strategies to manage the risks and the acceptability of any residual risks."[15]

The question of what tools are available, appropriate or perhaps even required for project developers is generally left fairly open. There are additional challenges with EIAs for energy projects because many of their environmental impacts are cumulative in nature, and therefore can't be properly addressed by individual project developers.

Interestingly, a number of these issues have been highlighted by the EIA process for wind farm developers in Australia. Such projects offer global environmental benefits yet can have adverse (as well as beneficial) local impacts that engender local opposition. The reverse can also be the case – for example, a proposed coal-fired power station in NSW that claimed it would create hundreds of jobs and improve supply security was recently rejected by the NSW State Government on the basis of its high greenhouse intensity.[16]

Furthermore, perceived impacts may depend on cumulative developments – for example, opposition to a wind farm on the basis that there are 10 other projects also planned for the same area. There is a clear need for regional and national planning frameworks that include a formal sustainability assessment framework given such issues.[17] Interestingly, mineral exploration and development regimes provide a possible model for such a framework as they must also manage interacting and co-dependent project development.

Finally, BASIX (the Building Sustainability Index), is a web-based planning tool introduced by the NSW Government that assesses the potential performance of new residential dwellings against a range of sustainability indices.[18] The government has set targets for new dwellings of a 40% reduction in water consumption and 25% reduction in greenhouse gas emissions, compared with the average home. These targets, and use of the BASIX tool in development applications is being

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[13] See the CSIRO website for more details on this initiative. The quote comes from a CSIRO February 17 2005 press release.
[14] Jenny Pope (2003) *Sustainability Assessment – What is it and how do we do it*.
[15] See the NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) website – www.dipnr.nsw.gov.au.
[16] Redbank 2 power station was denied planning permission in late 2003.
[17] See, for example, LUC and Ecotec, *Sustainability assessment of renewable energy projects*, Report for ETSU and TCA, July 2001.
[18] See www.basix.nsw.gov.au for more information.

made mandatory. Despite acknowledged challenges in accurately modelling building performance, this is a promising integrated sustainability assessment tool for improving the State's housing stock.

Concluding remarks:

This paper has attempted to outline both the necessity, yet also of the key challenges in applying integrated sustainability assessment for energy systems in Australia. Both top-down and bottom up tools are required. The complexity of energy systems and their associated impacts means that these tools will inevitably have both errors and, more general, broader inadequacies. Their policy value depends, then, on the way they are applied, by whom and under what sets of assumptions. Transparency and open stakeholder consultation, in both the development of the tools and their application to particular policy questions, is required. Nevertheless, results are highly susceptible to the intent of the users.