



Wind Farms and Landscape Values Foundation Report

For public comment until 5 April 2007

DRAFT 5 March 2007

DRAFT Released as a preliminary draft for public comment by the Australian Wind Energy Association and the Australian Council of National Trusts.

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Overview of the Project

The Brief

The Wind Farms and Landscape Values – National Assessment Methodology project is joint project between the Australian Council of National Trusts (ACNT) and Australian Wind Energy Association (Auswind), funded by the Department of the Environment and Heritage under the Low Emission Technology and Abatement Program, to develop a methodology for assessing landscape values of potential wind farm sites and related tasks.

This project builds on a project undertaken in 2004/05 jointly undertaken by the ACNT and Auswind called *Wind Farms and Landscape Values Stage 1 Report, Identifying Issues*, March 2005. That report concluded:

There is growing unity of the need for consistent, transparent and comprehensive consideration of the special values of the landscapes in which wind farms might be sited, and there is a desire for consistent and adequate community involvement in this.

It also outlined a business plan for a stage 2 project (this project). A copy of the final report from that project can be located on the ACNT website:

www.nationaltrust.org.au

Objectives

The objective of this project is to provide a sound and transparent, nationally applicable framework for:

- Identifying and assessing landscape values;
- assessing the potential impacts of wind farms on landscape values;
- site impact assessment and mitigation; and
- community consultation procedures.

It will be based on, and consistent with, internationally recognised heritage principles as represented in the Burra Charter, which was developed by Australia ICOMOS to guide Australian heritage identification and conservation practice.

Auswind and ACNT

The outcomes of the project will be incorporated into the Auswind Best Practice Guidelines. The Auswind Accreditation Scheme, currently under development and to be based on ISO 14001 principles, will independently audit compliance with the Best Practice Guidelines.

The ACNT will consider adoption of the project outcomes as ACNT policy on the siting of wind farms.

The project's funders – the Commonwealth Department of Environment and Heritage – wish to support alternative energy initiatives provided they are founded on proper processes of community consultation.

Key Outputs of the Study (from the Brief)

The key outputs and requirements expected of the study are:

- A review of landscape values assessment methodologies, in particular related to wind power developments, and analysis of the merits of different methods and potential application within an Australian context.
- A draft National Landscape Assessment Methodology.
- A wide-ranging regional and metropolitan consultation program to engage with stakeholders including state government agencies, the existing stakeholder database, experts, industry and the community groups to seek feedback relating to the appropriateness of the draft methodologies.
- A final draft set of national assessment methodologies.

Study Products Framework

The study has set out to answer a number of questions on the following topics:

1. Understanding landscape values
2. Modelling the impact of wind farms on landscape values
3. Assessing the impact of the wind farms on landscape values
4. Managing the impact of wind farms on landscape values

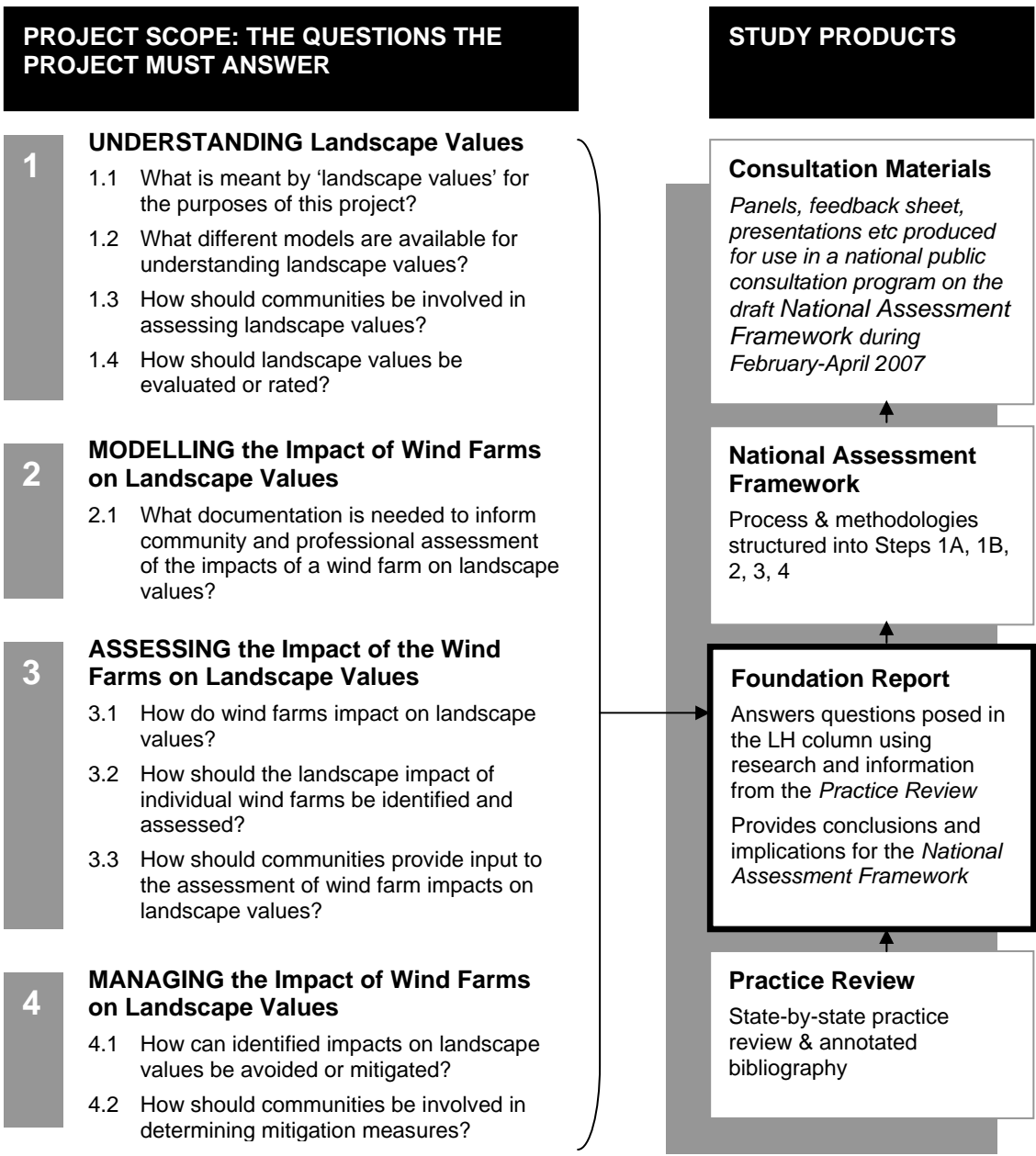
These questions are shown in the left hand column of the Study Products Framework diagram on the next page. The main products of the study (also shown in the diagram) will ultimately be:

National Assessment Framework (this document)
Foundation Report
Practice Review

The Foundation Report will be available on the Auswind website for public comment from 5 March to 5 April 2007. The Practice Review is expected to be finalised and released along with the final version of the National Assessment Framework.

Study Products Framework

THE BRIEF: develop a sound & transparent nationally applicable framework



Not included in this project:

Assessment of actual landscapes or development proposals

Development of assessment or consultation frameworks for aspects of wind farm siting other than impacts on landscape values (eg biodiversity, noise)

Introduction to the Foundation Report

This report contains a discussion of findings and conclusions arising from the review of current approaches in landscape assessment in Australia and overseas ([Practice Review](#)).

This report forms part of the **review current national and international approaches to landscape value assessment** required by the brief. It draws conclusions about the potential applicability of landscape assessment methodologies in the Australian context, drawn from a review of relevant landscape, heritage and environmental literature and an analysis of the scope and potential applicability of methodologies to the project objectives.

The 2005 Stage 1 Report

The discussion in this document builds upon the work of the Stage 1 project completed by the Australian Wind Energy Association and the Australian Council of National Trusts in 2005. The Stage 1 Report (Planisphere, 2005) provides an invaluable resource from which to approach a review of studies and the development of best-practice methodologies in this project.

Focus of this study

The Stage 1 Report found that a desire to protect landscapes from inappropriate change has led to the development of various techniques for documenting and reducing impacts on landscape values in the last three decades. But none of these methodologies has been universally accepted. Although methods of identifying the significance of some landscape elements (such as rare flora and historic buildings) and assessing impacts on some identified values have been adopted at local, state and national levels, there is no agreed framework for assessing less tangible landscape elements such as visual, aesthetic and cultural values.

Many methodologies associated with landscape values are well established. The focus of this project is on the contested area particularly associated with aesthetic / visual / scenic values.

Approach

The review of current practice focussed on the following sources:

1. Regulatory framework for wind farm impact assessment. We examined various government guidelines and protocols, in particular, guidelines for environmental assessment or development approvals processes, and where they exist, guidelines for development of wind farms. Some site-specific 'scoping documents' were also reviewed. The key question for this set of documents was 'what do governments require of wind farm proponents in order to understand and document landscape values and potential impacts upon them'.

Review was undertaken by jurisdictions, including each state in Australia, as well as at the Commonwealth level in Australia, and internationally. Government guidelines were not available in each jurisdiction reviewed.

2. Current practice in impact assessment for wind farms. Recent environmental assessment documents prepared by or on behalf of proponents (including the specialist landscape or visual assessment components of these, where available), were reviewed, as well as independent reviews of impact assessments by environment or planning boards and panels. The aim was to identify where and how landscape values and impacts are assessed.

At least two examples were sought from each state where wind farms have been subject to extensive environmental assessment or approvals processes (i.e. Tasmania, Victoria, South Australia, New South Wales and Western Australia), as well as internationally. No examples of Commonwealth (*Environmental Protection and Biodiversity Conservation*

Act 1999) assessments relevant to landscape values (as defined by this study) were identified.

A particular body of knowledge exists in Victoria where independent panel reports considering public comment on wind farm proposals have researched and established key issues in landscape assessment of wind farms, and particular emphasis was placed on examining the conclusions derived from that work.

3. Current practice in understanding landscape values. We also examined studies and reports with a more 'strategic' focus to establishing the values of landscapes. That is, studies not related to development approvals or impact assessment processes. This included a review of heritage assessments of landscapes; and other broader landscape values studies, such as landscape character, visual values inventories and public preference modelling.

The identification of these examples was more opportunistic than structured. In the main, landscape values examples were those known to the authors of this report, or in a few cases, recommended by the Steering Committee members or other stakeholders. While we have endeavoured to include many different types of assessments by different authors, there are bound to be others which we have missed or of which we are unaware.

Structure of this report

The discussion is set out in the following sections:

1. Understanding landscape values of a wind farm site and surrounds
2. Depiction / modelling of the impact of the wind farm on the landscape
3. Understanding the impact of wind farms on landscape values
4. Siting / design and mitigation options

Within each section, a series of **questions** are posed to direct the review and evaluation of material relevant to understanding the topic of that section. Each question contains is answered in the following parts:

- an **outline of the issue**;
- a discussion of **current practice** relevant to that issue, including:
 - key topic areas as sub-headings; and
 - implications for the national assessment framework;
- **conclusions** relevant to defining the scope and content of the National Assessment Framework; and

It is expected that further discussion with the Steering Committee, the Expert Advisory Panel and at national consultation in February-March 2007 will help to resolve the uncertainty in these cases.

Definitions

| Term | Definition | Notes |
|---------------------------------|--|---|
| Community | A group with shared culture, beliefs, traditions, ethnicity, activity, experiences or locality. | <i>Where necessary, the term 'local community' is used to specifically refer to people who inhabit (live or work) in a locality (that is the community of a town or rural area) and similarly regional community, state-wide community, Australian community.</i> |
| Community stakeholders | Individuals or communities who have been identified as potentially holding values about the wind farm site and surrounding area. This will include local and non-local communities (as well as future generations for whom the landscape is held in trust). | |
| Community-held landscape values | The values attributed to a landscape by a community or community sector. Community-held landscape values arise from people's responses to a landscape, including those connected to people's associations, memories, knowledge or experiences of that landscape. These | |

| | |
|-----------------------|---|
| | values may vary between different communities and within a community. Community-held landscape values represent the aggregate community perceptions of the value and significance of a landscape. |
| Indigenous community | Indigenous people holding traditional, historical or contemporary associations with a locality or landscape. An Indigenous community may include formal Indigenous organisations, family groups and individuals. |
| Landscape impact | A change to landscape values caused by development. Impacts can be either positive or negative. |
| Landscape values | Landscape values include any values of a landscape including those which have significance to a community or cultural group (e.g. for social, political, religious and spiritual) and those intrinsic to the landscape. |
| Proponent | The entity proposing development of a wind farm, with the intent of submitting a formal application for regulatory approval. |
| Study area | The combination of the <i>wind farm site</i> and <i>surrounding landscape</i> . |
| Surrounding landscape | Those areas outside the <i>wind farm site</i> that have been identified as relevant for investigation of landscape values or potential impacts. |
| Wind farm site | Those areas of land or property containing the known, likely or potential development footprint of the wind farm. |
| Viewshed | A viewshed is a region visible to an observer, defined by the extent of potential or theoretical visibility (influenced by for example topographic and atmospheric effects). |
| Wind energy industry | <i>to be completed</i> |
| Wind farm | An array of wind turbines located together for electricity generation. It includes all associated and ancillary infrastructure such as roads, sub-stations and transmission lines. |

Where an impact is positive the term landscape benefit may be used.

The focus of this project is the development of methodologies for community-held landscape values which derive from an individual's response to the landscape's natural or cultural character or otherwise arise from a person's associations, memories, knowledge or experiences of that landscape. It is not intended to provide methodologies for the assessment of natural or cultural heritage within a landscape.

May also be referred to as the developer.

The surrounding landscape will be informed by the viewshed of the wind farm. However, in some areas, such as flatter landscapes, the viewshed may be very large and other factors will need to be taken into account to determine a reasonable threshold for investigation.

1. Understanding landscape values

Understanding landscape values involves identifying essential characteristics of the landscape and working with communities to understand the meaning of the landscape to them.

The critical questions investigated to examine current practice in understanding landscape values are:

- Q1.1 What is meant by 'landscape values' for the purposes of this project?
- Q1.2 What different models are available for understanding landscape values?
- Q1.3 How should communities be involved in assessing landscape values?
- Q1.4 How should landscape values be evaluated or rated?

Q1.1 What is meant by 'landscape values' for the purposes of this project?

Outline of the issue

- The term 'landscape' is used in multiple ways and means different things in different disciplines, from design, to planning, to heritage and environmental management. It is important to explore these different uses, and determine which understanding is most relevant to identifying values of wind farm sites and assessing impacts.
- The scope of landscape values is often confused, sometimes it is narrowly defined as visual or scenic qualities, and others more broadly defined as relating to human perception and attachment to a place.
- Specific challenges exist around understanding the differences between landscapes as place types, and landscape values as a relevant element of assessment procedures.

Current practice

Understanding landscapes

The term landscape has multiple meanings. The Australian Concise Oxford Dictionary defines landscape as "inland scenery" or the painting, depiction or actual piece of that scenery. The Encarta online dictionary describes landscape as "visually distinct scenery – an expanse of scenery of a particular type, especially as much as can be seen by the eye", and lists synonyms as including: scenery, countryside, scene, setting, background, backdrop, panorama, topography, geography and surroundings.

Common in both professional and colloquial language, landscapes are described as a kind of place, one distinctive by their:

- scale – usually large extensive – not a single site, (often 'as far as the eye can see');
- complexity – comprising many smaller 'places' and often multiple values (natural and cultural);
- unifying characteristics – landscapes have unifying elements that distinguish them from adjoining landscapes;
- boundaries – a landscape may have boundaries (as opposed to the 'environment') created by the landform and land cover, or by how the landscape is read, understood and experienced (e.g. visual boundaries).

In addition, both design and heritage professions apply the term 'landscape' to differentiate non-building elements of a place (for example, the garden and landscape of a dwelling).

However, understanding the 'human' dimension of landscapes is essential. According to Cosgrove (1989), they are not about the physical place and what is seen, but a way of seeing

Landscape, in this view, is the external world mediated through subjective human experience. Landscape is not merely the world we see; it is a construction of that world. Landscape is thus a social and cultural product, a way of seeing projected on to the land, with its own techniques and compositional forms, a restrictive gaze that diminishes other modes of experiencing our relations with nature. Whyte (2002:11)

Natural and cultural landscapes

Often distinction is made between 'natural' landscapes, largely formed by natural forces and biodiversity and 'cultural' landscapes, strongly influenced by human processes. In Australia, distinction is also made between pre- and post-European cultural landscapes. Landscapes have both natural and cultural values, and in many cases these will be difficult to separate.

Landscape values

A landscape is a place, but landscape values are held by people and communities. Understanding landscape values is also about recognising broader kinds of places – for example the relationships between sites, combinations of sites and setting to sites.

People value landscapes as places that give meaning to their lives, and for their historic, scientific, social, aesthetic and spiritual values or inherent natural qualities (e.g. biodiversity or geodiversity). Landscapes also have intrinsic or 'existence' values.

Communities define their values of landscape based on a combination of memory, knowledge, associations and emotional response to the environment. The central component is working with communities to understand their values of the landscape.

Implications for Assessment Framework

For the purposes of this study 'landscape values' can be said to mean the aggregate community perception of the value and significance of a place at a broad landscape scale.

The focus of this study

The values held by communities about landscapes can vary widely, and may straddle several technical or professional ways of categorising landscape values. For example:

- Different stakeholder groups can be expected to place different values on the same landscape, and to weight common values differently – eg indigenous groups may place a greater weight on associative or spiritual than on aesthetic values.
- In some cases, one group's assessment of the aesthetic (or similar) impact of a wind farm may be influenced or even determined by their view of another value – eg people who see wind farms as elegant manifestations of a more sustainable energy future may perceive only positive impacts on a given landscape.
- People often confuse (in professional terms) landscape values with the concept of 'amenity'.
- We must accept that values change over time; indeed, it is important (if perhaps difficult or impossible?) for any assessment of the impact of a wind farm on landscape values should consider the values of generations yet unborn.
- Often, but more narrowly, landscape values are used interchangeably with scenic and / or visual assessment. This issue is tackled further below.

One way to resolve this confusing state of affairs is to take the position: this study should focus on those aspects of landscape values about which there is little or no

agreement about methodologies. In other words, it should focus on 'contested methodologies'. With this in mind, particular emphasis is given in this project to understanding and developing methodologies associated with assessing aesthetic, visual and scenic values and other intangible community-held values of landscapes.

While there will clearly be overlaps between aesthetic landscape values and the aesthetic and social values referred to in the Burra Charter, nevertheless, this is probably the closest we can come to a defining the landscape values 'territory' of this study.

Implications for Assessment Framework

The focus of this project is on the contested methodologies associated with assessing aesthetic, visual and scenic values.

Professional role

The investigation of the values of landscapes is a preoccupation of several fields of professional endeavour including planning, heritage and landscape architecture (among others).

Values belong to people, but technical specialists can perform a useful role in understanding, interpreting and applying values. Carried out effectively, this requires the use of methodologies that are tried and tested, and based in a transparent manner on observed behaviour or recorded information.

Professionals contribute layers of information relevant to understanding landscape values.

- landscape and visual character
- flora and fauna
- identification of places that are scientifically and historically important
- understanding significance of other heritage values.

Implications for Assessment Framework

Landscape values are held by people and communities, but professionals can play a role in understanding, interpreting and extrapolating those values. However this needs to be done in ways that are rigorous and transparent.

Cultural heritage

The cultural heritage values of a landscape means its aesthetic, historic, social, scientific and spiritual values.

The significant cultural heritage of a landscape might be embodied in the physical place (e.g. physical character) or elements within it (e.g. patterns of past occupation and land use) or in use (e.g. stage for important social events or functions) or in, associations, meanings, records, related places and related objects (Australia ICOMOS, 1999).

The Australia ICOMOS Charter for Places of Cultural Significance (The Burra Charter, (Australia ICOMOS, 1999) is the guiding document for understanding, assessing and managing cultural heritage in Australia.

Natural heritage

Landscapes also have natural heritage values. Natural heritage is those values embodied in the natural living and non-living components of the world that humans inhabit, that is the biodiversity and geodiversity of the landscape. Natural heritage can incorporate a range of values from existence to socially based values (Cairns, 2002).

The Australian Natural Heritage Charter (Cairns, 2002) is based on the Burra Charter and provides a guidelines for identifying and managing natural significance.

Indigenous heritage

Places, sites, landscapes and memories which provide evidence of the Indigenous past of an area are important to present day Indigenous communities. These can be represented tangibly as archaeological or heritage sites (e.g. scarred trees, stone tools, mission buildings etc.) or intangibly (places known to have been used by Indigenous people either prior to or following the European invasion of traditional lands). Present day associations to place are also important (for example, places which continue to be used by Indigenous communities, such as meeting places).

The identification of Indigenous heritage values and involvement of Indigenous communities is an essential component of any development, and involvement of Indigenous communities in understanding landscape values.

Understanding Indigenous heritage values in Australia is guided by the Australian Heritage Commission's publication *Ask First: A guide to respecting Indigenous heritage places and values* (AHC, 2002). This document advocates a consultative approach to sustain the relationship between Indigenous people and their heritage places.

Implications for Assessment Framework

The Framework should will not include methodologies for understanding natural or cultural heritage, but will be informed by the occurrence of these values.

The identification of Indigenous heritage values and involvement of Indigenous communities is an essential component of any development, and involvement of Indigenous communities in understanding landscape values .

Scenic, character and visual values

Scenic, character and visual values are cultural values of a landscape, essential to the communities who experience them. These values are offered separate consideration here because of the focus they have traditionally received in understanding landscape values, primarily in the fields of architecture and landscape architecture disciplines.

Scenic, character and visual values are sometimes used narrowly interchangeably for 'landscape values'. The 2005 Stage 1 Report cautions this approach and recognises that some authors use 'landscape values' to mean only the visual character or values of a place (see for example, Amir and Gidalizon, 1990), while others use the term to include a range of values including social, indigenous, cultural, artistic and environmental values (see for example Appleton, 1975). In other cases, whether landscape values include diverse and intangible cultural values or specifically the visual properties of the environment is not clear in the literature (the Macaulay Land Use Research Institute, 2004). To address this dichotomy, a distinction between 'visual landscape' and 'total landscape' is now evident in the literature.

Planning panels considering environmental effects statements for wind farms in Victoria have deliberately and consistently separated landscape from visual amenity (see for example, Bald Hills, 2004:96). Landscape is a "resource enjoyed by the public as a whole" which lies "at the foundations of myriad individual decisions, for example about where to live, travel, tourism and recreation" (Bald Hills, 2004:96).

According to Reid (2006:14), "landscape and visual impacts are essentially different".

In UK examples of both environmental assessments for wind farms, and methodologies (see for example, Tendring District Council, 2006), landscape and visual effects are treated separately, although frequently required through the one assessment process (e.g. Landscape and Visual Impact Assessment, LVIA). Landscape effects include "changes to perception of the landscape, character of the area or experience", while visual effects "include short distance views from nearby land, and long distance views including from the adjacent roads" (Tendring District Council, 2006:1).

Implications for Assessment Framework

Landscape values include, but are not limited to, scenic, character and visual values.

Environmental assessment processes

Australian environmental impact assessments for wind farms predominantly derive their understanding of landscape values from professional assessments using one or a combination of landscape character assessment, scenic quality assessment and visual amenity / visual impact assessment. Often, 'surrogate' models for understanding values (e.g. visitation, tourism and recreation locations, occurrence in publications, materials, arts) are used to supplement assessments.

Conclusions

- The focus of this project is understanding community-held values which derive from an individual's response to the landscape's natural or cultural character, or otherwise arise from an individual's association, memory, knowledge or experience of that landscape.
- It does not include methodologies for understanding natural or cultural heritage in that landscape, but will be informed by the occurrence of these values. In addition, landscape values may be significant natural or cultural heritage values.
- Landscape values are primarily community defined, however, they are those community values that are inherently about the place (as opposed to, for example, economic benefits), and on the whole are broad, rather than site specific.
- The emphasis of the project is those areas for understanding values of place for which methodologies for assessment are poorly defined, inconsistently assessed or are contested.

Q1.2

What different models are available for understanding landscape values?

Outline of the issue

- There are many approaches to understanding landscape values / the values of landscapes, in use in Australia and internationally. These derive from different disciplines (e.g. landscape architecture, heritage, environmental assessment) and vary in emphasis, scope and nature of assessment.
- The Stage 1 Report identifies (at page 12) that the scope of landscape values that wind energy facilities could affect is broad (may include: landscape character and scenery; Indigenous cultural values; amenity; cultural heritage; contemporary cultural values and sense of place) and notes that landscape assessment therefore requires an interdisciplinary approach.

A specific issue about the role of communities in identifying and defining landscape values is examined further in section 1.3 of this report.

Current practice

The central finding of the 2005 Stage 1 study was that, although there exists a large body of literature, practice and government policy which advocate different approaches to understanding landscape values, none has been universally accepted. It is also true that, with few exceptions, models to understand the values of landscapes are limited to specific values or issues.

The dominant models for landscape assessment in Australia are as follows¹:

- landscape character assessment;
- scenic amenity assessment;

¹ The Macaulay Land Use Research Institute (n.d., p3) defines three broad categories of assessment of landscape values: descriptive inventories (e.g. ecological / character assessments and formal aesthetic models); public preference models (psychological and phenomenological); and quantitative holistic techniques which use a mixture of subjective and objective and psychophysical and 'surrogate' models.

- visual impact assessment; and
- cultural landscape assessment.

To a large degree, these techniques overlap, and are often used in combination.

The key elements of these are set out as follows.

Landscape character assessment

Landscape character assessment is an approach derived primarily from the forest evaluation models of the US Forest Service in the 1970s (Litton, 1968).

It is concerned with describing the physical elements (landform, waterform, vegetation and land use) which make one landscape different from another. Landscape character assessment is primarily (though not solely) concerned with the physical and visible attributes of the landscape.

Recent approaches in Australia have included a 'community input' component to clarify or respond to professional opinions (see for example Planisphere, 2004).

Landscape character assessment has been extensively applied across the United Kingdom and the Republic of Ireland, where baseline mapping of landscape character has been achieved for all areas (see for example, the Countryside Agency <http://www.countryside.gov.uk/LAR/Landscape>).

Examples in Australia include, among others:

- Landscape Character Types of Victoria (Leonard and Hammond, 1984)
- A Manual for Forest Landscape Management (Forestry Commission, 1990);
- Meander Valley Scenic Management Strategy (Inspiring Place, 2002); and
- Coastal Spaces Landscape Assessment Study (Planisphere, 2006)

Benefits

Landscape character provides an approach to understanding landscapes and provides hypotheses for what might be valuable about a landscape and a framework for understanding the visual 'fit' of a development. It derives description from both natural and cultural elements.

Landscape character can be accurately mapped and modelled for places; specific valued characteristics are objectively defined; methodologies are transferable.

Limitations

Emphasises the physical environment, rather than 'values' associated with it. Often lacks a community input component, and assertions about value are frequently limited to the opinion of the professional undertaking the assessment.

Implications for Assessment Framework

Landscape character is a valuable input to understanding and describing the elements of a landscape valued by communities and will become an important component of understanding landscape values in the National Assessment Framework.

Landscape character assessment should be coupled with community-based activities to describe and rate valued characteristics, as well as a more holistic consideration of other values.

Scenic amenity assessment

A number of approaches to rating and evaluating the visual and scenic appeal of landscapes are contained under this heading, including scenic quality assessment derived from forest evaluation models (e.g. Litton 1968 for the US Forest Service) of the 1970s.

The key characteristics are methods which attempt to rate the elements within a landscape that contribute to higher or lower visual appeal. In this sense, it is primarily concerned with understanding values.

These approaches, are often undertaken in tandem with or informed by landscape character assessment and are primarily (often solely) concerned with the physical and visible attributes of the landscape. Generally they divide a state area into landscape character zones and give a high, medium or low rating based on characteristic elements and landscape diversity.

Successful methods have been applied in conjunction with landscape character in Tasmania (Forestry Commission, 1990) and in South Australia Lothian (2005). Other examples in Australia include:

- *Meander Valley Scenic Management Strategy* (Inspiring Place, 2002);
- *Scenic South East Queensland* (incorporating Lockyer Scenic Amenity Project Forest Images Pty Ltd, et. al, 2002; and Scenic Amenity in the Caboolture Shire, Forest Images Pty Ltd, et. al, 2003).

Common to all approaches is the identification of features characteristics which contribute to higher scenic appeal. Lothian (2005) describes the following variables as influencing perceived scenic appeal of coastal landscapes in South Australia: water land edge; area of water; awe – tranquil scale; diversity; naturalness; beach quality; landform type. Frequently, these will be expressed in matrix or 'frame of reference' which will then be mapped.

A core area of difference is the extent to which what is 'preferred' in a landscape has been researched. In older studies, generic rules were often applied to rate higher quality landscapes (e.g. diversity, presence of water), often derived from public preference studies undertaken elsewhere. However more recent approaches derive ratings from modelling of community preferences (e.g. quantitative research approaches such as the sorting and ranking of photographs of different kinds of scenes, containing different kinds of attributes). See for example Lothian (2005); Green (2003).

Benefits

Offers transparent criteria for values assessments which can be reviewed and critiqued. Conclusions are promoted as being 'objective' and often transferable (particularly where based on public preference modelling). Values can be spatially mapped and modelled.

Limitations

Does not recognise associations, meanings or memories which might affect preference rating, nor does it provide a means for these to be considered relevant values. Unable to integrate non-visual elements, including sound, smell, taste or an individuals knowledge (or perceptions) of other elements of significance (e.g. historic, natural).

Landscape preference models determined by asking groups of people how they would rate images of landscapes have been criticised (Ramsay, 1999) as not being an assessment of landscapes but assessments of images.

Implications for Assessment Framework

Various models used to rate the visual and scenic quality of landscapes can be useful for helping to identify the specific elements of the landscape that are valued by communities, but should be used in conjunction with methods to understand other values of the landscape. They must be based on sound and robust methodologies, and should be specific to the subject landscape and communities which value it. The methodologies used should be clearly reported.

Measures such as public preference modelling, scenic quality ratings if they are to be relied upon, must be demonstrated to be relevant to the landscape of the proposed wind farm site and the communities who value it.

Visual impact assessment

Visual impact assessments have been undertaken as part of environmental assessment processes since the 1970s, and increasingly play a significant role in judgements about the acceptability of developments including wind farms. To varying degrees, all wind farm impact assessments reviewed in this study examined issues of visual intrusion, though not all included full visual impact assessments.

Visual impact assessment (VIA) is concerned with the physical environment, and scientifically modelling visual intrusions by assessing such factors as topography, distance, development size, and atmospheric effects. For this reason, visual impact assessments are always professionally defined. Some methods also use information about the human vision (e.g. proportion of a landscape visible in the human field of view) in making judgements about the likelihood and magnitude of potential visibility (see for example, ERM 1999).

Many authors will make judgements about the relative 'sensitivity' of different viewer types (e.g. residents, tourists etc.) in order to input an 'evaluative' element to visual impact assessment, (see for example, EDAW 2001). Various reviews have stipulated the need for rigour and relevance to the subject place and communities in making such value judgements (Portland Wind Energy Panel, 2002).

Similarly, methods which combine of visual attributes (distance, size, visual presence), with landscape quality (scenic amenity ratings) and viewer preference are available (see for example, Scenic Spectrums, 2005; ERM, 1999).

Benefits

Provides a structured approach to defining and describing the visibility, visual intrusion based on objective and definable factors (distance, topography, atmospheric effects).

Limitations

Does not offer an understanding of the underlying value of the landscape, but rather provides evidence of whether or not a development will be visible, and the likely magnitude of visual intrusion. Usually does not include community values.

Implications for Assessment Framework

Visual impact assessments are not intended to be comprehensive assessments of landscape values. VIA provides a relatively 'objective' and defensible source of information about one element of the development that might impact on its values – namely the visibility.

Visual impact assessments will be an important component of holistic landscape assessment for wind farms but should aim to input objective 'facts' to the assessment process, rather than making value judgements about acceptability.

Cultural landscape assessment

Heritage practice has also tackled the assessment of landscape values, particularly for cultural values. Studies have been undertaken at various scales tailored to suit the level of heritage assessment (local, state, national, world) as well as the scale of the landscape units being assessed (a hill or a valley, expansive area such as the regional forest studies or the Australian alps area, or local shire landscapes).

Cultural heritage assessments of landscapes can be comprehensive covering all heritage values defined within the Burra Charter (Australia ICOMOS, 1999) – social, historic, aesthetic, spiritual and scientific – or specifically tailored to particular values (e.g. aesthetic).

Many local government heritage studies have identified landscapes of heritage significance for recognition and protection through Local Environmental Plans / Planning Schemes.

Some heritage studies have been criticised for being limited to a review of 'historical facts' rather than an evaluation of its cultural significance (heritage practice defined by the Burra Charter requires the latter).

Comprehensive assessments of cultural values of forest areas were undertaken for the Regional Forest Agreement process (see for example, AHC and CNR, 1994). The assessments involved primary research as well as desktop work. They used community consultation and involvement in the assessment of heritage values at numerous heritage workshops. Aboriginal heritage values also involved extensive community involvement through numerous workshops.

More targeted assessments include landscape assessment of aesthetic values of places, for example for inclusion on the Register of the National Estate (National Estate Identification and assessment in the Gippsland Forest Region, Victoria) or, more recently the National Heritage List (e.g. Glass House Mountains and the Warrumbungles at <http://www.deh.gov.au/cgi-bin/ahdb/search.pl>)

Benefits

Cultural heritage practice provides a framework for understanding a range of cultural values of landscapes, and provides examples of techniques for obtaining evidence for values, including community involvement.

There is a strong emphasis on thresholds, and significance provides a useful framework for decision-making.

Limitations

Tend to be large, resource and time-intensive processes, particularly where the range of community-derived (aesthetic, social, Aboriginal, spiritual) and professionally-derived (historic, scientific) values are included. Emphasis on significance may be limiting (e.g. values of landscapes that might not meet strict thresholds for heritage significance might be worthy of recognition / protection in landscape assessment for wind farms).

Implications for Assessment Framework

Heritage assessment provides valuable frameworks for understanding and rating cultural values of a place, providing well argued frameworks and threshold tests for rating significance to communities (e.g. AHC and CNR, 1994).

A number of cultural heritage methodologies (particularly those concerned with social, aesthetic and / or Indigenous values) provide sound examples for good practice in researching community-held values of landscapes.

Conclusions

- There are many methods and approaches, and none provide the 'whole answer'. The framework will need to both innovate and to adopt valuable components from a number of sources to produce a composite method
- Understanding landscape values for the purposes of wind farm siting will need to be derived from various disciplines with claims on the territory of landscape assessment.
- Issues such as personal aesthetic taste, tolerance of sound, preferences for smells and tastes, life experiences, philosophies, interests, education and knowledge are relevant. The framework will need to provide a method (or suite of methods) which considers not just scenic and visual but also values that derive from people's knowledge, memories, feelings and associations with a landscape.
- Values are not necessarily transferable from one landscape or one community to another. Measures such as public preference modelling, scenic quality ratings and proxy assessments of community-held values, if they are to be relied upon, must be demonstrated to be relevant to the landscape of the proposed wind farm site and the communities who value it.
- Methods to investigate 'personal values' need to be made transparent (see below).

Q1.3 How should communities be involved in assessing landscape values?

Outline of the issue

- There is apparent consensus that landscapes values are primarily (though not solely) community-held values. However, there are considerable methodological differences in how such values ought to be identified and documented.
- Some methods reviewed advocate direct community input for each specific site as the only effective method for gauging values. Others use community preferences surveyed in other places to indicate likely values in a different place (e.g. quantitative preference modelling) or derive an understanding of relative importance from 'surrogates' such as tourism or recreation visitation or artistic endeavour. A third category bases assessment on professional opinion, held to be a voice close to a 'consensus' community view.

Current practice

The vast majority of wind farm landscape and visual impact assessments both in Australia and internationally derive both their landscape description and evaluation from professional assessment. Instead of consulting directly with the community, these assessments tend to derive community values from 'surrogate' sources such as the level of tourism in an area, or levels of visitation for recreation; or from a professional opinion on the essential valued qualities of the landscape.

Nonetheless, this is not necessarily held as best practice. Independent planning panels reviewing impact assessments for wind farms in Victoria, for example, note that analysis of landscape values would ideally be conducted through social research instead of or in addition to expert opinion (Bald Hills EES Panel Report, 2004).

Government guidelines and regulations all require community input to the proposal, but rarely with specific reference to understanding landscape values (though more often when rating impacts on them). In Tasmania, for example, guidelines for a Development Proposal and Environmental Management Plan (DP&EMP) emphasise professionally-derived visual assessments. The Guidelines give strong emphasis to public consultation for certain values, for example, Aboriginal heritage values. However, the role of engaging communities for visual impact assessments was not articulated in the minimum standards outlined for visual impact assessment.

The guidelines for the preparation of a Public Environmental Report in South Australia, on the other hand identify aspects that are professionally-derived (description of landscape character and identification of landscape sensitivity) and others that need to be described by different sections of the public, e.g. identification of aesthetic responses to the proposal.

Objective or subjective

Arguments about objectivity or subjectivity are not the same as whether values are professionally- or community-derived. Rather there is a methodological question as to whether 'absolutes' can be identified for a place or region to give certainty to understanding values of another place.

Lothian (2005) also describes landscape quality as subjective; a qualitative resource, dependent on human perception. However, he challenges the perception that the subjective quality of landscapes cannot be measured objectively, arguing rather, that it is possible to measure the landscape quality and predict visual ratings and impacts (p.9).

Professional assessments are held by Victorian Planning Panels to be 'another subjective assessment', rather than an objective truth about what others might also see:

Landscape evaluation that is not based on sound social research is inevitably a subjective process. Training, for example as a landscape architect, rural or natural resource planner or as a fine artist, may inform and refine the exercise

of such subjective judgments. However, in the absence of reference to wider social values, the opinion of an individual remains just that – an interesting and informative guide but nothing more. (Bald Hills Wind Farm Project Panel Report, 2004:97)

No examples of social research into landscape values conducted as part of environmental assessments or planning permit processes for wind farms were reviewed in this study. However it is recognised that some do exist. .

Implications for Assessment Framework

While considerable weight can be given to the insight of a person trained in landscape, design and visual disciplines these should be augmented with community-based activities which allow the perspectives and values of members of associated communities to be contributed.

Which community(ies)?

Recognising that value is fundamentally derived from those who appreciate the place, various methods and literature note that this might include the people who live there, have holiday homes, pass through or value the place remotely. Edwards (2005) recognises that landscape values belong not only to a defined local area, but are a “resource claimed by many”.

There are multiple communities who may hold values of the landscape of a potential wind farm site. These will at a minimum include local residents and visitors to a place and future generations for whom the landscape is held in trust. In some cases a landscape will also be more broadly valued by non-resident communities for its ‘existence’ value, and this may include people who have never visited a place, or do so only rarely.

More significant landscapes will be those which have appeal to wider communities (e.g. communities of the region, state or nation).

Implications for Assessment Framework

The range of communities with associations with the landscape may be quite diverse, and include local and non-local communities, and community sectors with particular associations and traditions for example.

Methods must provide scope for understanding and responding to values of multiple communities for whom the landscape of a wind farm site is valuable. This may include resident and non-resident communities

How should community values be obtained?

Methods to understand community values of landscapes are varied. Some practitioners advocate that it is essential to work directly with the communities who hold the values to allow them to define and express their values in their own words. Others use a more anthropological approach, that is, study people or a group of people to discern their values and then extrapolate these values to other situations. Another approach is to derive an understanding of relative importance from ‘surrogates’ such as tourism or recreation visitation or artistic endeavour.

No wind farm impact assessments reviewed had undertaken detailed public preference modelling, and very few used community input as a large component of identifying baseline values. Three different example approaches from Australian wind farm impact assessments are summarised here.

1. The *Musselroe Visual Values Inventory and Impact Assessment*, applied a methodology for defining and assessing community landscape values. An approach determining patterns of viewing and the level of public sensitivity was developed, however this methodology was not applied for the local community. Provision of criteria and thresholds to rank the relative importance of scenic values was included in the methodology that was professionally-derived and rated. Some surrogate-approaches such as the importance of places for tourism and recreation, the number of vehicles travelling on roads etc. were used to inform ‘public sensitivity’ of various locations and impacts.

2. *Myponga Sellicks Hill* – The visual assessment and potential visual intrusion of the proposal was again solely professionally-derived. Levels of significance of impact were rated against the magnitude of visibility (e.g. zone of visual influence), although somewhat incongruously, reference was made to the public perception of the benefits of renewable energy in this section. A separate section of assessment was devoted to the public perceptions of the proposal, including aesthetic. This involved quantitative surveys of 209 residents of surrounding towns and covered a range of perceptions about the acceptability of the proposal. However, the surveys did not address questions of underlying landscape values of the place, nor were the visual impact assessments provided to respondents.

3. RFA Aesthetic Community Values workshop (values assessment not for wind farm project).

Within regional locations, workshops were held at selected centres of community catchments. Representatives of all the community social organisations, industry, recreation and other users groups were invited. To ensure the extent of the region was covered as much as possible, individuals familiar with the more remote areas were invited. In order to obtain information from representatives of the peak recreational organisations and other stakeholder groups who regularly use the region, one workshop was held in the State capital.

The topic of the workshops was kept to a general level designed to understand the spectrum of heritage within which aesthetic value was included. Initially, participants were asked to identify what they understood heritage to mean and hence themes of heritage importance were established. Within those themes, aesthetic value was clearly present and interwoven amongst the understanding community members held for heritage value. Words used by community members containing an 'aesthetic value' meaning were 'beauty', 'important', 'unique', 'recreational', 'nature', 'enjoyment', 'original', 'inspirational', 'unusual perception', 'ancient', 'pride', and 'scenic'.

The workshops were planned to inspire, encourage and elicit information, and critical to their success was sensitive and skilled facilitation. Participants firstly went through a listing exercise and then each undertook a selection of the top ten places from the combined lists. Participants were also required to record places that they initially identified, and describe the values of the place. All places recorded were delineated on topographic maps by the workshop team. Examples of places people identified as possibly having aesthetic importance were rivers and streams, travel routes, rainforests, ecological communities, geological formations, rock formations, viewing points, sacred sites, beauty spots, walking tracks, waterfalls, pristine habitats, pristine catchments, old trees, unusually formed trees, mountain ranges, mountain ridges, mountain silhouettes, and bridge settings.

The range of group techniques employed has included:

- Community gatherings of various kinds: focus groups (hand-picked); focus groups (self-selected); groups with a single community represented or mixed
- Site-based: back-to the place (White Bay); visits (Ingleburn, Maribyrnong Defence etc); walks (Condah); self-directed and documented trips (like M Walker method)
- Map-based: "walking down the coast" mapping as you go; defining cultural or traditional activity boundaries (Upper Mersey)
- Individual responses in the form of questionnaires (written) and phone interviews/surveys as a way of gathering data across a widely dispersed community (numerous examples).

Implications for Assessment Framework

Methods for obtaining or researching community-based values need to be adequately designed to identify particular and general attributes that are valued and measures to assess the extent and strength of this value.

Methods should also be flexible and appropriate to the communities being involved. This may involve consulting with these communities to determine the best ways for them to be involved, considering their resources, priorities and cultural protocols. Different methods may be needed for different communities.

Conclusions

- Methods must provide scope for understanding and responding to values of multiple communities for whom the landscape of a wind farm site is valuable. This may include resident and non-resident communities.
- Recognition also should be given to future generations for whom the landscape is held in trust (e.g. future generations).
- In seeking to understand values of landscapes held by members of communities, direct input is favoured.
- Consideration needs to be given to identification of 'shared' or 'collective' values and the identification of these, their strength and importance.
- The use surrogate methods including tourism or recreational visitation should be encouraged as an adjunct to community-based activities and professional assessment. However, these will not on their own constitute a full understanding of the values of a landscape and the limitations of such methods need to be carefully identified (for example, a remote landscape may receive low numbers of visitors, but may still have high landscape values).
- Other relevant sources for understanding the significance of the landscape include peer or expert opinion, appearance in artistic endeavour, tourism material or media.
- Values are not transferable from one landscape or one community to another. Public preference modelling should be directly related to the place, and not derived from elsewhere.
- Techniques which seek to understand values using modelling and other data (e.g. photographs) can be valuable, but their limitation should be acknowledged.
- It is important to maintain a two-way exchange of information between the wind farm proponent (and their consultants undertaking values studies) and the communities whose values might be affected by the wind farm. Information provided to communities will contribute to the communities understanding and values of the landscape.

Q1.4 How should landscape values be evaluated or rated?

Outline of the issue

- The Stage 1 Report recognises that there is much debate about whether and how the relative significance of landscape should be measured, but concludes that applying a rating of significance to values is essential to defining the acceptability of otherwise of impacts upon those values.
- Understanding relative significance of values (e.g. strength or extent to which a value is held) is important for environmental assessment and planning approvals processes.
- Understanding the context (geographic or otherwise) in which values of places ought to be rated will have implications for the way assessments are undertaken.
- Reviews of landscape and visual impact assessments of wind farms have in the past criticised a lack of strategic identification of appropriate sites (from a landscape perspective).

Current practice

Significance

The 2005 Stage 1 report notes that rating the significance of landscape values assists decisions about the acceptability or otherwise of impacts of a development on those values.

There is much debate about whether and how the relative significance of landscapes should be measured. Few of the existing approaches comprehensively address all potentially significant values.

Context (2002) explores the concept of significance for understanding landscapes that inspire communities. There are at least two dimensions of significance to consider in rating the landscape values of the wind farm site:

- strength and importance of the values within the community who holds them; and
- extent to which they are likely to be held across communities or cultural groups (e.g. at local, regional, state, national, international scales).

In many studies reviewed, significance has tended to be rated on the extent to which values are held. For example, landscapes might be held in high regard across a State or nation. The Planning Panel report on community reaction to the Portland Wind Energy Project in Victoria recommended that future landscape assessments of wind energy facilities rate landscapes “in international, national, state, regional and local significance terms” and identify the features that contribute to their significance in each case (Planning Panels Victoria, 2002).

Nonetheless, conflict arises where assessment fails to understand that a value considered to be relatively common might have special meaning to a local population. However, the qualities of local significance – reflected in the places where we lead our daily lives (so our personal “setting”) – can contain strongly held values important for consideration in wind farm developments. Often landscape-based protests are about the impacts on the “familiar landscapes” in which people live and the experience, attachment and memory experience associated with the place.

The strength of a value might be indicated by the occurrence of shared values, however, it is also recognised that understanding landscape values involves multiple communities with potentially disparate views about a landscape.

AHC & CNR (1994, adapted in Context 2007) outline a range of relevant factors to understand significance of aesthetic values which can be adapted for landscapes:

- the extent to which the value or combination of values is special or particular to this landscape;
- the extent of recognition of the place for its landscape characteristics across geographic and cultural boundaries;
- the length of time that this landscape can be demonstrated to have been valued by a community or communities;
- the occurrence or depiction of a landscape for these values in art, literature or tourism materials.

Implications for Assessment Framework

Rating the significance of landscape values will assist in assessing the acceptability of impacts on these values.

In rating significance, both the strength of value (its importance to the community who values it) and the extent to which the value is held by different communities (e.g. at local, state or national levels) will need to be considered.

Assessment context

To varying degrees, all Government guidelines reviewed in Australia include reference to understanding landscape values of both the site, and “the surrounding area” (State of Victoria PPG-WEF). This is largely for two purposes:

- to recognise that landscape values are expansive, and often have fluid boundaries;
- to provide a context for assessment of values, to understand for example the relative uniqueness or otherwise of a particular landscape character, feature or value within a particular locality or region (this is addressed further below).

In order to adequately understand and rate significance, a context for understanding and comparing values needs to be defined.

Cultural heritage practice has led the way in setting significance assessment within a context through 'comparative analysis'. Comparative analysis considers similar places, or places with similar values and rates the extent to which the place being assessed best embodies the value, or whether there are other, better examples of its type elsewhere. This approach works best for places or items which are of a readily definable 'type' or 'set' (for example, a building style) and relies on complete, or near-complete knowledge of the occurrence of other types of places which may be valued for the same reasons.

Several studies in the UK have sought to identify appropriate locations for wind farm development across jurisdictions (e.g. County of Lancashire, Lovejoy, 2005) using a range of physical, perceptual and value characteristics (see also section 2.2).

Some states have completed partial strategic landscape evaluation studies across regions, including Victoria (e.g. Planisphere, 2006); South Australia (e.g. Lothian, 2005); Queensland (e.g. Caboolture Shire, n.d.), which aim to identify highly significant landscapes (or to provide frameworks for their identification). In each case, these assessments are primarily concerned with visual character and scenic values.

Valuable resources are also contained in the Register of the National Estate (www.deh.gov.au) and various National Trust significant landscapes registers (see for example, <http://www.natrust.com.au>). However, these are sporadic and place-specific (as opposed to providing a strategic overview of a state or region).

More complete landscape evaluations are available overseas, for example the landscape character documentation undertaken by English Heritage (<http://www.english-heritage.org.uk/server/show/nav.1293>).

Implications for Assessment Framework

- Thoroughly undertaken comparative analysis is a sound way to ensure a robust and defensible understanding of relative significance. However, it is reliant on the adequacy of information available for other sites or places and at present this is lacking in Australia for most landscape values.
- Methods developed overseas where more comprehensive baseline assessment of landscape values has been completed (e.g. the United Kingdom) may not be directly applicable to the Australian context, where there are gaps in the knowledge of landscape characteristics and values within which to base a framework for rating of significance.

Strategic selection of sites

The vast majority of impact assessments for wind farms are site specific. That is, their brief is not to survey a range of sites and identify those that are more or less appropriate for wind farm developments from a landscape perspective.

Nonetheless, community comment on developments tends to emphasise the need for strategic selection. Several planning panels in Victoria have considered the issue of strategic selection of sites. Bald Hills Wind Energy Project Panel, for example, undertook to provide a strategic review of landscapes as part of its recommendations.

Lothian (2005) recommends the following strategic planning advice to the South Australian Government (pp. 54-55).

- planning for wind farms requires a map of wind resources; a map of landscape quality and acknowledgement of community's view about visual impact of wind farms, and should occur in all states;
- State Governments identify suitable areas for wind farms and define restricted areas;
- undertake a mapping of landscape quality at a national scale.
- avoid high rating coastal sites or, locate slightly inland to avoid visibility from coastline edge;

- avoid high-rating inland areas – low to middle ranking agricultural land is suitable for wind farms;

While several studies in the UK have sought to identify appropriate locations for wind farm development across jurisdictions (e.g. County of Lancashire, Lovejoy, 2005) using a range of physical, perceptual and value characteristics (see also section 2.2), the same issues about lack of complete information as discussed above applies to strategic selection of sites in Australia.

In absence of this information, the Victorian Government guidelines (Planning and Policy Guidelines for Wind Energy Facilities) require a two-stage approach. The first, a scoping phase, assesses the landscape significance of the place, and is used by the relevant Minister to determine whether or not a full Environmental Effects Statement is required. In practice, this step also allows industry to identify highly significant landscapes, which might be avoided.

Implications for Assessment Framework

- The ongoing development of knowledge about landscape values and significance through strategic studies should be advocated and encouraged to inform landscape impact assessments and provide a context for assessing significance.
- Preliminary assessment of significance is important to allow for early identification of highly significant landscapes, to inform site selection and locational decisions, and to assist Governments determine the level of assessment required.

Conclusions

- Primarily our National Assessment Method will be used for landscapes in the 'middle ground', not the iconic or highly important places, although early identification of highly significant / iconic landscapes will be important.
- Assessment should seek to identify levels of significance associated with a landscape as a basis for decision making about the development.
- The value and significance of the place ought to be assessed in the absence of the proposed development. That is, as far as possible, landscape values that exist prior to the development being proposed should be sought and documented.
- Assessments should seek to find and integrate other sources for understanding the landscape value of the proposed wind farm site, including previous landscape values assessments, heritage studies, environmental and impact studies as well as occurrence in media, art and literature.
- Assessment of landscape significance will need to be made in context, by both understanding the surrounding landscape (potentially to the extent of visibility) and also by way of comparison of the landscape with other places

2. Describing and modelling the wind farms in the landscape

The critical questions investigated to examine current practice in describing and modelling the wind farms in the landscape:

Q2.1 What documentation is needed to inform community and professional assessment of the impacts of a wind farm on landscape values?

Q2.1 What standards should apply?

The information contained in this section is derived from preliminary research by the consultants. This is a fast-developing field of methodology in which techniques are subject to continual review and change.

Q2.1 What documentation is needed to inform community and professional assessment of the impacts of a wind farm on landscape values?

Outline of the issue

Communities and professionals need sufficient and accurate information depicting the wind farm in order to make informed judgement as to impacts on landscape values.

An important component of this is visual analysis and modelling.

Visual analysis involves preparation of a digital terrain model, mapping of the zones of visual influence of the wind farm, selecting viewpoints from within this area that are representative of typical views that will be experienced, and preparation of visualisations that show the wind farm as developed from these view points. Visualisation techniques include photomontage, animation, real time models and video camera matching.

Current practice

Digital terrain models

The Digital Terrain Model (DTM) on which the Zone of Visual Influence (ZVI) and visualisations is based should be prepared using the most detailed (smallest cell size) terrain data available. The accuracy of the data used should be provided in the assessment documentation.

Zone of visual influence

Also called 'seen area' mapping, zone of visual influence is concerned with modelling the point-to-point visibility of a development. A visibility map, or ZVI map shows the extent and pattern of visibility of the wind farm development. ZVI maps are prepared using a DTM and Geographic Information System (GIS) software. The ZVI represents visibility regardless of local screening (buildings or vegetation) and atmospheric conditions (weather), and therefore represents a 'worst case scenario' for visibility. The ZVI does not take into account the nature (positive or negative) or magnitude (significant or insignificant) of visual impacts.

Modelling the ZVI is the first step to assessing visual impact, followed by the selection of viewpoints and the preparation of visualisations. Virtually all visual and landscape impact assessments reviewed in this study (both Australian and international) included some ZVI mapping as a component of understanding the visual impact of the wind farm.

According to the Sinclair Thomas Matrix (referenced in CPRW, 1999), current generation turbines (overall height of up to 95m) are potentially noticeable up to 35 kilometres away, and this distance is recommended as a suitable extent for zone of visual influence (ZVI) mapping, and to form the furthest extent of the potential landscape impacts of the development.

In preparing a ZVI, separate ZVI calculations should be run for the overall height of turbines (to blade tip) and for height to the hub/nacelle. Curvature of the earth and refraction of light should be considered in the calculation. The extent of the wind farm should be defined by the outer turbines. The viewer height should be set at 1.8m.

The ZVI map should show how much of the wind farm is visible (number of turbines – to be displayed in bands of colour). It may also show how much of each turbine is visible in terms of visibility up to the hub or up to the blade tip (SNH 2005, p.22). Other characteristics that may be calculated are the proportion of horizontal view occupied by the wind farm, and the number of turbines that will be viewed against the sky.

It is possible using some sophisticated techniques to model visibility including local screening. This should only be done in addition to the 'bare ground' visibility, not as an alternative to it.

Viewpoint selection

A number of viewpoints are chosen, in order to assess

- The existing visual resource,
- The sensitivity of this resource to the wind farm development,
- The proposed design
- The appearance of the final development (SNH 2005, p.43).

Viewpoints should be selected to show a representative range of views and viewer types. There may also be a need to show views from specific significant viewpoints (SNH 2005, p.43).

View types may include:

- High landscape significance and scenic value
- Visual composition
- Distance
- Aspect
- Extent of wind farm visible
- Sequential

Viewer types may include:

- Various activities such as working, travelling or being at home.
- Static or moving viewers (SNH 2005, p.48).

The selection of viewpoints is an iterative process. Consultation with the responsible authority and the community should be undertaken so as not to miss any key views (eg. the view from a popular beach). The responsible authority should be provided with a ZVI map and a provisional list of viewpoints, and the provision of a selection of wire frame images may help in predicting the likely impact at these locations. A large number of viewpoints, addressing a wide range of issues should be nominated for review. In discussions with the responsible authority the number of viewpoints can be reduced to between 10 and 25. The entire list of nominated viewpoints should be included in the assessment documentation.

In viewpoint selection and production of photomontages the limitations of a limited number of static viewpoints should be acknowledged. The entire visual impact of a development should be considered. It is usually inappropriate to alter the design of a development to address visual impact from a single viewpoint (SNH 2005, 45).

Visualisations

There are a number of visualisation techniques that can be used to communicate the visual impact of the proposed wind farm. Photomontages of the development are

usually prepared for every wind farm development as a matter of course, and are particularly valuable for understanding impacts on landscape values. In addition, some wind farms may have particular visual impact issues that require the preparation of animations, real-time models or video camera matching. These methods can be very useful but are expensive and time consuming to prepare.

Photomontages

A photomontage combines a photograph on an existing view with a computer rendered image of the proposed wind farm development (SNH 2005, p.84). The will be of most value for views within 15km of a wind farm (SNH 2005, p.85). Care must be taken to ensure that the geometry of the overlain image of the wind farm is an exact match of the existing conditions photograph. This is reliably achieved by producing a wire frame image of the landscape and matching this with the landscape depicted in the photograph. The effect of light and shade on turbines is an important factor in their visual impact. The lighting of the rendered image should match the light conditions of the existing conditions photograph – the direction of light should be matched to within 10 degrees (SNH 2005, p.88).

A good quality SLR Camera or high resolution digital camera should be used to take the original photograph. The camera should be mounted on a tripod and should be flat (through use of a spirit level). Any tilt or roll will cause distortion in the photo. ISO 100 or 200 colour print (not slide) film, and long exposure times should be used to achieve the greatest detail and resolution. With 35mm film a 50mm focal length should be used. Photographs should be taken in clear, high visibility conditions.

The turbines depicted in a visualisation should represent the shape of the intended turbines. Ideally they should be based on line a drawing of the actual model proposed. In most cases case models will depict the exact hub and rotor height, though some approaches which use higher models to account for errors in the underlying contour information are known to be used (e.g. for a contour base with accuracy plus or minus 10 metres, exaggeration of the height of the turbine by 10m may be warranted).

Working copies of visualisations and wire frame drawings should be prepared showing one blade of the turbine pointing up, ensuring all potentially visible turbines are seen. For realism, when preparing photomontages it is recommended that the rotors are displayed at random stages of rotation. However if a wind turbine in a photomontage will not be visible if the blades are at a diagonal, it should be shown with one blade pointing up.

Turbines may be oriented in the following ways:

- every turbine facing the viewpoint, (provides a 'most seen' scenario – one variation on this approach is every turbine facing the same direction, with the central turbine facing viewpoint), or
- every turbine facing the prevailing wind (SHN 2005, p.75).

There are various advantages and disadvantages. Turbines are considered to have more visual impact 'face on', however they are more visual comprehensible. It may also be considered less realistic to always face the turbines toward the viewpoint. The decision must be justified in the assessment documentation.

Animations

Animations are of particular use when demonstrating the appearance of a wind farm travelling along a particularly sensitive road. Animations have the advantage of being able to simulate effects such as movement – a major shortcoming of still photomontages.

To create an animation the entire landscape must be developed as a 3D model. In addition to the terrain, every element in the landscape needs to be modelled such as trees and buildings. Landscape is difficult to model because it does not consist of straight lines and repetitive textures which are inherent in 3D modelling software. Cameras are created which simulate the journey of the viewer and the view from the camera is rendered out as a video. The rendering process is time consuming and

therefore the length of the animation is a constraint. Animations must be prepared with the same care as still photomontages with regard to factors discussed earlier such as atmospheric effects, the focal length of the 3D model camera, and the height of the camera and viewpoints or journey selected.

Real-time models

Another tool available to assess the visual impact of wind farm developments is a real time 3D model. In 3D models the viewer can move around the landscape and examine the visual impact from an unlimited number of viewpoints. 3D models and animations are partner technologies with animations being easily created once the model is developed. Within a 3D model differing turbine layouts, heights and atmospheric effects may be assessed and compared. In this capacity it is an effective tool for testing design options. In a similar shortcoming to animations, the entire landscape must be modelled and so the visual result may be relatively crude when compared with photomontages.

Video camera matching

Video camera matching is a form of animation. Video camera matching combines the photorealism and detail (such as atmospheric effects) of photomontages with the movement of animations.

In this process video footage is taken along a journey and the wind farm is superimposed into the video. This method is very time consuming, and therefore expensive, because the foreground needs to be cut out of every frame in the video.

Implications for the Assessment Framework

Digital Terrain models must be accurate and transparent.

The zone of visual influence should be calculated to a distance appropriate to the development. This may be to the extent of potential visibility (but in practice, is likely to be less).

Viewpoints should be selected using an iterative process that involves consultation with the community and the responsible authority. Viewpoints should be representative of a range of views and viewer types.

Photomontages should be prepared as part of all VIAs. They must be prepared according to a number of specific technical standards to ensure an accurate depiction of the wind farm.

Animations, real time models and video camera matching are addition tools that may be employed where extra information is required.

Conclusions

Visual analysis (modelling) forms one component of Visual Impact Assessment (VIA). Visualisations and visibility maps inform the VIA process to show from where a development will be seen, and how it will appear. The visualisations and visibility maps must be prepared to a high degree of accuracy, however they cannot replicate the experience of seeing a wind farm in a landscape. It is important to visit the site of a proposed wind farm as part of the VIA. However these tools are important as predictions made without the benefit of visualisations and visibility maps are unlikely to be accurate.

3. Assessing the impact of wind farms on landscape values

The critical questions investigated to examine current practice in assessing the impact of wind farms on landscape values are:

- Q3.1 How do wind farms impact on landscape values?
- Q3.2 How should the landscape impact of individual wind farms be assessed and evaluated and assessed?
- Q3.3 How should communities provide input to the assessment of wind farm impacts on landscape values?

Q3.1 How do wind farms impact on landscape values?

Outline of the issue

- The 2005 Stage 1 Report identifies that wind farms have a range of impacts on landscape values, including landscape character and scenery; Indigenous cultural values; amenity; cultural heritage; contemporary cultural values and sense of place.
- These impacts are identified as being influenced by the wind farm's location; the height of towers and turbines; the number of turbines; movement; colour and materials; and ancillary infrastructure.

Current practice

Characteristics that influence impacts

The 2005 Stage 1 Report identified a number of factors which influence the impact of wind farms on landscape values. These are summarised as follows.

Location

Wind energy facilities are planned for locations in which take advantage of available wind resource and proximity to electricity transmission infrastructure. In most Australian examples these have included locations on or near the coast, in open inland areas or on ridgelines. All of these environments tend to be highly visible and often (particularly coastal areas) exhibit other natural and cultural values (e.g. recreational use, Indigenous sites, migratory bird species, scenic landforms etc.).

High-wind environments are also found offshore. Although wind farms have been developed offshore in other countries (most notably in Europe) to take advantage of this, no offshore wind farms have as yet been built in or proposed for Australia.

The height of towers and turbines

Turbines built in Australia are typically up to 120 metres high, consisting of a tower height of 50–80 metres with rotor blades of up to 40 metres long above that. The height of individual turbines can make them visible for long distances, and they can be prominent features on the horizon when viewed with the sea or sky as a backdrop. The turbines can also stand in dramatic contrast with the height of features of the surrounding landscape.

The number of turbines

Groups of wind turbines offer the opportunity for greater power output with reduced infrastructure requirements per megawatt of installed capacity. But, just as individual turbines can be dominant landscape elements by virtue of their height, collections of turbines can be highly visible because of the combination of their height, repeating elements and the geographical area they cover.

Lothian (2006) assessed the responses to photographs of constructed scenes containing between 6 and 13 turbines. With this scale of difference, no clear trend for the influence of number of turbines on visual preference was identifiable.

The largest approved wind farm in Australia is Macarthur with a total installed capacity of 329MW (approximately 180 turbines), while the largest installed wind farm is Walkway in Western Australia, with 54 turbines.

Movement

Wind turbines differ from other types of development in the landscape because they have large moving parts—the rotor blades—which naturally draw the eye. Numerous functioning turbines can have a particularly strong visual impact. The moving rotors also produce some noise, which, although only audible when one is close to the turbines, could affect some people's enjoyment of a place. Noise levels are, however, regulated by standards, planning controls, and environment protection authority requirements and are beyond the scope of the recommendations of this Project.

Colour, materials and lighting

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

In some cases, the mandatory installation of aircraft warning lighting has caused significant impacts. In others, a condition of permit has been that no lighting be added to the turbines or other infrastructure.

Implications for Assessment Framework

Accurate description and identification of all wind farm attributes will need to be made in order to inform impact assessment.

Technological and feasibility constraints on the size, type and nature of infrastructure (including turbines) should also be considered.

Ancillary infrastructure

Several studies indicate that ancillary and supporting infrastructure – such as roads, transmission lines and substations – can have a considerable impact on the landscape values of a proposed wind farm site, in particular on visual and scenic values.

To a large degree current practice for identifying landscape impacts focuses on the turbines themselves, which by virtue of size and number have a larger scale of impact on landscapes than supporting infrastructure. Further, the assessment of the landscape impacts of ancillary infrastructure is usually not mentioned in the scope of work for most wind farm assessments, except by implication.

However many studies have identified substantial landscape impacts contributed to. While wind turbines themselves might benefit from a 'scenic interest' element, no such aesthetic benefit is associated with the more ubiquitous and / or industrial ancillary infrastructure such as transmission lines, substations and roads etc (Gipe, 1996; Inspiring Place, 2002). Indeed, not only do these elements have their own visual and landscape impacts, but if poorly designed and sited, they may also detract from the aesthetic of the wind farm itself and therefore contribute in a substantial way to the relative acceptability of the wind farm itself.

Implications for Assessment Framework

Landscape assessment should include a review of the potential visual and landscape impacts of (at least) transmission lines, roads, substations and any permanent buildings to be located on the site, and make recommendations as to their appropriate design and siting.

Cumulative impacts

Landscape and visual impacts can also be cumulative. Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts of wind farms on landscapes, including:

- combined visibility (whether two or more wind farms will be visible from one location);
- sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail);
- the visual compatibility of different wind farms in the same vicinity;
- perceived or actual change in land use across a character type or region; and
- loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

Australian wind farm landscape and visual impact assessments have in only a few cases considered cumulative landscape impacts. The Victorian Planning Panels held that developments that have not been approved are not relevant to analysis of landscape capacity (Bald Hills p. 126). That is, it is not appropriate to speculate on the potential cumulative impact of an unapproved scheme as it may never be approved, but that cumulative impact assessment of the current scheme (if approved) should be undertaken to account in considering cumulative impacts of the future scheme.

Alternative policy guidance from state governments has directed developers to report on potential cumulative impacts with other wind farms in 'public knowledge' to assist in decision-making where several wind farms are being considered at once.

In the UK, cumulative impact is to be taken into account in considering applications for consent, recognising the increasing rate development of on-shore wind farms means cumulative impact is becoming more pertinent (SNH, 2005).

Cumulative impacts may also occur where there are no other wind farms in the area, but by virtue of combination with other landscape changes which alter the overall character or values of an area (e.g. through rate or scale of landscape changes). No examples of perceptions research undertaken for such cumulative landscape impacts were available for this review.

Implications for Assessment Framework

It will be relevant for assessment to consider all dimensions of potential cumulative impacts on landscapes, when considered with other wind farms or different development types in the area.

Positive landscape impacts or landscape benefits

Wind turbines are said to be a powerful symbol in the landscape, exhibiting a modern design aesthetic that may itself be valued.

The 2005 Stage 1 Report defines positive landscape benefits of a wind farm as potentially including:

- Aesthetics – The clean lines of the turbines, their contrast with the landscape and the uniformity of their appearance; sleek aerodynamic and sculptural forms; starkness and modernity of design; consistency and repetition of features; a sense of order; a strong presence.
- Symbolic – A symbol of new technologies and sustainable electricity production. Some people welcome the 'machine element' of a wind farm in the landscape and see it as an example of humans working in harmony with nature.
- Function – deriving from their ability to provide a public good (electricity) using renewable means.
- Substitution – the trade-off with alternative developments that produce the same product by different means and often in different locations.

The Portland Wind Energy Project (Planning Panels Victoria 2001) suggests that wind farms in a highly modified cultural setting cause less damage than in a 'natural' setting and may actually improve the landscape. Lothian (2006) identified that in certain inland areas of South Australia (those with low 'scenic quality') the addition of a wind farm may in fact improve an individual's impression of the scenic or visual values of that landscape.

Landscape benefits are not the same as providing off sets or landscape improvements in addition to the wind farm development to improve its overall acceptability (e.g. rehabilitation, restoration or other management measures). These are addressed in Section 4 of this report.

Implications for Assessment Framework

Consideration, evaluation and reporting of positive impacts of wind farms on landscapes should be made in assessment processes.

Conclusions

- Landscape impacts of wind farms can be direct, indirect, cumulative; of short or long duration.
- Landscape impacts of wind farms can be positive or negative.
- Wind farms have unique impacts associated with their size, location, potential for positive landscape benefits and other characteristics that mean they need to be considered differently to other land uses, such as other industrial land uses.

Q3.2

How should the landscape impact of individual wind farms be identified and assessed?

Outline of the issue

- Various approaches are currently used to identify and rate the relative impact of a development on established values.
- Evaluation of the level of impact (positive or negative) is essential to making decisions about the acceptability of the wind farm, and the need for measures to mitigate impacts.
- Transparency and rigour will be important to back up conclusions about impact as these will have major implications for the ultimate acceptability of the wind farm, and the application of mitigation measures.

Current practice

Relevant considerations

Environmental impact assessments in Australia and overseas take a range of factors into consideration in rating the potential impacts of wind farms on landscape values.

At a general level, landscape impact assessment evaluate and identify the severity of an impact by using a a combination of:

- the significance of the underlying landscape value (e.g. high moderate or low 'scenic quality'); and
- the degree of impact (e.g. through objective measures such as distance from viewers etc.)

Primarily, the assessments reviewed in this study used descriptions of scenic or visual character to define the significance of landscape values on which the wind farm might impact. Similarly, the degree of impact was typically defined using visual intrusion modelling, coupled with assumptions about the expectations of community members who will view the proposal.

Specific examples used in assessments reviewed in this study include:

- the underlying landscape:
 - existing character (degree of modification to the landscape, occurrence of features of high scenic quality);
 - sensitivity (landscape sensitivity is frequently used term and generally a factor the development type, and the underlying

character and significance of the landscape. Less sensitive landscapes are more able to accommodate a particular type of development without altering the character or values of that landscape.)

- environmental conditions (e.g. soil colour, erosion potential, slope);
- the nature of the development proposal:
 - scale, size
 - consistency (or otherwise) with existing character;
- viewing situation
 - number of viewers, viewing time,
 - distance from viewing;

Other factors sometimes taken into account include availability of mitigation options, costs of mitigation options and community input. The role of community members in assessing impacts is discussed further below.

Evaluating impacts

There is limited holistic work to understand and rate the impacts of landscape values, as defined by this study. What becomes clear is that the assessment of impacts against values established for the place is essential.

The use of matrices to assess impacts is common practice. These vary in complexity and in content. Scenic Spectrums (see for example Scenic Spectrums, 2005), which combines sensitivity and value by overlaying viewing distance (e.g. near foreground, middle foreground to far background) with assessment of scenic quality (defined by type and form of topography, vegetation, waterform and land use within a character area). This is closely related to the Visual Management Systems developed for forestry operations in the 1970s (and reviewed above). Closer locations with higher scenic quality, have the highest significance, and the most stringent management priority under this system.

In a local government study in the UK, the County of Lancashire identified several underlying factors affecting the sensitivity of the landscape to wind farm developments:

- physical (scale, openness, landform, land cover);
- perceptual (wildness / remoteness, degree of change);
- visual (views, skylines, distinctive backdrops); and
- value (rarity, designated scenic quality, artistic associations etc.).

These factors were rated across the entire shire, and appropriate locations for wind farm development identified (Lovejoy, 2005).

Implications for Assessment Framework

Consideration will need to be given in the National Assessment Framework to the identification of:

- the significance of the value that is being impacted;
- the degree to which the value is lost or altered;
- the duration and reversibility of the impact;
- the availability of mitigation measures; and
- evaluation by community members, ideally those involved in identification of values of the subject landscape.

Conclusions

- In understanding impacts, consideration should be given to several related factors: significance (value); sensitivity (the 'robustness' or otherwise of values to the proposed development); type, nature, scale of development (including all turbines, roads, ancillary infrastructure).
- An understanding of the characteristics of the development, as well as underlying landscape values and sensitivity are essential to assessing impacts.
- Negative impacts should be defined against a value established for the place.
- The evaluation of the acceptability of the wind farm as a whole will include consideration of the individual impacts, and their combined effect, as well as the wind farm's contribution to cumulative impacts on the landscape; the extent to which negative impacts are balanced by positive landscape benefits.
- It will be important to rate the acceptability of each impact, and of the impact of the wind farm as a whole.
- Impacts may be rated individually for different types of impacts on specific values. However, a conclusion of the overall combined impact of the wind farm on landscape values (including any balancing positive benefits) will need to be reported.

Q3.3

How should communities provide input to the assessment of wind farm impacts on landscape values?

Outline of the issue

- Direct input from affected communities is important in understanding impacts on landscape values, particularly those communities involved in identifying the values of the place.

Current practice

Given the central role of local and other communities in understanding values, it follows that a involvement of community members in impact assessment will also be important, supported by information from consultants and the proponent.

Community involvement in wind farm assessments reviewed in this study varied in the extent to which communities are engaged in considering impacts. It is common practice for environmental impact assessments to be made public and reviewed by community members, though this is often late in the process.

In virtually all cases, visual and landscape assessments set out to report on impacts on values that are held by community members (whether these values are defined by direct community input, or through professional assessment or in combination). The degree of community input to evaluating impacts themselves, however, varies. Some methods used to assess impacts on landscape values apply conclusions derived from social research different 'sensitivities' to different types of communities (e.g. locals, tourists, workers, land owners). However, these assumptions have been criticised in cases where the research or conclusions underlying them are limited, or sourced from locations remote to the subject site.

In Victoria, the Portland Wind Energy Panel EES process also highlighted the importance of community consultation in landscape impact assessment, and in the siting and design of the wind farm development. The importance of effective consultation with the community is emphasised by a number of essays in the recent publication *Wind Power in View - Energy Landscapes in a Crowded World*, by Pasqualetti et al. Community consultation has a valuable role in informing the visual impact assessment process, in testing the results, in informing the community about wind energy projects and allaying fears in relation to potential impacts. However, perhaps even more important is the involvement of the community in the wind farm design process, and the ability in some cases to respond to individual concerns as a result of the consultation process.

Some assertions are made in literature and consultation that the perceived landscape impact is affected by how a person perceives the overall benefit of the wind farm. How this focus is interpreted differs between viewers with some enjoying the experience and others perceiving it as an intrusion and damaging to the landscape.

Communities may also vary their impression of impacts depending on the availability (and suitability) of mitigation measures. This is discussed further below.

Implications for Assessment Framework

- Direct input from affected communities is important in understanding impacts on landscape values, particularly those communities involved in identifying the values of the place.
- Adequate information about the development and understanding of values need to be provided to community members
- The research and methodological basis for claims about public perception or sensitivity to change should be made utterly transparent if they are to be relied upon to understand impacts.

Conclusions

- Direct input from affected communities is important in understanding impacts on landscape values, particularly those communities involved in identifying the values of the place.
- Given that direct input from affected communities is important, careful consideration needs to be given to the way they are involved, taking into consideration the provision of adequate and accurate information, the opportunity to discuss other (non-landscape) issues of interest to community members.

4. Managing the Impact of Wind Farms on Landscape Values

The critical questions investigated to examine current practice in describing and modelling the wind farms in the landscape:

- Q4.1 How can identified impacts on landscape values be avoided, minimised or mitigated?
- Q4.2 How should communities be involved in determining appropriate mitigation measures?

Q4.1 How can identified impacts on landscape values be avoided or mitigated?

Outline of the issue

- Various to avoid, minimise or mitigate landscape impacts identified in the subject landscape.
- Recommendations can be of varying degrees: from ex-situ offsets, to localised screening and other measures, through to substantial changes to the location or design of the wind farm, to avoidance of the proposed site altogether.
- The degree of action to mitigate impacts should respond to both the magnitude of the likely impact, and the significance of the value or values being impacted upon.

Current practice

Two broad approaches to mitigating impacts are used in current practice:

- Respond directly to the impact by avoidance or other steps which remedy or minimise the impact on the value of concern.

- Provide other (e.g. off-site) remedies or benefits which balance the impact (this may include enhancing or celebrating any positive landscape benefits of the proposal itself).

Note: consideration of the acceptability of the landscape impacts of the wind farm when balanced against other (non-landscape) benefits (e.g. clean energy, economic benefits) is not addressed in this study. These are factors relevant to more general consideration of all impacts and benefits through a development approvals process.

Mitigation hierarchy

Various strategies are used to address impacts of wind farms on landscapes. These approaches are ordered in accordance with the degree to which they may affect the viability of the proposal (most to least), although this will vary from development to development.

- Changes to the location of the wind farm as a whole;
- Changes to siting of turbines within the proposed wind farm site;
- Changes to the scale, size, height of turbines;
- Changes to location or siting of ancillary infrastructure;
- Design of turbines (including colours, materials, logos, lights);
- On-site landscaping;
- Off-site landscaping;
- On-site landscape improvements; and
- Remote off-sets.

Mitigation options

Site selection and location

The scale of wind turbines ensures that mitigation options are inherently limited in effectiveness. Planning panels have emphasised that some landscapes are so significant and so sensitive that a mitigation strategy of avoidance is warranted (Bald Hills).

Siting and layout

Once it has been determined that a site is appropriate for the development of a wind farm, there are a number of strategies that have been employed to mitigate the landscape and amenity impacts.

In South Australia, a government committee (ERDC, 2004) looking at wind farm assessment recommended some blanket mitigation considerations for wind farms including buffer zones and setback distances to reduce the impact of wind farms including visual, blade glint and shadow flicker.

Changes to siting can also enhance the visual acceptability of impacts, by improving their legibility. These strategies include rectilinear, linear or geometric siting patterns. The employment of this strategy is highly dependent on the topography and landscape.

Size, scale, height

Another strategy is reducing the size of turbines. This strategy is in most cases not an option. Smaller numbers of larger turbines are more efficient, generating more electricity for the investment when compared to larger numbers of smaller turbines. Indeed wind farms are often not economically viable if the turbine design is altered. The size of turbines may be seen as an engineering constraint. In addition, panels have concluded that from a landscape and amenity perspective it is smaller numbers of larger turbines are preferable. (Bald Hills, p.125)

However, Bishop (2001) notes that reductions in size of turbines does not necessarily equate to a reduction in perceived size or lessened visual impact.

Landscaping / screening

Screening wind farms from key vantage points is a way of lessening the landscape and amenity impact. Panel reports have included screening programs as a condition of planning approval. These programs are typically a voluntary program of screening that is developed in conjunction with nominated landholders and is at the proponent's expense. This may include planting outside the property boundary of the nominated landholders.

Other measures

Other measures which do not respond directly to impacts might also be considered, including landscape improvements in and around the wind farm site or off-sets (the protection or management of other landscapes). However, these should not be considered to mitigate identified impacts.

Decommissioning

The 2005 Stage 1 report posed the question as to whether impacts might be mitigated by the reinstatement of the landscape at some future point in time, following decommissioning of the wind farm. In current practice reviewed in this study, little emphasis has been placed on decommissioning in considering impacts (very few assessments raise decommissioning and reinstatement of the landscape, and only one public review process was found to have addressed the question).

Decommissioning is seen as having lesser weight because:

- The life of wind farms (around 20-25 years) itself is a substantial (generational) impact;
- There is uncertainty as to the regulatory situation in the future;
- It is unclear whether the wind farm will set a precedent for landscape change that will affect the way land use decisions are made for that place in the future.

It is possible, however, for decommissioning and reinstatement of the landscape to be required as a permit of approvals. Many wind farm developers set up trust funds to provide for the decommissioning and / or reconditioning of the facility.

Implications for Assessment Framework

All of the above measures may be relevant to assist the avoidance, minimisation or mitigation of impacts on landscape values.

Consideration of mitigation measures should take into account the extent to which they address the impact of concern, and in order of their likely impact on the viability of the proposal.

Decommissioning of the wind farm should be given low weight (if any) in assessing impacts on landscape values.

Conclusions

- The development of management and mitigation measures will be iterative, responding to the identification of impacts, the identification of potential solutions to these impacts, and the testing of the acceptability of solutions with communities, proponents and Government authorities.
- Impact ought to be mitigated using the approach most appropriate to remedying that impact. Where two or more mitigation measures are appropriate, the measure with least impact on the viability of the proposal will be preferred.
- In cases where changes to the location of the wind farm itself or the siting of turbines or ancillary infrastructure are required in order to mitigate an impact, these should be identified and reported early on.

Q4.2 How should communities be involved in determining mitigation measures?

Outline of the issue

- The extent to which communities are currently involved in identifying and responding to mitigation options varies.
- Many other factors contribute to the appropriateness and viability of mitigation options, including technical and other constraints.

Current practice

The process of developing revised options for a development is complex and takes into account a range of factors, of which landscape values and community concerns are part.

However, the ongoing involvement of communities in understanding how impacts have or might be responded to is important for transparency of decision making, for continuity of involvement, and to ensure that proposed changes to the development respond effectively to community concerns.

Some good examples of ongoing community liaison by developers in finalising their layout options have been described for this study. These tend to involve open and transparent processes of engaging with stakeholders to explain how concerns have been listened to, and identify where changes have been made in response, and where they have not (because of technical or other constraints).

Lack of transparency and engagement by some has also been substantially criticised, particularly where this ends up in tribunal or court cases which by virtue of cost can be prohibitive for communities to pursue their concerns.

A clear area of improvement in the documents reviewed by this study is the reporting of community input to changes to the development, particularly where these changes are intended to respond (in whole or in part) to community concerns. It is essential that consultants and developers articulate the extent to which changes to the development remedy impacts on values (and on which values this has occurred), and also any residual community concern.

Technical and other constraints which influence mitigation measures also need to be reported on and communicated to community members.

Implications for Assessment Framework

Provide opportunities for the continued involvement of affected communities in addressing (mitigating) impacts, particularly where they have been involved in their identification.

In involving communities in understanding mitigation measures, provide sufficient information to communities about technical and other constraints which influence options which can be pursued.

Require full and adequate reporting of community input, and any residual community concern.

Conclusions

- Direct community involvement in understanding and responding to mitigation options is important for transparency of decision making, for continuity of involvement, and to ensure that proposed changes to the development respond effectively to community concerns.
- However, this does not necessarily mean that members of affected communities will have a direct say in developing options. This is unnecessary given they will lack the skills and knowledge of other constraints necessary to produce such options.

- It is essential that consultants and developers articulate the extent to which changes to the development remedy impacts on values (and on which values this has occurred), and also any residual community concern.
- It will be important to further explore these concepts in consultation.

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