The Sustainability of Renewable Energy Projects:-

Wind Energy

A Discussion Paper for the ACRE Energy Policy Group

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Introduction

The theme of this paper is that the sustainability of renewable energy projects cannot be taken for granted, as illustrated by the controversy surrounding projects such as the Three Gorges Hydro Scheme in China, the ill-fated Gordon Below Franklin hydro scheme in Tasmania and the stalled development of land-based wind farms in the UK. While these are (hopefully) extreme cases, similar factors are at play to varying degrees in all renewable energy projects, and are likely to become increasingly important given the rapid growth in the renewable energy industry.

The paper argues that to avoid such problems, a coherent policy framework should be developed and implemented in Australia within which individual project proposals can be considered in a collaborative planning context. The collaborative planning context should consistently address all aspects of sustainability and provide mechanisms by which stakeholders can gain an understanding of the issues and engage in a constructive dialogue with project developers.

It is important to note that it can be difficult to achieve a constructive dialogue between project developers and stakeholders in the absence of such a framework. Moreover, an appropriate policy framework should be developed as soon as possible because of the innovative and unfamiliar nature of renewable energy technology, the rapid scale of uptake under policy drivers such as MRET and state-based equivalents. In the meantime, care should be taken to avoid controversial renewable energy projects that may engender a negative image of renewable energy technologies among the general public. Bunting and Jenkins (2002) discusses the controversy that has developed surrounding the Portland Wind Energy Project in Victoria.

After discussing concepts of sustainability, defined in an earlier AEPG paper [Watt et al, 2001], the paper explores practical experience with renewable energy projects in Australia by means of case studies from a number of states. In each case the state policy context is considered as well as project-specific matters and issues that arise because of the mix of publicly owned and privately owned developers, and the varying electricity industry context. This paper focuses on wind projects. Companion papers will discuss other renewable energy technologies, for example bioenergy.

Sustainability concepts and their application to renewable energy projects

The concept of 'sustainability' or 'a sustainable society', is the goal or end-point of a process that has been called 'ecologically sustainable development' (ESD) in Australia or just 'sustainable development' overseas. There are many definitions of ESD, depending on the beliefs and interests of the person or institution that publish it.

In 1987 the World Commission of Environment and Development [1987] defined ESD as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' This expresses ESD in terms of a process that permits the Earth and human society to endure into the long-term future and recognizes the importance of equity between generations.

Another definition of ESD is 'types of economic and social development which protect and enhance the natural environment and social equity' [Diesendorf, 2000]. This definition avoids trade-offs between the natural environment and economy. Rather it accepts any type of social or economic development that meets the environmental and social constraints. It recognizes the importance of equity within the same generation and allows a broader concept of 'development' than that specified by growth in GDP.

Sustainability has a number of dimensions. For the purposes of this paper, we will take these to be economic, environmental, social and technical sustainability. Noting that these dimensions are not fully independent and that they may involve concepts of community at household, local community, state, national or global levels, we will use them as follows:

- **Economic sustainability** involves the concepts of productive, allocative and dynamic efficiency, of which dynamic efficiency is the most important in this context, since it relates to moving from a less sustainable to a more sustainable economy. We must also consider the long-term economic viability of households, communities, countries and global human society, because of the need to invest human and material resources to improve sustainability. For example, it has been suggested that the ability of poor countries to live sustainably is threatened by their international debt burden.
- **Environmental sustainability** includes specific issues ranging from local (eg wind turbine bird strike) to regional (eg salinity control) to global (eg climate change) and also encompasses the maintenance of entire ecosystems.
- **Social sustainability** involves the ideas of human knowledge and ingenuity, quality of life, equity and social skills which serve to create or maintain a society – it may not be reasonable to expect specialised knowledge or equipment to be available within a local community. Examples include concerns about the visual impact of wind farms and opportunities for local employment arising from renewable energy technology manufacture, installation and operation.
- **Technical sustainability** involves using "best practice" products, services, work practices and institutional arrangements, as well as the fostering of appropriate innovation in hardware, software and institutional framework – with an appropriate balance of self-sufficiency objectives at local, regional and national levels.

Sustainability must be considered in a broader context than a particular project – different issues arise if there is only one wind farm in a region compared to the situation if there are a hundred. For example, in the latter case the risks of environmental damage may increase but so may the potential to support a viable regional wind industry by capturing economies of scale.

To develop and implement sustainable projects, all relevant stakeholders should be involved from the commencement of project planning. Therefore, consideration of sustainability involves communal issues as well as decisions that are solely the province of a particular project developer. "Perfect" sustainability is not a practical goal, neither is consensus between all stakeholders. Rather, trade-offs must be made that allow communities to improve all aspects of sustainability through time.

Sustainable energy systems

An energy system is more than a set of technologies. It also includes relevant laws, organizations, education, information, pricing and taxation systems. It is based on the energy services required by society and must recognize the quantity, quality and spatial distribution of energy sources and cultural factors influencing energy use [Watt et al, 2001].

A sustainable energy system is an energy system for a sustainable society. Such an energy system must be able to supply the main energy services, while reducing to a very low level the impacts of the existing energy system on climate, biodiversity and pollution levels. It would use materials, land and energy efficiently; create employment; be affordable and least-cost (in a broad sense) to society and the planet; and at very least not increase social inequity. It would rely primarily on renewable energy resources rather than fossil fuels.

Many renewable energy technologies are now mature, yet renewable energy generally has yet to be widely accepted in the energy sector. Public support will be crucial in achieving acceptance and increased application. At this critical stage of development therefore, renewable energy projects must be and must be seen to be environmentally and socially sustainable. Project proponents must be acutely aware of potential impacts and must be open and transparent in their dealings with local communities. Although it may seem that renewables are being asked to pass higher levels of scrutiny than is required of fossil fuel projects, in the longer term this will be an advantage, as renewables will have gained the community trust and acceptance necessary for their widespread use and for a paradigm shift in energy planning (ibid).

The important role of externalities

Economists define externalities as positive or negative effects of an activity that do not appear as direct costs or benefits to the individual or organization undertaking the activity and thus do not influence project decision making. The term “impact” is often used interchangeably with the term “externality”.

Externalities are often abstract, such as the visual impact of a project or concerns about climate change. Thus they may have local, regional or global scale. People who are affected by the externalities of a project are often described as stakeholders, and may differ from one externality to another. Because renewable energy technologies are innovative, their externalities may not be well understood and the associated stakeholder groups may not be well defined.

Given that energy prices are unlikely to ever reflect or be allowed to reflect all externalities associated with energy use, including social and environmental impacts, there will always be a need for society to identify, promote and support specific technologies and applications, thus “internalising the externalities”. With better information and full life-cycle assessment, decision makers, including policy developers, government authorities, energy suppliers as well as consumers, can develop programs, regulations, pricing regimes and investment plans to achieve desired outcomes from a range of options. Ideally the amount spent on various options to achieve such outcomes should be related to the real socio-economic value of the investment [Watt et al, 2001].

Economists would argue that if all of the external effects of a renewable energy project could be presented to a project developer in a manner that reflected their costs and benefits, a rational project developer operating in a perfectly functioning economy would weigh them in an appropriate manner in decision-making. However this may not occur in practice, and distorted outcomes can then arise when externalities are large or uncertain, possibly leading to significant social discord.

Therefore the role of government is to provide appropriate frameworks within which externalities and stakeholders can be identified for these innovative technologies, and project developers and stakeholders can then negotiate consensus solutions. Otherwise individual project developers must try to implement such a process on their own, a challenge that is fraught with difficulty.

For example, a project developer may only become aware of negative externalities when stakeholders, who believe they will be negatively impacted, object to a project. Moreover, stakeholder concern about project impacts may only develop during project construction or after the commencement of operation, when abstract issues become more concrete and after a project developer has "sunk" substantial time and money into a project.

Therefore stakeholder resistance may appear as a significant risk to a project developer at a time when the developer finds concessions difficult or expensive to make, leading to confrontation rather than negotiation of consensus solutions. Such an outcome would, of course, make stakeholders even more wary of later project proposals that had similar characteristics. Thus problems experienced by one project developer may flow on to future projects, creating externalities between project developers as well as between project developers and other stakeholders. For all of these reasons also, there is a need to trade off commercial confidentiality against public accountability.

Table 1 considers the distribution of externalities over the life cycle for different types of renewable energy projects. The monetary value of the externalities would of course vary from one technology to another and from one project to another.

Table 1. Indicative distribution of externalities over the life cycle for selected renewable energy technologies

Technology	Distribution of externalities between manufacture, installation, operation and de-commissioning
PV-RAPS	Most externalities for PV modules occur during manufacture and, for PV technologies that use heavy metals, in de-commissioning. Significant externalities for batteries can occur during operation and de-commissioning, due to disposal of acid and lead.
PV-grid	PV-grid systems don't usually contain batteries, therefore the key externalities are those for PV modules, which occur during manufacture and, in some cases, de-commissioning.
Wind energy	Most externalities occur during installation and operation, due to the impact of the turbines on ecosystems and the landscape.
Biomass	Most externalities occur during installation and operation, due to impacts (positive or negative) on ecosystems and the landscape.
Hydro with storage	Most externalities occur during construction and operation, due to impacts (positive or negative) on ecosystems and the landscape.

Table 1 hypothesises that a large fraction of the external costs for PV-grid occur during manufacture, which are effectively internalised in the installed cost of the system. These internalised costs are therefore paid directly by the project developer, reducing the likelihood of contentious issues arising during the construction and use of a PV-grid project. Thus there is also little likelihood that broad social resistance will develop to the technology. By comparison, PV-RAPS has a greater fraction of external costs during installation, use and de-commissioning due to disposal and leakage problems associated with lead-acid batteries. Therefore, PV-RAPS faces a greater stakeholder risk than grid-connected PV.

It is well known that grid-connected wind, biomass and hydro projects generally have lower direct costs than PV-grid. However a much higher fraction of their external costs appears during installation and use. These costs are likely to be externalities from the perspective of the project developer and borne by other stakeholders. Thus they may manifest themselves as stakeholder resistance to a project. Stakeholder resistance may then translate into unanticipated direct costs to the project developer, in the form of delays in project approval or construction, modifications to project design, reduced operating life, vandalism and so on. It may also translate into generalised social resistance to a technology that then impacts on future projects, even if they are more benign in terms of their external impacts than the project that created the initial problems. Risks of this kind are best managed by implementing an appropriate planning framework.

Many more wind farms have been installed in Europe than in Australia, and here is evidence that generalised resistance has already developed there – particularly in the UK but also in Holland. Wolsink [2000] proposed the following categorisation of community resistance in the context of a study of wind power projects in Holland. It is interesting to note that this categorisation is adapted from conclusions reached in earlier studies of community resistance to waste incineration and genetic modification facilities:

> *"Resistance Type A. A positive attitude towards wind power, combined with opposition to the construction of a wind farm anywhere in one's own neighbourhood. This attitude-behaviour combination reflects the only true NIMBY[1] standpoint.*
>
> *Resistance Type B. Rejection and opposition to a wind farm in the neighbourhood because one rejects wind turbine technology in general. This position is sometimes called `NIABY', or Not-In-Any-Backyard. This kind of opposition is based on concerns about the general consequences of wind power on the scenery.*
>
> *Resistance Type C. A positive attitude towards wind power, which becomes negative as a result of the discussion surrounding the proposed construction of a wind farm. This type shows the significance of the dynamics in attitudes, as it reflects a NIABY attitude resulting from changing risk perceptions during the decision-making process.*
>
> *Resistance Type D. Resistance created by the fact that particular projects are considered faulty, without a rejection of the technology as a whole. This type advocates the generation of wind power, but only under some conditions. This opposition is particularly limited to proposed wind farms on specific locations, as it is based on concerns about the consequences of a wind power plant, on primarily the scenery and, to a lesser degree, on interference and nuisance. People here may be unconvinced about the suitability of the selected site. They may expect interference or they may consider the landscape on the chosen location too sensitive, especially when other available locations nearby are considered more suitable."*

Wolsink found that Resistance Types A (NIMBY) and B (NIABY) were not common among wind farm resistors in Holland. Instead, he found that Resistance Types C or D might arise from experiences with actual or proposed developments, largely based on visual impacts, with noise being a less important factor. No dilemma was found in choosing between site specific ecological values and more general global environmental concern, even amongst environmentalists.

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[1] The NIMBY or "Not In My Backyard" attitude combines support for an activity in general with resistance to the presence of the activity in one's own vicinity.

Resistance Types C and D both have the potential to generalise to all wind farms through a loss of faith in the planning process. Also, they may not arise until well into project construction or operation, as it may be very difficult for stakeholders to assess the nature of the visual impact of a wind farm prior to its construction. This increases the risk of unresolvable conflicts because the cost of modifying the project design to meet stakeholder concerns may then be very high.

Also, communication problems are likely to occur due to the abstract nature of important externalities. For example, it may be difficult for project developers to convince stakeholders that wind energy is as sensitive to site selection as they claim it to be. Likewise, project developers may be sceptical about stakeholder estimates of the societal cost of visual impacts. Therefore it is important to have impartial intermediaries who are respected by all stakeholders and who can facilitate a negotiated outcome.

Wolsink believes that the best way to facilitate the development of appropriate wind farms is to build institutional capital (knowledge resources, relational resources and the capacity for mobilisation) through collaborative approaches to planning: *"Policy actors and wind-power developers should direct themselves towards building up institutional capital for wind power and other renewable resources, instead of complaining about public attitudes"* [Wolsink, 2000, p 63]. He notes that neither project-specific nor "top-down" imposed decision-making is likely to be as efficacious as a collaborative approach – the top-down task is to establish an appropriate process rather than to impose an outcome.

Turning to the UK, 1,154MW Declared Net Capacity (DCP)[2] of wind power was contracted under the Non-Fossil Fuel Obligation (NFFO) scheme during its existence. However by mid 2001, only 164MW DNC had actually been installed. Edge [2002] provides the following analysis of the reasons for the low success rate:

> *"While the structure of NFFO made life difficult for developers, more capacity would have been built if there had been stronger guidance from central government to local planning authorities. Without a strong steer from Whitehall, councils were swayed by small but vociferous minorities who objected violently to virtually any application. One organisation, Country Guardian, whose leading light was Margaret Thatcher's former press secretary, Bernard Ingham, crusaded against wind power – with, it is rumoured, funding from the nuclear industry. A string of planning decisions followed which turned down applications for wind farms on the grounds that the landscape damage that would result were not justified by the small amount of power that would be generated. This was inconsistent with stated government policy, but without this policy being translated into direction in the form of a planning policy guidance (PPG) note, local officials were free to ignore it.*
>
> *"This lack of forethought on the part of central government to the issue of planning contrasts with countries such as Germany and Denmark, which early on marked out which areas would and which would not be suitable for development. Developers could hence move forward with projects in confidence that permission would not be refused, within reason. The model of support in these countries, a simple fixed tariff, also enabled many wind turbines to be co-operatively owned by local residents, thus building a constituency of support that facilitated the granting of planning permission. The complex NFFO bidding process was only really accessible to professional developers, so local communities in the UK were effectively "shut out" – hardly a situation likely to breed trust and mutual support."*

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[2] Declared Net Capacity (DNC) is a measure of the ability of a power station to reliably export power. It is generally equal to name-plate capacity less power requirements for internal power station use.

Thus Edge identified the same issue as Wolsink – the absence of a policy framework that implements a collaborative approach to planning, with a consequent failure to build institutional capital.

Krone [2002] comments as follows on the Danish experience:

> *"With a highly visible technology such as wind turbines, the development of models for dealing with the public planning (zoning) issues has been very important for many countries acceptance of the technology.*
>
> *In Denmark the public planning procedures were initially developed through local trial and error. In 1992 more systematic planning procedures were developed at the national level, with directives for local planners. In addition, an executive order from the Minister of the Environment and Energy ordered municipalities to find suitable sites for wind turbine siting throughout the country. This "prior planning" with public hearings in advance of ant actual applications for siting of turbines helped the public acceptance of subsequent siting of wind turbines considerably. A similar planning model has since been introduced in Germany with considerable success. Other countries are studying the experiences with a view to overhauling their planning procedures.*
>
> *Around 1997 another set of planning regulations were developed for offshore wind farms, with a central, national authority – the Danish Energy Agency – being responsible to hear all the interested parties, public and private. This "one stop shopping" method has facilitated the planning process considerably, and is widely studied around the globe."*

It is useful at this point to remember that the wind energy industry in Denmark began as a community-based industry that constructed, installed and operated small, distributed wind farms on rural properties, with substantial local participation in manufacture, installation and ownership, typically of both wind farm and site. This process automatically built institutional capital and selected sites that had low visual impact on stakeholders who were not otherwise connected to the project. It was a collaborative approach to planning achieved largely by informal means.

However the international wind energy industry has now progressed to a stage where large turbines are being installed in large wind farms, often by large organisations that seem remote to other stakeholders. Also, in the pursuit of high wind speeds, proponents have a strong preference to locate wind farms close to shorelines, which the community often regards as having high visual and ecological values, and as already being under threat from other development pressures.

Therefore, both the potential for confrontation and the need for formal collaborative planning procedures are now much greater than in the early stages of wind energy industry development in Denmark.

Germany has partially resolved this dilemma by implementing a scheme whereby the buy-back rate for electricity from wind farms is higher for low-wind speed sites than for high-wind sites. This reduces the incentive for wind project developers to seek out the windiest sites, and could be regarded as a surrogate for internalising those external costs that are correlated to wind resource (such as shoreline values).

The Australian experience

The Australian experience with large renewable energy projects is mainly restricted to large hydro schemes. In that context the ill-fated Gordon Below Franklin hydro scheme in Tasmania clearly represented a failure to plan in a collaborative manner and to consider external costs at an appropriate stage in project development. Moreover, because of the late stage in project development at which the confrontation developed, it was only resolved by formal intervention by the Federal government after strong public confrontations and a High Court challenge. Advocates of sustainable renewable energy projects would not wish to see that experience repeated.

Supply of electricity services has been centralised and government controlled until recent restructuring of the industry. Community involvement and debate have been largely restricted to localised issues of grid extension and placement of transmission lines and power stations, for which reasonably effective processes were developed over the years, although not without some contentious projects. For example, there has been significant public debate over expansion of hydro facilities in Tasmania, as mentioned above, placement of some transmission lines and the possible use of nuclear energy.

The last decade has seen major changes in the structure, operation and ownership of the electricity industry and its assets. There has been little general public debate about most of these changes. Where it has occurred, debate has focussed on the privatisation of public assets.

At the same time, international interest in the use of renewable energy sources and technologies has increased rapidly and Australia's early lead in research and small scale off-grid applications has been superseded by large scale development of the grid-connected market. While some grid-connected systems have been installed in Australia, in general there has been little development of renewable energy institutional capacity. The Australian public, whilst generally very supportive of renewable energy development and use, has not had the opportunity to participate in informed decision making and debate about appropriate norms for large scale renewable energy use in this country. Drivers such as Mandatory Renewable Energy Targets (MRET) establish a generic "market-pull" for grid-connected renewables but do not in themselves address the task of building the associated, often technology-specific, institutional capacity.

Some State governments are beginning the process of developing guidelines, standards, benchmarks and educational support material, however, market based mechanisms to increase the use of grid connected renewable energy have already led to projects going ahead or being proposed before such "top down" institutional frameworks have been established. Hence, for instance, wind farm projects are being developed by both private and public companies in the absence of prior public involvement in the decision making process. Where land use, environmental impact, aesthetics, native forest products, water use and other issues, which may be classed as being in the public domain, are involved, local communities have understandably been concerned about the developments, and about the processes being followed.

As has occurred overseas, wind farms are expected to be a major contributor to renewable energy generation in the near future. To date wind farm development has had mixed results in terms of community acceptance, and unless appropriate steps are taken, it is possible they will experience similar problems to large-scale hydro schemes in Australia and wind farms in the UK.

Overview of case studies

With this background, we will investigate experience with delivering sustainable renewable energy projects in Australia by means of case studies for NSW, Victoria, South Australia, Queensland, Tasmania and Western Australia. Initially we will consider wind energy projects but later we will also investigate biomass, hydro and photovoltaics.

For wind energy, we will consider the Portland region of Victoria, the Ayre Peninsular region of SA, the Albany region of WA, the Western Slopes region of NSW, the Atherton Tableland region in Queensland and the Northwest Cape region of Tasmania.

We will look at both the policy context provided by the State and the procedures adopted by wind farm developers. Immediate issues arise – for example publicly owned project developers operate under different drivers from privately owned ones, particularly if the publicly owned developers also own the host electricity networks and/or retailers. This raises interesting questions about how to improve sustainability in a context of mixed public and private ownership, where some industry participants may internalise policy issues due to their public ownership and others may not.

Prior to considering the individual states, we will review the federal policy context.

The Federal Policy Context

There are several bodies mandated to support and promote renewable energy at a federal level, notably the AGO and ITR. The framework for federal support for renewable energy is set out in the National Greenhouse Strategy (1998). This document sets out the following measures for new action to promote renewable energy:

a) Strategic Development of Renewable Energy:

i. An action agenda for the renewables industry

ii. Direct support through the Renewable Energy Equity Fund, Renewable Energy Commercialisation Program, Renewable Energy Showcase, Renewable Energy Technology Internet Site, Photovoltaic Rebate Program and the Remote Renewable Power Generation Program.

iii. Strengthening industry standards and training

iv. Data dissemination on services and equipment

b) Mandatory Targets for the Uptake of Renewable Energy (MRET)

A legal requirement for retailers and large power consumers to source an additional 9,500 GWh of electricity from renewables and specified waste product energy sources by 2010. MRET is a price-based mechanism that increases the financial viability of renewable energy projects without specifying particular technologies.

c) Extension of Green Power Schemes

Green Power schemes enable electricity customers to pay a premium for a certain percentage of their electricity to be generated from renewable sources. They were initiated in order to cover the price differential between conventional and renewable sources of energy and so increase penetration of the latter into electricity markets. The National Greenhouse Strategy aims to assist green power uptake through nationally agreed definition and accreditation.

Of these the MRET has been translated into a legislative mechanism and has the potential to have the most significant impact on the uptake of renewable energy in Australia.

Issues of possible impediments to renewable energy growth are identified in the renewable energy action agenda, including; *information failures, education and training, labour market, market access issues and business input costs*. Though not mentioned specifically, the federal strategy recognises that there is a role for federal government in the identification of impediments to the growth of wind power.

However, less consideration is given to the questions of intervention to alleviate or resolve these barriers, and the development of appropriate mechanisms to resolve externality imbalances.

Commonwealth Environmental Approvals

AusWEA (2002) and SEDA (2002) have identified a long list of relevant federal government policies, guidelines and stakeholders for wind developments. The two main Commonwealth interventions that can be triggered concern the Commonwealth Environmental Protection and Biodiversity Act (EPBC) and the National Heritage Commission Register:

(i) The Commonwealth Environmental Protection and Biodiversity Act (EPBC) applies if any wind development were to have a significant impact on:

- Nominated world heritage areas
- RAMSAR wetlands
- Listed threatened species
- Listed migratory birds
- Commonwealth land
- Commonwealth marine areas

(ii) The National Heritage Commission maintains a register of protected heritage sites. It also provides methodologies for assessing heritage values.

Discussion

In principle Green power schemes allow for specific selection of technology. However, they represent less than 1% of eligible customers, and approximately 0.2% of total sales. Nevertheless, sustainability criteria are built into the accreditation processes.

Commonwealth interventions (controlled actions) are vehicles for assuring some aspects of sustainability in wind project development. At present they are only triggered under conditions of significant environmental risk in the specified areas. Thus they are a 'fail-safe' mechanism rather than an ongoing tool for developing industry sustainability. Used in the context of overlays and mapping as Hydro Tasmania have undertaken, simply the presence of these Commonwealth policies can provide suitable guidance to developers making site selection decisions, before significant expense has been made. However, their scope does not stretch to include the more abstract issues of landscape or visual impact, or to assessment of cumulative impacts.

Of the three possible federal government interventions, MRET appears to have the strongest influence on the market for renewable energy projects, but is least able to influence sustainability. In principle MRET is technology neutral, with the Office of the Renewable Energy Regulator (ORER) requiring only that *'individual power stations to be accredited to contribute towards the achievement of mandatory renewable energy targets'*. Assuming that all wind farms satisfy these criteria they provide no further guidance for wind farm development specifically.

The MRET is delivered through the mechanism of Renewable Energy Certificates, RECS. At this point the penalty price for non-compliance with the target is set at 4c/kWh. It should be noted that since the penalty is not tax deductible, it has an apparent (pre-tax) value of approximately 5.7c/kWh. At present there is also an over supply of RECs from existing large hydroelectric facilities but this may ease in the future. The income for renewable energy projects, combining the pool price for electricity with the REC value, has been estimated at 7 to 8 cents per KWh [Young, 2002].

In comparison with overseas examples, the MRET mechanism appears to be a compromise between an emission reduction scheme, typically technology neutral so as to minimise costs of reductions to the community, and an industry development mechanism, usually technology specific. The MRET mechanism is technology specific in so far as it requires the energy resource to be renewable, but it does not set up technology specific banding for the various renewables.

The advantage of technology neutrality is that it is cost efficient in the short term. However, it concentrates resources on the most mature and lowest cost technologies and away from less mature technologies, some of which may be more appropriate in the longer term. Thus we currently see REC sales gravitating towards existing large hydro (AEA, 2002), with some wind power at the margins. By comparison, the technology specific step of identifying technologies to be accelerated by market intervention has been shown to more effective at industry development in numerous cases: Denmark (wind), Germany (wind and solar PV), Japan (solar PV), Spain (wind), UK (wave power). There are few examples of a technology neutral mechanism that has an industry development impact.

Technology neutrality also appears to lead federal and state governments away from providing policy support in other areas such as planning and zoning, possibly because these needs are technology-specific. Instead it may be left to the market to internalise the externalities associated with renewables. Thus controversial projects or technologies may be held up at planning stages and RECs will go to projects that more easily gain approval. In addition, it leaves the door open for controversial projects to be pushed through the planning processes with potential long term damage to the sustainable image of the renewable technology, and consequent long term reduction in future take-up. Nevertheless, the state based industry development strategies described below could be used to support the market based mechanism provided by MRET and facilitate the sustainable implementation of specific technologies such as wind power.

New South Wales

State policy context

Historically, wind farm site selection in NSW has been the responsibility of developers, with little direct involvement by government, except as provided by the generic planning framework. Wind farm developments to date have managed to avoid significant community opposition by choosing inland sites that have low negative externalities.

Recently the NSW government has been taking a much more proactive approach to wind farm development. The NSW Sustainable Energy Development Authority (SEDA) has established an internal business unit, WindBusiness, which provides the following range of services to aid site selection and development.

1. Regional wind reports

These cover 50km square areas using a standard GIS AusLIG grid and include CSIRO WindScape three dimensional modeling. They also include other information relevant to location of a wind farms. These are in the form of overlays and include transmission and distribution networks, transport (roads, rail, air), vegetation, local government boundaries, cadastre (property ownership), and national parks, state forests, and aboriginal heritage.

2. Wind data

For an annual licence fee, data is available on a non-exclusive basis for over 25 monitoring sites throughout NSW. In addition developers have access to data for correlation, calibration etc.

3. A wind monitoring service

Exclusive data is available for a 2 year minimum term licence fee for a client-nominated site. SEDA owns, operates and maintains the tower, and arranges all aspects of the monitoring process including development and landowner approval.

4. Site agreements

These are expected to be available by September 2002 and involve SEDA securing sites based on existing data and the SEDA Landholder Database. Following registration of interested developers, sites will be allocated along with a detailed site prospectus.

5. NSW Wind Energy Handbook

Provides comprehensive information on many aspects of wind energy development in NSW. It is a resource for wind developers, land holders, local councils and communities and is updated regularly.

Together, the services offered by SEDA provide very useful support for wind farm development in New South Wales. It may be possible to strengthen this further with an analysis of externalities for the various regions of New South Wales.

Planning NSW has recently released the NSW Wind Energy EIA Guidelines. They emphasise a number of aspects critical to sustainability, including consideration of environmental and social, as well as economic factors. They also emphasise that these issues should be identified early in the EIA process, usually through consultation with the local council, government agencies and the community.

The guidelines have many positive features, however they require the developer to undertake some tasks that might be more appropriately undertaken through broader public processes, since they involve issues of public good that go well beyond a particular project. For example, developers are expected to ensure that the best solution has been identified in terms of;

- Alternative locations
- Alternative renewable energy options, eg fuel cells or biomass
- The do-nothing (no-build) option - the consequences of not proceeding with the proposal or any alternatives must be considered.

Regional and local government policy context

Local governments in NSW have, to date, had little input into wind farm development apart from processing development applications for wind monitoring towers and for wind farms themselves. The one exception is Wingecarribee Shire, which has produced a Development Control Plan that specifies the requirements for Wind Energy Generation facilities within the Shire. The aim is to permit wind farms that are of a scale appropriate to the location and in line with Council's Ecologically Sustainable Development objectives. However, this plan illustrates a lack of information on, and understanding of, wind farm requirements - it specifies that turbines must not be put along ridge lines and also that small scale turbines must be screened from view by vegetation. It is possible that this type of DCP is symptomatic of growing community concern with wind farms. This could become especially problematic if similar planning controls are adopted elsewhere.

Experience with wind farm projects to date

Wind turbines have been erected in NSW at Blayney (15 turbines), Crookwell (8), Hampton (2), and Kooragang Island (1). With the exception of the single turbine at Kooragang Island, all are located in the Western Slopes region in inland NSW. This has occurred for a number of reasons:

- Coastal areas that are less populated but have high aesthetic value, such as in the south, have network constraints that require more augmentation – and therefore higher up-front costs - than inland areas that have strong transmission networks.
- The wind resources of the southern coastal region are relatively turbulent.
- Inland areas along the Great Dividing Range consist of open rolling farm country with a small population that welcomes the income and employment associated with wind farms.

Thus, although inland wind speeds at 40 metres are 1-2m/s lower than those found on the southern coast of Australia, the up-front costs and risks are less because of reduced requirement for network augmentation (compared to South Australia) and because of high acceptance by the local community (compared to Victoria). Also, because large wind turbines have hub heights of about 70 metres, the difference in wind speeds between inland and coastal sites may be less than anticipated.

Discussion

Although the Planning NSW Guidelines emphasise sustainability principles, developers are expected to shoulder the burden of ensuring that sustainability criteria are met, not only for the site of interest, but also in a more general sense. The EIS process expects them to not only evaluate the project site but also to conduct early evaluations of alternative sites, designs and technology options. This approach has two main problems:

(i) developers are expected to contribute disproportionately to the general energy planning for a locality, and

(ii) the process is project-centred, with all requirements, both general and project specific, being dealt with in the assessment of each project.

This approach would be improved if government were to undertake a broader wind industry planning process involving extensive community consultation prior to the project-specific planning process.

The products and services offered by SEDA significantly reduce up-front costs and risks faced by wind project developers in NSW – an approach consistent with government contributing to developments that have positive social and environmental externalities. However, more could be done to ensure that developments are likely to be accepted by the local community.

We understand that a survey of the local community was undertaken at Hampton before and after installation of the wind farm. It would be useful to analyse this survey and to undertake a further survey at a later stage. It would also be useful to undertake a more extensive survey of community attitudes to wind farms in areas where wind farms have been installed and in other prospective areas.

Construction of such a database would also provide a valuable opportunity to educate communities regarding a wind farms' likely impacts. Inclusion of such information would mean that those affected by local negative impacts had been given the opportunity to decide whether these impacts were outweighed by the local benefits.

South Australia

State policy context

In 1984 the State government released the South Australian Wind Survey that identified sites within and outside the existing electricity grid suitable for wind generation. This survey provided information on wind potential only, and no information was provided regarding other factors relevant to wind farm viability, such as network infrastructure, transport, property ownership, or sites of natural or cultural significance. Beyond this, government has played no role in initial site selection, and the task has remained solely the responsibility of developers.

However, the SA Government's planning department has written an advisory notice, number 21 "Wind Farms", to provide guidance on the approval requirements for Wind Farms under the *Development Act*. This performs a similar function to the Wind Energy EIA Guidelines recently released by Planning NSW.

Regional and local government policy context

Involvement by local government is restricted to a regulatory role, although some Councils have been proactive in encouraging wind farms in their areas. Once a site has been selected, developers must then seek planning approval through either the Local Council or the Development Assessment Commission - a central independent body. Although there is no regional government body, regional development boards could have an indirect interest through the regional development aspects of proposals.

Experience with wind farm projects to date

Like NSW, wind farm developments in South Australia have avoided significant community opposition in most cases. However, rather than being the result of government policy that discourages development in areas valued by the community, this has been due to high wind value sites being in remote areas with low population.

There are currently many proposals in SA, mostly coastal. The most popular regions are the Lower South East, Fleurieu Peninsula, and Eyre Peninsula (west coast and near the Iron Triangle). Because most proposals are relatively remote or are not in sensitive environments, communities have been generally supportive, although there have been some exceptions, notably locations closer to Adelaide, where significant community opposition has been seen.

The first South Australian wind farm development was approved in April 2002. It will be established by Tarong Energy at Starfish Hill near Cape Jervis and will consist of 17 turbines with a total rating of 34.5MW. It will be on fairly isolated private farmland about 5 km from the nearest town and will extend inland from the coast. Construction is due to start in June 2002 and the wind farm is due to be fully operational by autumn 2003.

Approval has also recently been given for a 46 turbine wind farm at Wattle Range near Lake Bonney South East, on quite isolated private farmland about 10 km south of Millicent. Construction is subject to approval for connection to the electricity grid and further collection of wind data.

Discussion

Apart from the Wind Survey released in 1984, the South Australian government has provided little assistance to lower up-front costs and reduce risks for developers. Although wind farm proposals to date have generally avoided significant community opposition, this appears to be because the sites are either remote from inhabited areas or not considered to be of significant scenic value. However, a proposal south of Adelaide and in line of sight of suburbs has met opposition at public meetings based on visual impact, noise, and potential to lower property values. Had government taken a more proactive role and emphasised community acceptance in addition to wind resource in initial site selection, it is entirely possible that this site would not have been considered in the first place. This would not only have saved developers' time and money, but would also have avoided creating a pocket of opposition to wind farms.

Western Australia

State policy context

Western Australia does not have an overall wind development policy. Like South Australia, wind farm developers are free to choose suitable sites and are then responsible for any necessary approvals (environmental, land use, etc), securing local support (local government, residents, etc) and arranging suitable network connections. They are also solely responsible for wind monitoring.

Regional and local government policy context

Again, the major role of local government is to approve projects proposed in their area, and if necessary to rezone land. Some Councils have been proactive in identifying what types of renewable energy generation could be located in their jurisdiction, and what sites/locations are suitable.

Experience with wind farm projects to date

Although private companies have expressed interest, only Western Power, a government owned power utility, has constructed wind farms in Western Australia. Thus far, wind farms have been completed at Albany (12 turbines), Salmon Beach (6), and Ten Mile Lagoon (9) on the southern coastline, and at Denham (3) and Exmouth (3) on the west coast north of Perth.

Another government agency, LandCorp (that sells and develops land), is currently in the process of calling for expressions of interest for developing a wind farm 20 kilometres north of Geraldton on the coastal escarpment of Oakajee. The site forms a coastal buffer zone for a 140-hectare industrial estate currently being developed by LandCorp, and development of a wind farm is seen as a means of adding value in a way that is compatible with the industrial estate.

Of the wind farms developed so far, Albany has been the most contentious. All the others are in isolated areas distant from significant tourist attractions. The Albany wind farm is on the southern end of the Bibbulman Track, a very popular walk extending over 960kms from Kalamunda near Perth to Albany.

Discussion

Opposition to the Albany wind farm was fairly small-scale, but quite vocal, and was very much smaller than local support for the project, which was quite strong. However because of local opposition, Western Power had to go to a lot of effort to get local support, including changing some aspects of the project. According to the Western Australian Government, there is little if any residual resentment to the project, and their understanding is that the people of Albany are generally very happy with the result. However, on speaking to locals, it is apparent that some opponents to the project have maintained their opposition and feel that the process followed was not ideal.

Victoria

State Policy Context

In the state of Victoria there are has been significant interest in wind power for many years. To date there are:

- 18 MW installed
- 21 MW under construction
- 300 MW planned by 2005

General mapping data in the public domain, via the Victorian Wind Atlas. It was commissioned in the 1980s by the SECV / Solar Energy Council. Some additional monitoring has since been done by private entities and is not in the public domain.

The Victorian government has had a significant historical role in wind resource assessment. All but one of the sites currently installed or planned are coastal at (or close to) locations identified in the original Victorian Wind Atlas. The exception is the Pacific Hydro proposal for Chalkom Hills, which is in inland Victoria, though part of the combined Portland proposal.

More recently, SEAV have funds set aside for a more extensive wind mapping program as a project under the Victorian Greenhouse Strategy. This has not yet gone to tender. Government agencies will use the mapping to help prepare councils in zones with wind potential with their planning and overlay laws.

There are no wind specific guidelines currently in place. However, the Victorian Government is developing new guidelines, which are intended to:

1. Provide a statement of the government's policy on wind farm developments
2. Provide a balanced framework for evaluating the environmental, social and economic costs and benefits of wind farm developments.
3. Establish evaluation criteria to support the consistent assessment of individual wind farms proposals by responsible authorities
4. Outline the baseline information to be submitted by all wind farm proponents.
5. Be incorporated in the planning system.

It is specifically noted that the guidelines will not replace the Terms of References for Environmental Effects Statements in Victoria. Rather, the guidelines will attempt to help developers and planners address sustainability issues in wind power implementation. The evaluation criteria require consideration of:

1. The contribution to increasing the amount of energy supplied from renewable resources
2. The visual effect on the landscape
3. The extent to which greenhouse gases will be reduced
4. The extent to which appropriate steps have been taken to protect nationally and state protected flora and fauna
5. The contribution to economic development and employment
6. The extent to which appropriate steps have been taken to protect cultural heritage.

Regional and local government policy context

Local authorities are responsible for small and medium developments. The Minister for planning is responsible for larger developments or when triggered by environmental sensitivity (EBPC). Contentious council decisions can be appealed. In case of appeal, the Victorian Civil and Administrative Tribunal (VCAT) is intended to resolve contentious planning issues.

Key documents for guiding council planning include:

- Planning and Environment Act 1987
- Environmental Effects Act 1988
- Coastal Management Act 1995

Experience with wind farm projects to date

As discussed, there are currently 18MW of installed capacity and 21MW under construction in Victoria. There has been significant debate on the social and environmental impacts of many of the projects, due largely to their coastal locations. The Bridgewater wind farm has been especially vexed following rejection of the original Lend Lease proposal, now revised and re-submitted by Pacific Hydro.

Independent surveys of the Victorian communities indicate strong support at a local level for local wind farms, and an increased level of acceptance after installation. However the opposition groups, though small and not necessarily representative of community consensus, are vocal, well organised and increasingly acting collectively. Groups such as National Trust Victoria are especially concerned about landscape externalities and cumulative impacts. Many other national stakeholder NGOs have been drawn into the debate.

Equally, state government bodies are focussed on enhancing positive externalities, such as employment, through achieving critical mass in wind power developments. The policies have nevertheless left the handling of negative externalities largely to the project developers, and the government has so far declined to rule out any sites as ‘no-go’ for wind power.

Discussion

Victorian is aiming to include wind energy development provisions into its planning legislation. The government is clearly willing to capture the positive externalities flowing from wind turbine manufacture and employment. The government has also recognised that significant social externalities may impede planning processes, and is developing new planning guidelines to standardise the assessment processes. Mapping is to be undertaken to assist in identifying potential future stakeholders. Missing however, are mechanisms to assist in managing social externalities. For instance, if the community at large wants wind power and also wants to protect specific landscapes, perhaps it should be called upon to provide additional funds or other mechanisms that allow other wind sites to be used instead of the high-value coastal sites.

The Victorian guidelines will increase and broaden sustainability parameters within the planning assessment process. However, despite the proposed changes to planning and guidelines, the planning process will still remain project focussed and the onus will continue to rest with the developer to balance competing interests in the process of seeking project approval.

Queensland

State policy context

There is one 12MW wind farm currently installed in Queensland but none under construction.

There is no specific government agency for renewable energy, however, the Environmental Protection Agency has a Sustainable Energy Systems and Technology Unit and maintains a general state wind map. There are no specific planning guidelines or legislation covering wind power projects. Instead, the local authority is responsible for planning consent in combination with other agencies. See below.

Wind monitoring of selected sites was undertaken in Queensland in the 1980's, however, there is no current state-based wind resource or site monitoring. Consequently monitoring is undertaken by developers and does not enter the public domain. Some developers consider this a better use of resources in Queensland than less targeted general mapping, as the topographical enhancement of wind speeds is so significant in the inland mountain ranges.

Regional and local government policy context

Local authorities in co-conjunction with other agencies are responsible for development approvals under the Integrated Development Assessment System (covered by: Integrated Planning Act 1997, Integrated Planning Regulation 1998, State Planning Policies and Local Government Planning Schemes).

With the absence of state guidelines for wind farm planning, the process of assessment is localised and project specific.

Experience with wind farm projects to date

- There is one 12MW wind farm in Queensland, at Windy Hill. This is an inland site in the Great Dividing Range.
- Surveys were taken before and after construction as part of the community consultation.
- There are no projects under construction, however some projects have been planned but not yet proposed for construction. They have been selected on the basis of high wind resources and access to transmission lines.
- Coastal regions are heavily populated and, unlike the southern states, do not have significantly better wind sites than inland regions.
- Projects under consideration by developers are generally marginal under current REC pricing.
- There has been little or no intervention by state or regional government to address externalities. Rather this is left to developers.

Discussion

Compared to most other states, the Queensland policy context provides little intervention at a planning level to facilitate implementation of wind power. There is no dedicated agency for the promotion of renewable energy as there is in WA, NSW and Victoria, and the issues of sustainability and externalities associated with wind power are left to the developers and local planning authorities to resolve. However, with responsibility for renewable energy resting with the Environmental Protection Agency, there is scope for sustainability guidelines developed within the EPA to automatically be applied to renewable energy developments.

Tasmania

State policy context

The Tasmanian electrical industry structure strongly influences wind power development. Hydro Tasmania is the main developer and takes on many of the roles undertaken by state agencies in other states.

Both the state and Hydro Tasmania have a long term wind development strategy with 11MW installed, a further 130MW approved, and up to 470 planned for 2005. There are state incentives intended to encourage local manufacturing.

There is no specific agency that handles renewable agency, and there would seem little point in a state that already has such abundant hydroelectric power. There is an office of state energy planning within the Department of Primary Industry, Water and Energy (DPIWE) and a policy division within the Department of Premier and Cabinet, which advises on energy policy issues.

There are no specific guidelines or legislation for wind energy development in Tasmania. There is however to be a new noise criterion in revised development policies.

There has not been any state-sponsored mapping of wind resources or other relevant characteristics. However, Hydro Tasmania has undertaken mapping and has developed infrastructure, environmental and social overlays to assist with wind farm site selection. This has been used to identify sites with high potential environmental or social externalities, and also impacts of new transmission lines for wind farms.

There is little or no state intervention in planning, unless triggered by environmental issues as per the Commonwealth Environmental Protection and Biodiversity Act. Tasmania is the only state which has a bilateral agreement with the Commonwealth concerning this Act and can therefore deal with the issues in state. Councils handle all other planning approval processes.

Tasmanian wind development may become constrained by excess capacity, this depends on industrial development in the state and the construction of Basslink.

Regional and local government policy context

Unless state and commonwealth controlled intervention is triggered, the local council handles the planning, e.g King Island wind farm. (as covered in Land Use Planning and Approvals Act 1993, Local Strategic Plans, revised noise policies). Typically councils are generally supportive.

Experience with wind farm projects to date

The 1MW King Island wind farm has now been eclipsed by the first stage of the Woolnorth wind farms, at 10.5MW, with another 130MW approved for construction.

Environmental and social externalities are a major issue, especially because of the need for new transmission infrastructure to be added for new wind developments. Therefore there has been significant project adjustment and transmission re-routing to minimise social intrusion. This internalisation of impacts has significantly enhanced social acceptance.

The state and Commonwealth governments managed the Woolnorth wind project planning process jointly due to potential environmental impacts. It was approved subject to increased risk assessment for migratory birds and additional precautions to minimise impacts.

Stakeholder surveys have been used to assist in assessing perceived and actual impacts, and to check for externalities. However, the developer undertakes this rather than the state government or the local council. The survey outcomes are not in the public domain for previous projects but will form part of the public participation process for future projects.

The most significant government intervention to increase positive externalities is the strategy to attract wind turbine manufacture to the state. This addresses the need for multiple, staged projects to attract manufacturing. Vestas, a major international wind generator manufacturer, has recently announced the establishment of a wind generator assembly plant in Tasmania.

The policy framework in Tasmania appears to be a reasonably successful mix of careful site selection, incorporating environmental and social externalities on the part of the state owned utility Hydro Tasmania and 'project centric' assessment with respect to negative externalities such as landscape or bird impacts, with the onus resting with the developer to address externalities as part of the project approval process. As with Western Australia, it would be fair to say that a private developer would find it hard to justify the time and effort put into project pre-feasibility work that has been undertaken by Hydro Tasmania.

Discussion

Hydro Tasmania plays a dominant role in wind energy development in Tasmania, taking on roles that government agencies undertake in other states. As with several other states, there is a desire to acquire the positive impacts of wind power such as manufacturing and employment, and therefore to tackle the negative externalities as early as possible, to ensure that the industry is sustainable and therefore able to grow unimpeded. These issues have been taken up by Hydro Tasmania through its coordinated mapping of social, environmental and infrastructure factors to assist in site identification and to minimise social and environmental externalities. Hydro Tasmania considers its community consultation and externality assessment skills to be one of its key competitive advantages. This provides an interesting example of a developer attempting to achieve sustainability in a policy void, although, as a government owned utility, it may be seen to represent government policy in this regard.

Comparison of Australian wind energy case studies

In the absence of institutional frameworks, wind farm site selection and development in Australia has generally been the responsibility of project proponents. Thus selection criteria are restricted to those that serve the developers' interests given their understanding of community concerns. Taking into account price and cost constraints, this process generally emphasises areas with the highest wind resource. Frequently, such areas also have other public values, which can lead to conflicts with the community. Although community consultation is given high priority, it is often treated as an afterthought or consequence of the initial selection criteria. Thus, rather than being an integral determinant in initial site selection, maximising community welfare and addressing local concerns are sometimes seen as unfortunate but necessary hurdles in the process of project development.

Such a project-based approach runs the risk of confusing general support for renewable energy with support for a particular project. Although the perceived "interests of the majority" may prevail and the development go ahead, such an approach can result in a hardened minority who feel that their concerns have been brushed aside. Such "minorities" can coalesce into a vociferous lobbying group that can make the development of wind farms in other areas much more difficult. This has occurred in Britain where the Country Guardians have formed a very effective lobby group and successfully managed to halt a number of wind farm developments [Edge, 2002].

Wind farms have both positive and negative externalities. In general, negative externalities occur locally and can include reduced visual amenity, lower real estate prices, etc. Positive externalities can also be local or regional, including tourism and employment, but are generally more widespread; for example reduced global warming (global) or improved balance of trade (national). Thus the recipients of the benefits may not always be those who bear the costs, particularly those costs associated with negative environmental or social impacts. An additional disparity occurs where developers are expected to shoulder the burden of ensuring local community acceptance of a project that provides positive externalities to the wider community.

Since many of the positive externalities accrue to the general public (ie. are public goods), it could be argued that the general public, through Government, could contribute to the process of wind farm development. This could take two forms:

(i) through development and implementation of an appropriate coherent policy framework within which individual project proposals can be considered in a collaborative planning context, and

(ii) (ii) through assistance with project pre-feasibility studies by contribution to wind monitoring, site selection, assistance with contracts and planning approval processes, and even assessment of community acceptance.

In addition to reducing up-front costs for developers, site selection could then be more readily based on a wide range of criteria, in addition to wind resource, that combine environmental, social and economic sustainability aims. Such criteria could include aesthetics, generation of local employment (during construction and operation), economic diversification and development of the local area, effects on wildlife habitat, etc.

Inclusion of these criteria in the initial stages of site selection, as being equally important to the wind resource, may broaden community involvement from being one of reacting to a reasonably well advanced project proposal, to being one of pro-actively engaged in site selection. This could have a number of beneficial consequences:

- Facilitate a development process that results in less conflict between developers and other stakeholders
- Result in projects that are more likely to be accepted by, and be of benefit to, the local community
- Reduce short term risk for developers (in terms of wasted resources from a rejected proposal)
- Reduce long term risk for developers through being less likely to generate a backlash and general opposition to wind farms elsewhere in Australia.

Such a process may result in wind farms being developed in areas with lower wind speeds than might otherwise be the case, thereby reducing the economic returns from the electricity generation component of the project. However, reduction of up-front costs would decrease the amortised cost per kWh of electricity produced. In addition, the risk of a project being halted at an advanced stage would be significantly reduced. Thus the likelihood of a developer having to make difficult or expensive concessions is reduced, as is the probability of confrontation leading to creation of an anti-wind farm lobby group.

Since the aim of renewable energy use is for overall social benefit, it may be reasonable to expect society to contribute in some way to the generic costs of project development. This could be through policy mechanisms that increase the requirement for renewable energy to the point where these sites become commercially viable (eg. mechanisms such as the MRET target), that mandate a certain percentage of wind power in the renewable energy mix through a portfolio-based MRET, or that provide pre-feasibility assistance.

However, it is critical to realise that market-based policies on their own will do nothing to discourage establishment of wind farms in sensitive areas. They simply enhance the financial viability of developments across the board and so make those in areas with a lower wind resource more achievable. Thus it seems a combination of policies that provide markets, as well as reducing project risk and up front costs, are necessary to provide the institutional framework required for development of a sustainable wind industry in Australia in the longer term.

Conclusions

A challenge for society is to make investments in technology or applications that are consistent with the real socio-economic value of those investments to society. Assessing the sustainability of renewable and other energy options will encourage better investment decisions to be made by imposing some discipline on the allocation of resources. Priorities can be allocated in a broad societal framework, which itself is often characterised by limited budgets and changing priorities. For renewable energy systems, this would help to ensure that investments are not made at the expense of, for example, energy efficiency or education, or alternatively that there is not a lack of investment due to indecision. In addition, renewable energy systems are not necessarily always sustainable. While renewable energy has a high level of community support, some of the most intense public debates in Australia have centred on hydro, biomass and wind projects [Watt, et al 2001].

Rapid development of renewable energy projects is now anticipated under the influence of the Federal Government's MRET scheme and related initiatives at State level. Given Australia's late entry into the grid-connected renewable energy projects other than hydro, there has been little opportunity to build institutional capital. Therefore, we may anticipate a challenging period in which projects are brought forward in an immature planning context.

Public support will be crucial in achieving acceptance and increased application of renewable energy technologies. Renewable energy projects must be seen to be environmentally and socially sustainable and this cannot be taken for granted. Although some may feel that renewable energy projects are being asked to pass higher levels of scrutiny than is required of fossil fuel projects, in the longer term this will be an advantage, as renewables will have gained the community trust and acceptance necessary for their widespread use and for a paradigm shift in energy service delivery (ibid).

To minimise problems, governments should actively facilitate the development of collaborative planning mechanisms that build institutional capital by consistently addressing all aspects of sustainability and empowering stakeholder participation. Although many aspects of such a process will be technology neutral, there will be a need for technology specific considerations and processes to be developed.

In the case of wind energy, governments could consider regulations or economic instruments that improve the cost effectiveness of wind developments in areas where visual, other environmental and social impacts are low. This would significantly reduce the risks and pre-installation costs associated with renewable energy projects and reduce the pressure to develop sensitive sites. MRET is one example of such as strategy. Covering the costs of transmission access, as has previously been done for coal-fired power stations, would be another, as would placing a value on greenhouse gas emissions and incentives for employment creation or other socio-economic policies.

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