



Wind Farms and Landscape Values

DRAFT ISSUES PAPER

Australian Wind Energy Association and
Australian Council of National Trusts

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Foreword

The placement of wind farms in the landscape, particularly in areas of high landscape value, is an issue that needs to be carefully addressed. To this end, the Australian Council of National Trusts (ACNT) and the Australian Wind Energy Association (AusWEA) have embarked on a landmark joint project to develop mutually agreed methodologies for landscape assessment.

This first stage of the Project is being funded by the Commonwealth Government through the Australian Greenhouse Office (AGO) and the Heritage Division in the Department of Environment and Heritage, with in kind contributions from the ACNT and AusWEA. Two further stages of the project are envisaged, depending upon the success of Stage 1; Stage 2 will establish agreed landscape assessment procedures, which will be trailed and tested in Stage 3.

This *Wind Farms and Landscape Values Draft Issues Paper* is a key element in Stage 1 of the Project. The *Draft Issues Paper* has been prepared by Planisphere Urban Strategy Planners, under the direction of the Wind Farms and Landscape Values Steering Committee and following an initial consultation process with a range of relevant stakeholders. The *Draft Issues Paper* aims to elicit further information and encourage discussion about the issues presented and potential solutions to be addressed in Stage 2.

AusWEA and ACNT are seeking your input into this consultative process, particularly with regard to the following questions:

- does the *Draft Issues Paper* sufficiently cover relevant landscape values issues?
- which issues should have the highest priority for further investigation in the next stage of this project?
- what are the landscape values solutions and assessment methodologies which should be considered in the next stage of the Project?

Comments can be made in writing, and should be sent to:

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Please forward your comments before Friday 9th July 2004.

We look forward to your input to this important project.

Yours sincerely,

Simon Molesworth AM QC
Chairman ACNT

Ian Lloyd-Besson
President AusWEA

Table of Contents

Introduction	1
Siting Wind Farms in the Landscape	2
1. What are the characteristics of a wind farm?	2
2. How do wind farms affect landscape values?	3
3. What positive impacts can wind farms have on a landscape?	5
4. What negative impacts can wind farms have on a landscape?	6
5. Are there ways of siting and designing wind farms that might reduce their negative impacts?	8
Methodologies for Assessing Landscape Values	10
6. What should and should not be covered in a landscape assessment?	10
7. How should landscape assessment be undertaken?	11
8. How should significance be measured?	12
Where to From Here?.....	13
9. Should landscape assessments be completed for all areas with wind resources?	13
References	14
Appendices	
Appendix 1 – Status of Wind Energy in Australia	
Appendix 2 – Report on Survey of Issues Associated with the Siting of Wind Farms and Landscape Assessment	
Appendix 3 – Existing Policy and Regulatory Context for Siting Wind Farms	
Appendix 4 – Preliminary Literature Review: Landscape Assessment	
Appendix 5 – Examples of Non-government Policies for the Siting of Wind Farms	

(Appendices are available for download from the project partners' websites: www.auswea.com.au or www.nationaltrust.org.au)

Introduction

While the development of wind power generally has widespread support as a sustainable energy source, the construction and placement of wind energy generating facilities in the landscape (either singularly or as collections of turbines in 'wind farms'¹), has, in some instances, raised community concerns about the appropriateness of their siting and their impact on landscapes.

This *Draft Issues Paper* discusses the issues associated with the siting of wind farms in the landscape and approaches to landscape assessment, and poses a series of questions for further discussion. These questions, and the issues discussed in the Paper, draw on the results of background research and a written survey involving a range of stakeholders, which was conducted in March/April 2004 (see Appendix 2).

Scope of Issues

Landscapes potentially hold a range of natural, aesthetic, historic, social and indigenous values, and while all of these will be considered, this Project may need to draw some boundaries around the scope of its recommendations. For example, there are approaches, which are established or are emerging, for assessing the potential noise², and bird and bat strike³ impacts of wind farm proposals and it would be inappropriate for this Project to attempt to duplicate these processes.



(Source: Hydro Tasmania, 2002)

¹ For the purposes of this *Draft Issues Paper*, a wind farm is defined as "an array of wind turbines located in close proximity to one another using the same substation (transformer) and power line to connect to an electricity grid." (Saddler et. al. 2004:vii).

² See for example Australian Standard AS 1055.1-1997 *Acoustics - Description and measurement of environmental noise - General procedures* (www.standardsaustralia.com.au) and New Zealand Standard NZ6808:1998 *Acoustics—The Assessment and Measurement of Sound from Wind Turbine Generators* (www.standards.co.nz).

³ The Australian Greenhouse Office is currently funding a national project to develop a bird and bat strike protocol for collecting data to input into bird strike models for the assessment of wind farms (www.greenhouse.gov.au).

Siting Wind Farms in the Landscape

1. What are the characteristics of a wind farm?

Wind farms typically include:

- one or more turbines (tower, nacelle⁴ and rotor blades);
- transmission infrastructure including cables that connect turbines with a sub-station, and an off-site transmission line linking the substation to the electricity grid;
- access roads for construction and maintenance; and
- signs, fencing and other infrastructure as required.

The design characteristics which contribute to potential landscape impacts (positive or otherwise) of wind energy facilities are summarised as follows.

Siting and location

Wind energy facilities are designed and sited to take advantage of the available wind resource. On land, highest wind speeds are found in open, elevated and / or coastal environments⁵. They also need to be constructed in reasonable proximity to existing electrical grid infrastructure in order to economically deliver the electricity they generate to consumers. This makes it difficult to locate them in remote or uninhabited areas. Accordingly, the majority of wind energy facilities developed in Australia have been on or near the coast, in open inland areas, or on ridgelines, which tend to be highly visible and / or prominent locations.

Such environments – particularly in the coastal situations – often have high cultural (e.g. recreational), heritage (e.g. indigenous sites), environmental (e.g. migratory bird species) and aesthetic (e.g. dramatic cliffs or landforms) values (see for example Lothian, 2002).

Height of towers / turbines

Existing technologies for wind turbine development allow the construction of turbines that are significantly elevated above ground level, thereby reducing friction with topography, vegetation and built structures. While the technology exists to construct taller turbines, installed wind turbines in Australia typically have a total height of up to 120 metres (AusWEA, 2004a). This is comprised of a hub or tower height of between 50 to 80 metres and rotor blades of up to 40 metres in radius above that. The height of individual turbines makes them potentially visible for long distances, frequently contrasts with the height of surrounding features of landscapes in which they are sited and can make them prominent features on the horizon when viewed with the sea or sky as a backdrop.

Number of towers

Groups of wind turbines provide an opportunity for greater power output, with reduced infrastructure requirements. However, just as individual turbines can become dominant elements by virtue of their height, collections of turbines are potentially impressive and highly visible because of a combination of height, repeating elements and the geographical area they cover. While most existing wind generating facilities in Australia consist of just a few turbines, the current trend is for larger developments. The biggest wind farm in Australia at present is the Woolnorth project in Tasmania, which has 37 turbines and an installed capacity of 65MW, (AusWEA, 2004b).

⁴ The nacelle is the section of a wind turbine that houses electricity generating equipment.

⁵ High wind environments are also found off-shore where the sea provides less friction to the wind than landform. Although wind farms have been developed off-shore in other countries (most notably, in Europe) to take advantage of this, no off-shore wind farms have yet been built or proposed in Australia at the time of writing.

Movement

Wind turbines are different from other forms of development in the landscape because they include large moving parts – the rotor blades – which naturally draw the eye. The cumulative impact of numerous functioning turbines can have a particularly strong visual impression on a landscape. The functioning rotors also produce some noise which, while it is only discernible when close to the turbines, could potentially impact on some people's enjoyment of a place. However, noise levels are controlled by existing Standards, Planning Controls, and EPA requirements and are outside the scope of recommendations of the Project.

Colour / materials

The colour and materials used in wind turbine design are also characteristics which potentially contribute to landscape impacts.

Ancillary infrastructure

Substations, access roads, electricity transmission lines and other infrastructure also contribute to the landscape impacts of wind farms.

2. How do wind farms affect landscape values?

While the physical characteristics and design constraints of a wind energy facility which potentially impact on a landscape can be clearly documented, how a wind farm affects what is valued in a landscape is less easily defined. Table 1 summarises the views of respondents to the stakeholder survey of the effects of different aspects of a wind farm development on the landscape and the positive or negative responses they had to these effects⁶ (see Appendix 2 for details of the results of this survey).

Table 1 Characteristics of wind farms and their effects

Characteristics	Effect	Examples of Responses (feeling/sensation)
Scale of development (height and number of turbines)	Change of rural land use/ 'natural' character	Majestic or dominating, depending on point of view
	Eye catching	
	High visibility, including from long distances	
	Contrast to the horizon	
	Interruption to natural tree line	
	Impact on cultural heritage, including indigenous cultural heritage.	
	Impact on flora and fauna	Loss
Form of structure (e.g. clean/thin lines of turbines and blades)	Eye-catching	Majestic or dominating, depending on point of view
	Change of rural land use/ 'natural' character	
Movement of blades	Sun glint and shadow flicker	Distracting
	Eye-catching	Relaxing or irritating
	Noise	
	Impact on birds	
Colour of towers and blades	Contrast to the surrounding area	Intrusive, or non-intrusive
Location of substations	Change of rural land use/ 'natural' character	Dominating
	Reduction in visual appeal of area	Change or loss
Siting in landscape (e.g. on high land)	Change of rural land use/'natural' character	Majestic or dominating, depending on point of view
Layout (ordered or natural)	Change of rural land use/'natural' character	Majestic or dominating, depending on point of view.
	Reduction in visual appeal of area	Change or loss

In debates about the impact of wind farms on landscape values, there is a tendency for polarisation of views, among those who hold firm opinions. Indeed, many of the effects above can be construed either positively or negatively, depending on the perspective of the

⁶ This stakeholder survey was a small sampling with 30 respondents and 27 additional unsolicited responses from people who had predominantly been involved in wind farm proposals as objectors.

viewer. However, this polarisation is not necessarily an accurate reflection of the views of the wider community. A large majority of people may not have very strong views either way. In studies of residents living close (up to 20km) to a wind farm undertaken in Britain, a large majority (74%) thought that the wind farm was either neutral in its impacts on the landscape (51%), or they had no opinion either way (23%) (Braunholtz, 2003), although the closer they lived to a wind farm the more likely they were to have strong opinions.

The stakeholder survey has only canvassed the views of stakeholders sufficiently interested to respond, and as such the view of the majority might have been missed. Nonetheless, the views of people who hold strong views are useful in helping to illuminate the issues addressed in this *Draft Issues Paper*.

In order to obtain some less 'interested' views, four people either living or working in close proximity to a wind farm were randomly selected for an interview on 20 May 2004 - one from Albany (WA), one from Crookwell (NSW) and two from King Island (TAS). Two of the four people who were interviewed were largely indifferent to the wind farms in their area, and in response to the questions about what they liked and disliked about these wind farms, said there was "nothing I really like or dislike" (Crookwell interviewee) and "I haven't thought about them." (King Island, interviewee). The other two interviewees were more supportive, than indifferent. The Albany interviewee said that they did not worry him, and that they were "very interesting and a great thing in Albany", while the second King Island interviewee said that "you never hear of someone complaining" (about the wind farms) and that people "grow to accept them." He suggested that wind farms would become like lighthouses which are now an accepted part of the landscape.

These interviews provide some indication of views not obtained in the stakeholder survey. While they indicate some alternative views, a range of factors such as the length of time the interviewee has lived in a place and the age, style and size of the wind farm potentially affect views, and they are not necessarily representative. To obtain representative views of 'disinterested' parties, requires extensive, rigorous and quantitative perceptions studies, which were beyond the scope of this study. However, substantial work on the impacts of landscape change on people's values has been undertaken in Australia and overseas. According to Green (2000b:84):

past research on public visual preferences has repeatedly identified a natural versus built dimension of landscape preference in which the more natural a scene is the more scenically attractive it will be evaluated and the more culturally modified, the less attractive it will be judged.

Green's work on landscape change around coastal towns in Australia has consistently shown a preference for natural landscapes followed by low scale developments or uses which reflect the coastal or rural character of an area.

While studies undertaken for the Australian Wind Energy Association have indicated that up to 91% of people are in favour of development of wind energy in Australia (Australian Research Group, 2003), no landscape-specific perceptions studies are known for wind farms in Australia. Thayer and Hansen (1989) also recognise that there is both a widespread acceptance for wind energy as a source of electricity, and a high rate of 'not in my backyard' syndrome, related primarily to landscape intrusion, citing developments in California and The Netherlands.

However, it should be noted that much of the perceptions work referred to by Green and conducted by Thayer and Hansen was undertaken before the development of modern wind farms of the style being proposed today. Studies in the United Kingdom of modern wind farms have shown that the majority of residents living near a completed wind farm development are in favour of the wind farm, and that the actual visual intrusion on the landscape was less than that originally anticipated (Collett, 1995, Braunholtz, 2003). In Australia, a survey of Victorian residents found that a majority of people describe wind farms they have seen with positive descriptions such as 'interesting' (93%), 'graceful' (73.8%) or 'attractive' (55.9%), while 33.8% described them as 'industrial' and 5.0% as 'ugly' (Auspoll, 2001)⁷. There is also anecdotal evidence that some constructed wind farms in Australia –

⁷ Study undertaken for AusWEA.

notably Codrington and Challicum Hills in Victoria – have been favourably received. Although this is not always the case, in the stakeholder survey, both Codrington and Challicum Hills were cited by survey respondents as positive or appropriately located wind farm developments.

3. What positive impacts can wind farms have on a landscape?

While the development of a wind energy facility has substantial, and to a large extent unavoidable, impacts on a landscape, elements of the design, scale and function of wind farms contribute to some perceived positive landscape benefits. These are summarised as follows:

Aesthetic

To many people the form, line and colour of wind turbines are aesthetically pleasing. The clean lines and form of wind turbines, their contrast with landscapes and the unity of their appearance are cited as positive benefits, which in some cases may even improve the appearance of a degraded landscape (Smith, 2002). The aesthetic landscape values of wind farms are recognised as being associated with (among others)⁸:

- sleek aerodynamic / sculptural design lines and shapes;
- starkness and modernity of design;
- consistency and repetition of features;
- a sense of order and legibility; and
- a strong presence.

The stakeholder survey question asking respondents to indicate what they liked about a wind farm they had seen elicited the following remarks:

... a majestic, yet serene, presence on the landscape as the blades rotated slowly in the wind.
Wind farm developer.

The tall graceful, elegantly designed form of the towers and turbines are attractive.
Professional consultant in landscape or heritage planning or wind energy.

Indeed a number of respondents who objected to the landscape impact of a particular wind farm recognised that the structures themselves exhibited some aesthetic value.

Symbolic

The balanced landscape which we need at this point in our evolution, is one in which the excitement and possibilities of the new machines may in certain areas be seen contrasted against the peaceful background of a landscape matured in the age-tested harmony of nature.⁹

Encapsulated in Dame Sylvia Crowe's quote above, the wind farm is a strong and recognisable symbol of new technologies, and sustainable renewable electricity production. Some people will welcome the 'machine element' of a wind farm in the landscape, and see it as a positive example of humans working in harmony with nature. This was expressed through responses to the stakeholder survey.

Function

Advancing on the symbolic values, to many respondents to the stakeholder survey, the positive value of wind energy developments is derived from their function as providing a public good (electricity), via renewable means.

⁸ Adapted from Inspiring Place, 2002; Gipe, P. 2002; Stanton, C. 1996; and Birke-Neilsen (1996).

⁹ Crowe, S. (Dame) (1958). Cited in Inspiring Place Pty Ltd. 2002a

One respondent noted that while they objected to the visual intrusion of a wind farm, they valued the “thought of its potential as a renewable energy source as compared to a continued reliance on polluting, finite fossil fuels” (*surfer / coastal community stakeholder*).

Substitution

A fourth landscape benefit of wind farms is the trade-off with alternative developments, producing the same product, by different means (often in different locations). The starkest example of this is a coal-fired power plant, although many hundreds of turbines are required to replace the power output of one such coal-fired facility. An employee of an environmental non-government organisation suggested that they liked the wind farm that they had seen because of:

the enhanced rural landscape, both aesthetically and through the good feeling of seeing sustainable energy displacing fossil fuel energy.

It should be noted that while a wind farm will often feature prominently in the landscape, the impacts of greenhouse gas emissions that wind power helps to reduce are predominantly out of the public eye. Additionally, the landscape impacts of large scale coal-fired power stations (which currently produce around 84% of Australia’s electricity) are also pretty much “out-of-sight and out-of-mind”.

4. What negative impacts can wind farms have on a landscape?

Impacts on landscape character and scenery

Both wind turbines themselves and their ancillary infrastructure (electricity transmission lines, substations, access roads, for example) can impact on the landscape character and scenery of a place. Given the scale and size of wind turbines and wind farms, and their contrast with the landscapes in which they are developed, it’s not surprising that their effects on scenic and character elements are perhaps the most contested of all values¹⁰.

The size and physical presence of wind farm turbines is uncontested. Whilst to some, the presence “speaks of inspiration and aspiration”¹¹ to others the visual dominance unacceptably changes the character of the place, with several survey respondents claiming wind farms contribute to an “industrialisation” of rural or natural landscapes. A more balanced response was obtained from a visual management expert who responded to the survey, to whom the towers were both “tall, graceful, elegantly designed”, but a “very large scale ... intrusive on the landscape”.

Individually, wind turbines exceed ‘human scale’ and can be an overpowering and unacceptable presence to the viewer (Stanton, 1996; Inspiring Place, 2002a). Survey respondents claim wind turbines have a heightened impact on character and scenic values where they are located (either individually or collectively) and on features of high scenic or aesthetic value to communities (see also Smith, 2003).

It is as collections of turbines in wind farms that wind energy facilities have the greatest potential impact on character and scenery. Although not quantitatively measured in this survey, greater numbers of turbines, covering a larger land area, or occurring in important view fields, appear more likely to be viewed as unacceptably detracting from the landscape character or scenic values. According to overseas studies – based on the now superseded technology requiring large clusters of earlier types of smaller turbines - the number of turbines has been found to have a greater effect on landscape character than the size of turbines (van de Wardt and Staats, 1988).

Further, the scale of wind turbines and their contrast to landscapes, means that impacts on scenic and character values extend well beyond the wind farm site. Although the threshold

¹⁰ Potentially, some of the impacts on values described as ‘character’ may reflect some of the more intangible values identified for landscape including sense of place, personal association and contemporary indigenous values.

¹¹ Inspiring Place P/L. 2002 *op cit.* at p.70)

distance for visual intrusion is debated¹², potential scenic and character impacts of wind farms extend to far greater distances than most other types of development in a landscape (Schwann, 2002). Concern exists therefore, over potential visual intrusion on areas where appreciation or sense of place value depend upon a natural landscape setting (for example national parks).

Impacts on indigenous cultural values

A site with a proposed wind farm may be of cultural significance to Aboriginal people because of its association with Aboriginal tradition, or with the current practices of local indigenous people or the traditional owners or custodians of that site. The existence of particular species on a site, for example, may be important because of its role in Aboriginal spirituality. Alternatively, a site may be of significance because it was the location of an important historical event, e.g. a massacre site. To one respondent:

More natural aspects other than built generally hold more appeal. Aboriginal people here describe this "as a connection to place".
Employee/representative of an indigenous and representative of the traditional owners

This respondent further explained:

We feel that this connection is much stronger than currently accepted or understood and binds people to their custodial estates. Landscapes can be described by indigenous people as a cultural map, locations are described in terms of clans, special places and resources similar to descriptions of Aboriginal art.

A traditional owner who participated in the survey said that based on her experience, the main concerns of Aboriginal people in relation to wind farms located on the coast were that wind farms block sacred coastal views, cause disruption to coastal fauna, in particular migratory birds, and result in damage to sites with other indigenous heritage values.

Nonetheless, the presence of indigenous values at a site will not necessarily preclude the development of that site for a wind farm, as evidenced by the current partnership between Framlingham Aboriginal Trust and Pacific Hydro to develop a wind farm on Aboriginal owned land (Deen Marr) at Yambuk in Victoria.

Impacts on amenity

Amenity in this instance is separated from scenic / character impacts, although the two are related. Amenity deals with the continuing enjoyment of places (including residences, recreational areas and travel routes, among others). Apart from being dominant visual elements, the movement of wind turbines can also produce other visual phenomena including:

- sun-glint and strobing effects caused by sun reflecting from the blades;
- overshadowing; and
- shadow flicker,

that may impact on amenity . These effects tend to be experienced by those in close proximity to a wind farm, although sun glint may be visible from several kilometers away.

Impacts on cultural heritage

None of the responses to the stakeholder survey referred to adverse impacts on built heritage items. This is probably because built heritage items are reasonably well

¹² The Portland Wind Energy Project Panel Report (Smith, 2003) cites Parks Victoria claiming that wind generators are "easily seen in clear weather" (at page 69) up to 20 kilometres away, and landscape professional Alan Wyatt suggesting beyond 5 kilometres the "visual impact reduces to imperceptible" (at page 69). According to Inspiring Place (2002a) a single wind turbine of total height 120m becomes insignificant in the vertical field of view at 13.75 km (a collection of turbines, however, may be significant beyond this depending on the proportion of the horizontal viewed area they occupy).

documented and protected in Australia, and as a consequence wind farms have been sited away from existing built heritage features.

However, there is an emerging recognition in the heritage profession that the geographical and landscape context of sites are also worthy of protection. The Burra Charter (Australia ICOMOS, 1998) refers to the need to protect the “fabric and setting” of heritage places. Through their visual and landscape change, and potential dominance, wind farms may create significant changes to the setting of heritage features, and thus impact on the protection of their values. In one landscape assessment study in Tasmania, for example, it was recommended that a wind farm be sited away from the sight line of an historic coastal settlement (Inspiring Place, 2002b).

Furthermore, landscapes themselves may be identified as significant heritage items, by virtue of their association with the history or development of people and cultures, a value which is increasingly recognised through formal documentation (e.g. the National Trust Register of Significant Landscapes). These may also be impacted through inappropriate design or siting of wind energy facilities.

Impacts on contemporary cultural values and sense of place

Some of the people surveyed (see appendix 2) described an emotional and sometimes spiritual connection with those places where wind farms have been developed. Sometimes, these connections appear to be shared by the community generally, or by particular groups. In Australia, the coast is one such place as is evidenced by the references to the coast in our poetry, art, theatre, music and television productions.

In some situations, respondents described how it seemed to them that those connections had been adversely affected by the introduction of wind farms into those places. One survey respondent noted, for example, that the introduction of the wind farm or ‘machine element’ into a place that she valued, had changed her feelings about that place as a site of reflection and contemplation. It is difficult to gain an accurate understanding of the extent and magnitude of these effects, but having said this, a sense of loss pervaded a number of those responses from respondents with a predominantly negative viewpoint about the development of wind farms.

5. Are there ways of siting and designing wind farms that might reduce their negative impacts?

For some values, for example a particular location of high biological significance, avoidance may be the only acceptable way to protect a value. For other values, impacts are more difficult to avoid. For example from a scenery / character perspective, it is virtually impossible to hide or screen wind farm (Birke-Neilsen, 1996). Given the height of the development, vegetative screening is only of use when located to screen views *from* a viewpoint, rather than to a tower (Smith, 2003). Similarly, typical treatments for minimising the visibility of development on the landscape such as integrating the development with topography or borrowing line, form, colour and texture from the surrounding landscape, are impossible or very difficult to achieve in the case of wind farm turbines, and indeed may be undesirable (Stanton, 1996). Instead, careful layout which avoids particularly sensitive features, and enhances a wind farms positive attributes is a more effective tool. Wulff (2003) notes that of the three potential siting options for wind turbines – to disguise or hide; to merge or integrate; or to highlight – “highlighting of towers is intrinsically the easiest visual result to achieve”.

With this in mind there are a range of design, siting and management options which reduce intrusive impacts of wind farms, and improve their appearance, and therefore their acceptability (Gipe, 2002). Some of these are summarised below:

Siting and layout

A number of layout regimes can potentially reduce landscape impacts. For example, survey respondents suggested that clustering turbines to avoid significant view lines or landscape features, would reduce their visual and landscape impacts. However such clustering may

also reduce the generating efficiency of the wind farm and present challenges to the management of other potential impacts. Gipe (2002) further suggests that siting turbines in a manner which corresponds with existing landscape features, (for example by reflecting the line of ridgelines in hilly topography or in a grid formation in flat areas) contributes to the 'legibility' of a wind farm and thus has a more positive and acceptable impact.

According to Stanton (1996), siting wind turbines away from ridges does not reduce their impact on the landscape, but compromises the relationship between the landscape and the function of wind turbines: "it is about honestly portraying a form in direct relation to its function and our culture".

Height

The overpowering presence felt by some respondents to the survey was undoubtedly a response to height. However, as another respondent pointed out:

Whether a wind turbine is 120 or 150 metres high is largely indiscernible to most viewers.
Wind farm developer / visuals expert

Nonetheless, many people felt that reducing the height of turbines would reduce their negative impact. According to the recommendations of one landscape impact assessment, turbines should not exceed the relative visual height of landscape features in the region (Inspiring Place, 2002a).

The height of wind turbines is a design constraint – the higher the rotor and the longer the diameter of the rotor blade, the greater the amount of electricity produced. Hence, a reduction in rotor height or diameter may lead to an increase in the number of turbines proposed, which may in turn generate other unwanted effects including visual clutter and an increase in the amount of land required for the development, as discussed below).

Spacing and density

Locating numerous turbines in an open landscape can result in negative impacts for some viewers. Indeed the number of turbines in an array can be more detrimental than the height of the turbines themselves (van de Wardt and Staats, 1998)). According to Thayer and Freedman (1987), in a study undertaken in the USA, people are more likely to prefer fewer larger turbines than more smaller ones.

Further, impacts caused by groups of turbines can be lessened by avoiding dense spacing which creates visual clutter, and clustering turbines into 'functional units', with substantial open space between them (Gipe, 2002). This can also be a useful technique for mitigating impact on particular views or features.

Enhance their positive attributes

The relative acceptability of wind farms has been found to be a function of how 'well presented' they appear to viewers (Gipe, 2002). Enhancing positive attributes including their aesthetic form (using clean lines and modern materials), consistency of design (turbines of the same colour, design and height) and function (all turbines moving, thus appearing to be functional) have been cited as important in ensuring wind farms are received more positively (Gipe, 2002; Stanton, 1996).

One respondent to the stakeholder survey noted that they would have preferred to see information boards for tourists to engage and inform viewers about wind farms, and that this would reduce negative perceptions about impacts on the landscape (*Employee of environmental non-government organisation*).

Hiding or managing negative attributes

Despite the difficulty of screening turbines, it is possible to hide or mitigate potentially negative attributes of a wind energy facility including powerlines (e.g. undergrounding intra-farm powerlines, to avoid visual conflict with the turbines), roads (appropriately siting to avoid sensitive areas and potential for unsightly erosion), and clutter (cleaning up the site and removing waste) (Gipe, 2002; Stanton, 1996)

Colour / materials

It has been suggested that careful selection of colour and materials can reduce contrast and visual impact of wind turbines on the landscape (see for example Cleary, 2003). Colours which are muted (soft grey, tan, cream) and materials which have a matte finish can reduce distant visibility and contrast. However, borrowing colour from the surrounding landscape can also increase contrast, where the sky is the backdrop. Because of the scale of wind turbines, most views of the tops of the towers and the rotors are against the backdrop of the sky, and as such lighter colours are frequently recommended. Stanton (1996) argues that, in British conditions, using muted colours or off-whites should be avoided because this appears as an attempt to camouflage, and recommends white towers be used to make “a clear, forthright statement”.

Methodologies for Assessing Landscape Values

6. What should and should not be covered in a landscape assessment?

A landscape assessment is a tool used to identify, and determine, the value, character and significance of a landscape, and the extent to which a development is likely to impact on this character or significance. In the case of wind energy developments, landscape assessment is an important means to document values of a development site and its surrounds, and ensure that wind farm developments are responsive to potential impacts on these values. Ideas as to the scope of potential values of a landscape vary: some authors use ‘landscape value’ to mean only the visual character or aesthetic values of a place, while others use the term ‘landscape values’ to include a range of values including social, indigenous, cultural, artistic and environmental values.

However, there is an established recognition nationally, and internationally, of the artificiality of separating cultural and natural values, and an increasing appreciation of the need for a holistic assessment of landscape values. This perspective is reflected in the approach taken to scoping the values of World Heritage places, and is evidenced in the new national heritage system, where ‘heritage’ is defined as part of the environment. Places, including landscapes, which are placed on the new National Heritage List may be listed for their natural, indigenous, and/or cultural (as in historic, aesthetic, spiritual etc) values (see Lennon, 2004).

‘Heritage’ then is increasingly seen to encompass intangible as well as tangible values. This is reflected in the definitions of heritage being adopted by State/Territory governments as they revise their heritage legislation.

As shown by the discussion above, and the input of stakeholders to this project, the scope of landscape values which wind energy facilities could potentially affect is broad. Issues and impacts identified through literature review and stakeholder involvement include such diverse values as environmental, (e.g. the impact on birds and bats), aesthetic (e.g. the contrast of wind farms with the landscape), social (e.g. a familial connection to the landscape), emotional (e.g. a feeling of wonder or loss) and cultural (e.g. impact on features of historic or archaeological importance).

Landscape assessment therefore requires an interdisciplinary approach, and a number of methodologies have been developed which are designed to capture all values. However, no methodology has yet been universally accepted. Existing processes are set out for environmental assessment / planning approvals in different states, and nationally (see Appendix 3). Moreover, some values (for example environmental and historic heritage) have well defined, accepted guidelines for assessing the level of significance of the value, the potential impact of a development on it, and the acceptability of the impact, while others (aesthetic, cultural) do not. Methodologies which are less well defined, or are emerging, include:

- visual, aesthetic and scenic value of landscapes;

- landscape character and significance;
- contemporary cultural values (as opposed to heritage values), for example the value of landscape condition to contemporary indigenous people or personal, emotive attachment to place.

7. How should landscape assessment be undertaken?

The pioneering work in landscape evaluation in Australia largely occurred through the early work of the National Trust, particularly in Victoria and NSW and the development of visual resource management systems (VMS) for forestry activities (e.g. Leonard and Hammond, 1984; Forestry Commission, 1990). The latter uses approaches derived from traditions of formal aesthetics assessment and landscape architecture and typically include:

- a classification and description of the landscape into character types;
- an objective assessment of the relative aesthetic value of landscape (expressed as high, moderate or low 'scenic quality' with higher scenic quality usually associated with variety, uniqueness, prominence and naturalness of the landform, vegetation and water form within each character type);
- determination of the ability of the landscape to absorb different types of development based on physical and environmental characteristics; and
- an assessment of 'viewer sensitivity', based on the relative sensitivity to change of different viewer groups (e.g. tourists as opposed to forestry workers) and how many view, and from how far.

These techniques are specifically concerned with rating the scenic or visual aesthetic value of a landscape. Nonetheless, adaptations of this standard approach have been commonly applied in landscape assessments of wind farms to in Australia date (for example: Inspiring Place 2002a, 2002b; ERM, 2002; Haack, 2002; Cleary, 2003, among others), with some adaptations including:

- computer modelling of visibility of the wind farm to surrounds (and from key viewpoints) based on topography; and
- visual modelling of the wind farms and production of 'photographic montages' visually depicting the potential landscape change.

While the visual assessment traditions which underpin traditional VMS approaches make them justifiable, repeatable approaches they been criticised for, among other things:

- lacking a community input into defining value and scenic quality;
- giving greater weighting to natural features than cultural (being developed largely for use in natural areas);
- poorly defined 'viewer groups' and lack of rigorous quantitative analysis of perceptions of different viewers; and
- failing to recognise the less tangible and 'emotive' values of landscapes.

The landmark Australian Heritage Commission Landscape Assessment Studies for Regional Forest Agreements carried out in the early 1990s, used intensive community consultation to assess less tangible values – social, spiritual and aesthetic connections to place.

This issue of community involvement is a central tension in methodologies. According to Shuttleworth (1980):

There is a fundamental, theoretical, divergence of opinion over the question of whether landscapes have an intrinsic or objective beauty which may in some way be measurable or

comparable, or whether scenic beauty is a value that can only be subjectively attributed to an area or specific landscape¹³

Assessments which are based on a professional judgement of landscape value (e.g. 'scenic quality') are sometimes criticised as not being sufficiently representative of the perspectives of non-professional interest groups. In view of this, communities are increasingly voicing their expectation that they should be consulted as to what is of significance to them, and these expectations are increasingly being met by regulatory authorities.

Many of the values identified as of importance through the stakeholder survey are not easy to measure or quantify. For example, it is easier to quantify the effects of a wind farm development on tangible values - native vegetation (if any), but far more difficult to quantify the effects on intangible values - an individual's feelings about a place. Schwann, 2002 suggests that less quantifiable values, while presenting a challenge to planning and assessment, are still important to record and document. Clearly, effective community involvement enabling the views of the broad community to be considered and not just the most vocal is essential to this process.

Nonetheless, for a landscape assessment to be a useful tool to guide the planning and development of wind farms, there needs to be a balance between subjective input, and professionally developed frameworks with which to understand and document this input.

An approach trialed in a South East Queensland study (although not specifically related to wind farm development) integrated computer-generated visibility data with detailed analysis of community preferences of landscape types and features to come up with a 'scenic amenity' rating of the landscape (Davison and Preston, 2001). Similar rigorous perceptions studies have been undertaken along Victoria's Great Ocean Road and in coastal towns in New South Wales and Queensland (Green, 2003). Such approaches have some potential value to rating viewer sensitivity and preferences for wind farm developments, although none has been completed to date with wind farms in mind (Smith, 2003).

Using similar methodologies to Green, Andrew Lothian (2002) has undertaken statistically relevant public perceptions studies (over 300 people) in South Australia, and found that people's landscape preference are similar across ages, genders and cultures. However, he suggests that while this work has the potential to feed into landscape assessment work nationally, it is important for similar studies of what people value in a landscape to be completed across Australia.

8. How should significance be measured?

From a planning perspective, a key output of landscape assessment is a rating of the relative value of landscapes, such that decisions can be made about the acceptability of otherwise of landscape impacts. The independent Panel Report on community comment to the Portland Wind Energy Project in Victoria, for example, recommended that future landscape assessments of wind energy facilities should rate landscapes "in international, national, state, regional and local significance terms" and identify the features which contribute to their significance in each case.

Nonetheless, there is substantial contention about whether and how the relative significance of landscapes should be measured. In the words of one respondent to the stakeholder survey:

All land is important. Values differ from landscape to landscape.

Traditional owner of an area in which a wind farm has been installed or is proposed

The diversity of values which potentially come under 'landscape value' creates further difficulties in defining what is significant in a landscape. Answers to the stakeholder survey question "what makes one landscape more special than another" ranged from the measurable (e.g. the diversity of topographic variation, or the presence / absence of water)

¹³ Reference in Macaulay Institute (2004).

to the intangible (e.g. the degree of personal meaning and association with a place), and the 'in between', (the level of naturalness, or wilderness qualities of a landscape).

As outlined above, there are various existing techniques for rating the relative importance of a landscape and the features within it. Whether value should be rated objectively or subjectively is a key area of tension among the different approaches.

Few of the existing approaches comprehensively address all potentially significant values. Some examples of criteria for significance used to contribute to a hierarchical rating system in existing studies include:

- Scenic quality (either professionally determined, or through community perceptions studies, or both);
- Scarcity (the relative uniqueness of a landscape type or feature)
- Visitation / recognition (the level to which people are drawn to a landscape, and broadly the catchment from which they are drawn)
- Visibility (the number of people who view a landscape, and from where they view it);
- Occurrence in the arts (including the documentation of landscapes in visual or written artwork, the level of recognition of the artwork, and length of association of an artist with a place).

Other criteria are also likely to be relevant. In addition, the issue of boundaries for landscape assessment as discussed above, is also relevant here. Nonetheless, development of standard criteria seems essential to the replicable assessment of landscape values for wind farm siting across states and regions.

Where to From Here?

9. Should landscape assessments be completed for all areas with wind resources?

Landscape assessment on a regional basis is increasingly recognised as essential to understanding the relative values of landscapes. The significance of landscape features depends to a large extent on an understanding of the relative significance or importance of a landscape or a landscape type. Just as the scarcity or otherwise of vegetation communities is available on regional, statewide and national bases, strategic assessment of landscapes have the potential to provide a measure of significance for landscapes.

At present, the landscape impacts of wind farms are assessed on a case-by-case basis, driven by development applications. While this is essential for detailing the specific impacts of the development, it can not rate the importance of this impact, in absence of a regional context of the relative significance of landscapes. Furthermore, a failure to identify which landscapes are particularly special or significant can create unnecessary conflict and uncertainty in the development of wind farms.

Given that certain landscape impacts are unavoidable when wind farms are developed, and that there are state, national and international objectives driving wind power as a renewable energy source, planning processes must consider the need to balance high level policy directions for wind farms with the desire to protect valued landscapes.

At present, some state governments have identified certain areas (e.g. national parks) as unsuitable for wind farm developments. Landscape assessments may be unnecessary or redundant in such areas.

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