Submission No: 92

House of Representatives Standing Committee on Industry and Resources

Inquiry into

CASE STUDY INTO RENEWABLE ENERGY IN AUSTRALIA

Submission by

Australian Academy of Technological Sciences and Engineering

Summary

The renewable energy industry in Australia comprises many technologies at different stages of development. The Australian Academy of Technological Sciences and Engineering, ATSE, supports government investment in further development of those technologies and agrees with the thrust of the recent Report of the Task Group on Emissions Trading concerning the role of government in encouraging low-emission technologies..
Reduction of greenhouse emissions will be achieved by a mix of technologies that includes renewables; the market should determine that mix. Similarly, decisions about where government support for technology development is best placed should, wherever possible, be market driven. Mechanisms to ensure market input into such decisions need to be implemented.

ATSE

The Australian Academy of Technological Sciences and Engineering recognises and elects to its Fellowship men and women of achievement in the application of science, technology and engineering. The Academy exists to:

- celebrate excellence and inspire the next generation; and
- lead debate by guiding informed thinking and influencing public policy

The Academy is deeply involved in the major issues facing Australia today – energy, water and climate change. It recognises the importance of the further development and application of new energy technologies in maintaining the integrity of Australia's economy and environment.

This brief submission aims at providing some strategic insights that might assist the House of Representatives Standing Committee on Industry and Resources in its inquiry into the state of development of the various renewable energy technologies.

Primary Issues

The Academy sees the primary issues as:

- Concerns about climate change and long-term energy supply sustainability have created a rapidly increasing requirement for clean energy sources and a surge of interest in the further development of renewable energy technologies.
- The renewable energy market (with the exception of hydroelectricity, which is not considered here) is largely at an early stage of development and/ or adoption; several renewable technologies are in commercial use at a rather modest scale.
- Government is being called upon to take measures to counteract climate change by reducing greenhouse gas emissions.
- Government is increasingly being asked to intervene to support and accelerate the further development of renewable energy technologies, particularly to complement

its proposed introduction of a mechanism to attach a price to carbon emissions, which makes renewable energy (and other options) more economically viable.

- Renewable technologies can be very different and difficult to compare and evaluate. They all produce electricity from natural, renewable sources and each is expected to make some contribution to future power supplies.
- While faced with these intrinsic difficulties, and issues such as reliability of supply, government has had to respond to vigorous advocacy and public promotion of a disparate range of developing technologies that have intrinsic popular appeal and newsworthiness.
- Government needs to implement formal mechanisms to objectively distinguish the merits of the funding proposals it receives and to allocate resources as effectively as it can so that the best renewable technologies can make the most rapid contribution to tackling the issues of clean energy and climate change.

The Committee is presumably interested in matters such as the degree of Australian involvement in equipment supply chains and how these might evolve as the technologies mature. These detailed matters cannot be addressed here, but ATSE expects that other submissions, especially from industry, will allow a view to be developed concerning the current and projected structural development of the relevant businesses. If not, then suitable studies could be commissioned for that purpose.

Technologies are in different states of development

The Committee is interested in solar, wave, tidal, geothermal, wind, biomass and hydrogen technologies as they relate to energy production and use. These technologies are clearly in very different stages of development, both in Australia and globally.

Wind and solar technologies stand out as the most commercially developed and, on a smaller scale, landfill gas operations are well established. There are already many commercial wind farms in operation and the suppliers and contractors for such projects seem to be readily accessible. Solar photovoltaic equipment for domestic and other small-scale application is available off-the-shelf. There is much information on the costs and efficiencies of such generators and on projections as to how those parameters might change as further development occurs and experience is accumulated. Research will probably continue to deliver marginal improvements in cost and performance in the existing commercial technologies.

There are several new large-scale solar technologies at various stages of development; some are claimed to be close to commercial. Wave, tidal and geothermal technologies are pre-commercial, but there are some interesting developmental projects under way. Geothermal energy projects are very active in Australia, which is considered to have favourable hot rock resources. Hydrogen is in a different category and is discussed separately below.

Prospects and comparisons for the less-developed technologies are difficult to evaluate

The increased interest in renewables as a means of combating global warming has stimulated the flow of large projects aimed at developing and demonstrating innovations in electricity generation from renewable energy. These projects are evolving in all the sectors of interest, with solar and geothermal perhaps having the highest profiles.

The relative merits and prospects of these large projects are difficult to evaluate. They are characterised by competing and vigorous advocacy, with little or no 'downside' information concerning, for example, technical and cost barriers or development problems encountered in any prior smaller scale work.

To give an example, there are at least three large-scale solar technologies on the drawing board or at a more advanced stage of construction, and competing for government and

private investor funding: Enviromission's 200MW solar tower, Solar Systems' 154MW Victorian Project, and Solar Heat and Power's 40MW Liddell project and 240MW design-stage project. Each project puts forward impressive claims and attractive projections. It is not at all obvious how to evaluate their relative prospects.

Government has a role in supporting emerging renewable technologies

The recent Report of the Task Group on Emissions Trading addresses quite thoroughly the matter of how government should direct its support at the various stages of the cycle of innovation so as to ensure that the best renewable energy technologies are successfully commercialised. In its view, while carbon pricing is the single most important step that government can take, there are other supportive measures that government should consider in order to encourage investment in low-emission technologies. At the R&D end of the innovation chain, the Report says there is *'a strong case for further increasing the level of resourcing for Australian R&D in low emissions technologies'*. For example, the Academy supports the suggestion, contained in the Tambling Review into the Mandatory Renewable Energy Target[1], that consideration be given to the creation of renewable energy certificates through approved R&D expenditure on renewable energy.

The Task Group Report goes on to state the case for some government involvement in mitigating investment risk at the high-risk end of the chain, that is, in the demonstration phase. Beyond that, at the 'deployment end' of the chain, the Report takes the view that any government support should mainly deal with the removal of barriers and constraints.

ATSE agrees with the Task Group Report's general direction on these matters, which largely reflect conventional thinking on the decreasing role of government and increasing role of the market in providing direct funding for technology development as it moves along the track from early stage research to full-scale commercialisation. We also strongly endorse the Report's position that more government support for early-stage R&D is required. However, there ought still be mechanisms to ensure that such government support is prudently directed towards ideas that have realistic potential and are capable of exploiting Australia's competitive advantages in natural resources and technical expertise.

The Energy Research and Development Corporation, which was abolished by the government nearly ten years ago, played a very useful role in bringing energy R&D to the commercialisation stage. A similar body, with it's aims confined to renewable energy technology objectives, would be worth considering.

Technology customers and other stakeholders should drive government investment decisions

Historically, government interest in renewables has been driven by strong public sentiment. Public perceptions have been that renewable energy sources are free, are widely available in Australia (especially solar energy), are particularly well suited to a country with large unpopulated spaces, and ought by rights to be exploited. These sentiments still dominate popular opinion, even though they are not always technically valid. It is therefore not surprising that public investment in renewable energy research and development predated the current interest in greenhouse gas mitigation by many decades.

Despite the cautions expressed in the Emissions Trading Report and noted above, the dramatic increase in interest in renewables has resulted in a greater call for investment of public moneys into major demonstration projects that are well beyond the early research or small scale proving phases. Even though there will be greater private investment certainty resulting from any new 'carbon price signal', the political reality is that the government is

[1] *Renewable Opportunities: a Review of the Operation of the Renewable Energy (Electricity) Act 2000,* Australian Greenhouse Office, Australian Government, September 2003

responding to these pressures. The process for making government investment decisions is therefore becoming more critical.

Our view is that the best signals for government funding come from the level and nature of commercial backing for a project, in other words from the market. Defining that market is not always straightforward, but strategic investors such as electric utilities or large industrial or resource businesses should preferably be involved. They are the ones who could become future customers for the technology or its product (electricity) and one can reasonably assume that they have the capacity to make detailed technical analyses of the merits of a project and informed investment decisions. Sometimes commercial backing will come from financial intermediaries who could profit by bringing a technology to market. Either way, the informed judgement and willingness of such parties to invest provide the best market signal for the prospects of a particular technology. Government should rely on that signal and set the commercial investment parameters that will justify the injection of public funding.

Business plans/paths to commercialisation will affect prospects

Investment analyses will usually include an understanding of how a particular technology will be commercialised. Renewable technologies can have several paths to commercialisation, or business models, and the business model generally defines the market for the technology. For example, the promoters of the large solar projects mentioned above have quite different commercial plans. One wants to be an electricity generator, presumably selling into the grid. Another wants to be a manufacturer and supplier of components and/or plant design intended for purchase by generating utilities. Such different models are perfectly legitimate but their strength and feasibility, and the nature of their market, does need to be considered as part of the assessment process.

Carbon pricing will help critical evaluation

Carbon pricing will transform the perception of renewables. Until recently they have been more or less 'exotic' technologies that can produce electricity, but only at a cost substantially above that of conventional energy (from coal and gas fuelled, or hydroelectric, power stations). With carbon pricing, plus further advances in technology and economies of scale, they can become realistic future suppliers of power to customers and will be judged by the price at which they can deliver that electricity.

However, in any carbon pricing regime, renewables will be competing with so-called clean coal technologies based on carbon capture and storage. Eventually, all these technologies will be judged by a single parameter, the price at which they can deliver electric power at the output terminals of their generators.

Externalities tend to be underestimated in early development stages

It is a matter of common observation that public sentiment towards renewable energy concepts, initially favourable, tends to fade in the face of the more immediate prospect of major construction activity, land acquisition, increased water usage, impact on groundwater or biodiversity, and so on. These external impacts need to be identified, analysed and publicised as early as possible in the process of assessing technology prospects. The technology developers, investors and community can then take them properly into account in all stages of the planning process.

The role of storage

As the Committee has already recognised, energy storage technology that can be used to enhance the delivery capability of intermittent energy sources such as solar and wind is an important part of the technology chain. However storage comes at considerable capital and

efficiency costs. Storage facilities such as dams for pumped storage and storage batteries are always inefficient to some extent or other. That is, some of the electric power being stored is lost in the process of storage and subsequent release. The principles of thermodynamics make such losses inevitable. From 10% up to 50% of the input energy is lost. Some storage technologies, such as conventional batteries, are relatively mature, others including new battery concepts, are being demonstrated, and new ideas keep coming forward. It can be expected that as electrical energy in general becomes more precious, there will be a tendency to avoid waste and every effort will be made to use the energy directly rather than store it.

The public sector holds much information on renewables

We note that Australia has a long history of active involvement in the development of renewable energy technologies and that many innovations have been the subject of substantial government encouragement and public funding. Most of this funding will have come via the CSIRO, other public research agencies and bodies such as the National Energy Research Development and Demonstration Council (NERDDC) and the Energy Research and Development Corporation (ERDC). NERDDC and ERDC have been disbanded but, as both those bodies made a point of being investors rather than mere granting agencies, they have presumably left a legacy of evaluation material that should assist in understanding where the most promising technologies lie. A review of that material, perhaps involving individuals who had linkages with the disbanded agencies, could be productive.

Hydrogen is a special case

The inquiry includes hydrogen in its terms of reference. Hydrogen is not in itself a form of renewable energy. It is analogous to the electricity generated from a renewable energy source in that, like electricity, it can act as a medium for transmitting and utilising that energy. However, unlike electricity it is also a chemical substance that can be physically stored, transported and dispensed. In those respects, it resembles the more familiar gaseous and liquid fuels of today.

Hydrogen can be produced with electricity by the process of electrolysis and its greenhouse impact is essentially that of the electricity source. A renewable or nuclear energy source will produce hydrogen with a correspondingly low greenhouse impact. Hydrogen can be burnt in a heat engine (like an internal combustion engine), or converted back into electricity in a fuel cell, essentially a kind of battery, and its combustion product is water. Herein lies its appeal as a transport fuel for either conventional motor driven vehicles or electric vehicles.

Hydrogen has a quite different role in clean coal processes that involve carbon capture and storage. Here hydrogen happens to be an intermediary in pre-combustion gasification processes designed to separate out a concentrated stream of carbon dioxide suitable for disposal by underground storage. The hydrogen stream emanating from this process then goes to a conventional turbine for generating electricity. All of this happens in the one processing plant, so the issues of storage, transport etc associated with hydrogen do not arise. Hydrogen could in principle be taken from such processes for use in the 'hydrogen economy' but it would need considerable further purification to prepare it for use in a fuel cell.

It is fair to say that the future role of a 'hydrogen economy' is contentious. Hydrogen is notoriously difficult to handle, its properties as an energy storage medium are far from ideal, and much of the original energy is lost in the production and utilisation chain. Nevertheless, there is much advocacy of a 'hydrogen economy' that exploits hydrogen's special place as a clean combustible transport fuel that can be synthesised using renewable or nuclear power.

Government support for hydrogen projects needs to distinguish between 'clean coal' and 'hydrogen economy' prospects. The evaluation criteria will be different but the general requirement for market signals from investing customers should still apply to both cases.