CLEAN ENERGY COUNCIL

BEST PRACTICE GUIDELINES

For Implementation of Wind Energy Projects in Australia

June 2018

Acknowledgements

The Clean Energy Council (CEC) would like to acknowledge the support of the Australian Greenhouse Office which funded the preparation of the original AusWEA Best Practice Guidelines 2002 under the Industry Development Component of the Renewable Energy Commercialisation Project. This version of the Guidelines is an update and revision of the 2006 update of the Best Practice Guidelines.

The CEC wishes to thank Entura for its work on developing these updated Guidelines, its member companies who provided input into the Guidelines and in particular the Best Practice Guidelines subcommittee for their efforts on revising and updating the Guidelines.

Disclaimer

Executive summary

This 2013 version of the Clean Energy Council's Best Practice Guidelines for the Australian Wind Industry is an update of the original guidelines, released in 2006.

The update has modified and edited information to ensure currency and revised the birds and bats appendices from the previous version into one appendix that covers all ecology considerations.

This update has also coincided with the development of Community Engagement Guidelines for the Australian Wind Industry.

The Guidelines are intended to be practical and are designed primarily for use by wind farm proponents, owners and operators. The Guidelines are also designed to assist people involved in the planning process, and the general community. The Guidelines aim to help the industry and stakeholders understand the wind farm development process and provide confidence in the level of rigour that can be expected of proponents when preparing a wind farm proposal for development approval.

The Guidelines focus on the planning, approval and operational aspects of onshore wind farms, although sections of the document may be relevant for offshore wind farms. Inclusion of guidance specific to offshore wind farms will be considered by the CEC if required in the future.

The Guidelines cover the following stages of wind farm development:

1. **Identification of stakeholders and approvals pathways**
2. **Site Planning**
   a. Site selection
   b. Project feasibility
   c. Detailed assessment
   d. Planning and environmental approvals
   e. Development application decision
2. **Site Operations**
   a. Construction
   b. Wind farm operation
   c. Decommissioning

The goal of each stage is to identify what is required of a "Best Practice" development, while also acknowledging that each wind energy development will be unique and require assessment on its individual merits. The Guidelines are based on what is best practice for a "typical" project, acknowledging that projects can range from a single small capacity wind turbine to a utility scale wind farm with many large capacity wind turbines. The aim of the Guidelines is to describe the environmental, amenity and stakeholder consultation aspects of the planning, approval and operational aspects of wind farms. Consideration of technical/commercial and contractual aspects are also included where the issues are of public interest.

The Guidelines do not replace existing energy or environmental planning legislation, policy or regulations at local, state or federal levels but can be used to support these assessments. Project proponents must ensure they are developing their project according to the current legislation, policy and/or regulations relevant to the location of their project.

The exact timing of the various activities outlined in these Guidelines will vary according to the individual site parameters, jurisdictional requirements and each proponent's internal systems. As a result, no attempt has been made to provide a list of requirements or a schedule that can be universally applied to all developments equally. The proponent will always need to investigate specific timing requirements that may relate to a particular site and address these appropriately during the development process.

Similarly, the Guidelines do not attempt to comprehensively identify all approval pathways and/or approval timelines across Australia given that these are not only subject to change, but can vary immensely based upon the jurisdiction and the nature, scale, location and potential impact of the development.

Information in the main document is supported by appendices which contain additional information on key areas relevant to wind farm development. These are:

- **Appendix 1** - Glossary
- **Appendix 2** - Native title and cultural heritage
- **Appendix 3** - Useful websites
- **Appendix 4** - Aircraft safety
- **Appendix 5** - Landscape assessment
- **Appendix 6** - Noise
- **Appendix 7** - Ecological assessment (Combined Birds and Bats appendices 8 and 9)
- **Appendix 8** - Fire management guidelines
- **Appendix 9** - Electromagnetic interference (EMI)
- **Appendix 10** - Wind turbine standards
- **Appendix 11** - Environmental Management Framework
- **Appendix 12** - Wind energy reference publications

The appendices of the Guidelines refer to different legislation, regulations and policy requirements that exist for wind farms throughout Australia, rather than prescribing specific methodologies for assessments or studies. The requirements, or the most appropriate methodologies, often differ depending on the project location and specifications. Such requirements and methodologies would be sourced by proponents from expert consultants and planning authorities.

Although the principles behind the Guidelines should remain the same for every development, the work required by a proponent in project design and technical and environmental assessments will vary from project to project.

Commitment to the Best Practice Guidelines

The Clean Energy Council (CEC) is committed to developing a robust Australian wind community that makes a significant contribution to safe, reliable, economically and environmentally sustainable energy supply.

The CEC represents the Australian wind community and promotes the sensitive and appropriate growth of wind energy in Australia.

Attributes of a Best Practice Wind Farm

▶ Safe

The wind farm will not negatively affect the health and safety of the community, its employees, contractors and other stakeholders during its development, construction, operation and decommissioning.

▶ Socially sustainable

The wind farm proponent will actively seek stakeholder participation and support through well-planned, open, inclusive and responsive engagement processes.

The proponent will ensure sound and consistent methodologies are applied to assess and identify the most appropriate siting of the wind farm for landscape, amenity and environmental impacts.

▶ Economically sustainable

The wind farm will make a positive economic contribution to the community in which it is located.

▶ Environmentally sustainable

The wind farm will be sensitive to the environment. Any significant negative impacts will be avoided or minimised and appropriately managed or offset as required during its development, construction, operation and decommissioning.

The wind farm will make a positive contribution to the environment by producing clean energy and therefore also reducing the production of greenhouse gases from fossil fuel fired power stations.

▶ Reliable

The wind farm will supply clean electricity into the grid in accordance with the relevant industry standards.

Table of Contents

1. Introduction 3

1.1 The Clean Energy Council 4

1.2 The best practice guidelines – background 4

1.3 Principles underpinning the Guidelines 5

1.4 Implementing the Guidelines 6

1.5 Guideline themes 7

1.6 Structure of the Guidelines 8

2 Approvals, consents & stakeholder liaison 9

2.1 Approval pathways 10

2.2 Land owner consent 10

2.3 Regulatory authorities 11

2.3.1 Commonwealth government 11

2.3.2 State government 11

2.3.3 Local authorities 11

2.4 Community consultation 12

2.5 Other stakeholders 12

2.5.1 Native title and cultural heritage 13

2.5.2 Emergency services 13

2.5.3 Network Service Providers and regulators 13

2.5.4 Electricity Retailers 14

2.5.5 Local Infrastructure Agencies 14

2.5.6 Other third party land use groups 14

3 Stages of development 15

3.1 Site selection 16

3.1.1 Technical considerations 16

3.1.2 Environmental considerations 18

3.1.3 Communication and consultation 20

3.2 Project feasibility 21

3.2.1 Technical Considerations 21

3.2.2 Environmental considerations 23

3.2.3 Other Considerations 23

3.2.4 Communication and consultation 24

3.3 Detailed assessment 25

3.3.1 Technical considerations 25

3.3.2 Environmental considerations 26

3.3.3 Communication and consultation 27

Table of Contents

3.4 Planning and environmental approvals 28

3.4.1 Application process 28

3.4.2 Conditions of approval 28

3.5 Construction 29

3.5.1 Technical considerations 29

3.5.2 Environmental considerations 29

3.5.3 Contractual considerations 30

3.5.4 Communication and consultation 30

3.6 Wind farm operation 31

3.6.1 Technical considerations 31

3.6.2 Environmental considerations 31

3.6.3 Communication and consultation 31

3.7 Decommissioning 32

Appendices 33

Appendix 1: Glossary 34

Appendix 2: Native title and cultural heritage 38

Appendix 3: Useful websites 46

Appendix 4: Aircraft safety 48

Appendix 5: Landscape assessment 49

Appendix 6: Noise 50

Appendix 7: Ecological assessments 53

Appendix 8: Fire management guidelines 59

Appendix 9: Electromagnetic interference 61

Appendix 10: Wind turbine standards 63

Appendix 11: Environmental management framework 67

Appendix 12: Wind energy reference publications 68

Introduction

1

1.1 The Clean Energy Council

The Clean Energy Council (CEC) is the peak body for the renewable energy and energy storage industry in Australia. It is an industry association made up of hundreds of member companies operating in the fields of renewable energy.

The CEC's members are involved in the development or deployment of clean energy technologies such as cogeneration, energy efficiency, geothermal, hydro, solar, solar hot water and wind energy.

The CEC is an incorporated not-for-profit association which is based in Melbourne and operates nationally. It is funded principally by membership fees, with additional income generated by events and activities. It provides a variety of services to members but its primary role is to develop and advocate effective policy to accelerate the development and deployment of all clean energy technologies.

The CEC also promotes awareness of supported industries, provides leadership and clean energy business opportunities through industry events, meetings, newsletters, directorates and the media. The CEC reports to a board elected by its members.

1.2 The Best Practice Guidelines – background

The CEC recognises the importance of ensuring that wind energy facilities are appropriately and sensitively sited, developed and operated from an environmental and community perspective.

In late 2000, the need for a national wind industry best practice document was identified. AusWEA, a predecessor or the CEC, produced the first edition with the assistance of the Australian Greenhouse Office, the Federal Government's peak body on greenhouse matters.

The first edition of the Best Practice Guidelines was drawn up with the participation of a broad range of external organisations that held an interest in wind farm developments. The aim was to facilitate the development of high quality wind energy projects. An important role of this document was to guide the proponent through the steps required to develop a wind farm project.

This edition of the Guidelines has been updated following a technical review and liaison with the industry. The CEC recognises the importance of ensuring wind energy projects continue to be developed in a sensitive and appropriate manner - one that not only takes into account the concerns of all stakeholders, but ensures that the development meets the current expectations of both the regulators and the wider community.

The Guidelines build on the experience gained by CEC members and have been benchmarked against guidelines from other regional and international wind development associations. This ensures that all relevant issues are identified and addressed within the Guidelines, and approaches consistent with those taken in other regions are demonstrated where appropriate.

During the preparation of these Guidelines, the following documents were reviewed:

- *Sustainability and Due Diligence Guidelines – World Wind Energy Association* (2005)
- *European Best Practice Guidelines for Wind Energy Development* (2002)
- *Wind Energy Development Best Practice Guidelines – Irish Wind Energy Association* (2008)
- *Best Practice Guidelines for Wind Energy Development – RenewableUK* (formerly British Wind Energy Association) (1994)
- *Best Practice Guidelines: Consultation for Offshore Wind Energy Developments – RenewableUK* (formerly British Wind Energy Association) (2002)
- *Policy and planning guidelines for development of wind energy facilities – Department of Planning and Community Development* (VIC) (2011)
- *Draft NSW Wind Farm Planning Guidelines – Department of Planning and Infrastructure* (NSW) (2011)
- *Draft National Wind Farm Development Guidelines – Environment Protection Heritage Council* (2010)

The CEC is committed to promoting responsible activity and development within the Australian wind energy industry, and expects that member wind farm companies will fulfil the spirit of the guidelines, as well as seeing them as a valuable reference throughout the process.

Principles underpinning the Guidelines

1.3

The Guidelines are intended to be practical and are designed primarily for use by wind farm proponents and operators.

They only cover those issues that are the responsibility of, and can be controlled by, the proponent or operator. Throughout the Guidelines, the term 'proponent' is used to refer to proponents, developers and operators of wind farms. However, the Guidelines can also assist the general community and regulators to understand and have confidence in the process undertaken by proponents when preparing a wind farm development proposal for approval.

The Guidelines are written for the development of onshore wind farms, although sections of the document may be relevant for offshore wind farms. Offshore wind farms have not been specifically included as currently there are no offshore wind farms constructed or being planned in Australia. The inclusion of guidance specific to offshore wind farms can be considered by the CEC if this is required in the future.

The Guidelines emphasise the environmental and amenity aspects of the planning, approval, operation, decommissioning and rehabilitation phases of the wind farm life cycle. Consideration of technical, commercial and contractual aspects are also included in these Guidelines.

Any guidance in relation to stakeholder consultation provided here relates to specific environmental and amenity aspects. The reader is encouraged to read the CEC's "Community Engagement Guidelines for the Australian Wind Industry (2012)" for a broader understanding of the consultation process.

The Guidelines do not replace existing energy or environmental planning legislation, policy or regulations at local, state or federal government levels, but can be used to support these assessments. They acknowledge that each wind energy development will be unique and will require assessment on its individual merits. The exact timing of the various activities outlined in these Guidelines will vary according to the individual proponent's preferred approach and in addition various activities may not be required for all wind farm projects. As a result, no attempt has been made to define exact project specifications or provide a schedule that can be universally applied to all developments equally. The proponent must investigate specific issues relating to a particular site and address these during the development process.

Similarly, the Guidelines do not attempt to comprehensively identify all approval pathways and/or approval timelines across Australia. These are not only subject to change, but vary immensely based upon the nature, scale, location and potential impact of the development.

Although the principles behind the Guidelines should remain the same for every development, the work required by a proponent in project design, environmental assessment and stakeholder consultation will vary from project to project. Perhaps the most basic principle is to follow the basic hierarchy of environmental management – avoid, minimise, and then (where necessary and specified through legislation) offset significant negative impacts. If a significant negative impact cannot be successfully avoided, mitigated or offset when following best practice principles, the proponent will need to reassess the project.

The Guidelines recognise that some wind energy developments are built as single one-off projects, possibly by a landowner, and others are built by specialist companies that may be looking to develop a number of sites. While the Guidelines ensure proponents consider the issues relevant to the development of an individual site, they also take into account the possibility that other locations may need to be investigated.

1.4 Implementing the Guidelines

The Guidelines are intended for use by assessment authorities as well as proponents as a best practice reference point. Although industry adherence is voluntary, the CEC's members are committed to taking the Guidelines into consideration during their activities. The CEC also invites local planning authorities to promote adherence to the Guidelines, in order to encourage appropriate wind energy development.

The Guidelines are available from the CEC website and will be a live controlled document that the CEC and its members can agree to update as required. The document will also undergo a review every five years to ensure changing technical, environmental and social circumstances are covered by the Guidelines. As part of its goal to foster responsible renewable energy development throughout Australia, the CEC invites comments on the Guidelines via info@cleanenergycouncil.org.au.

Regardless of whether project teams are resourced internally or largely outsourced, proponents are urged to base the project pocesses on quality, environmental and safety management systems such as those outlined in the Australian Standards AS/NZS ISO 9001 (quality), AS/NZS ISO 14001 (environmental) and AS/NZS ISO 18001 (safety). Also, the AS/NZS ISO 31000 standard contains principles and a generic set of guidelines on risk management which can be used by proponents to manage the development and approvals process. There is a strong need for competent project management, programming and coordination from the early site evaluation stages right though to decommissioning or refurbishment, and these competencies are best supported by robust management systems.

Guideline themes

1.5

Each phase of project development is discussed within the Guidelines in the context of the following broad themes:

Technical

This relates to the various technical aspects of the development such as wind speed, site access, infrastructure, electrical connections, construction issues and the proponent's analysis of the economic viability of the project.

Environmental

Consideration is given here to the various environmental aspects of development such as birds, bats, flora, cultural heritage, shadow flicker, and visual impacts. The Guidelines discuss all potential environmental and planning approval requirements for assessing the impacts on the environment and nearby amenity. The selection and development of sites will depend heavily on these aspects, and the ability to avoid, reduce, or if possible, offset any impacts.

Preliminary environmental assessments will assist in the initial site selection phase and should then be followed with detailed studies as part of the planning permit application. Environmental assessment provides essential inputs to the detailed design of the wind energy project. Altering wind farm design to balance impacts on the environment and amenity is an iterative process requiring continual re-evaluation and consultation throughout.

Dependent upon conditions of approval, environmental considerations will extend to the operation of the wind farm and final site decommissioning and rehabilitation.

Consultation

Consultation between the proponent and stakeholders during the whole life of the project is required. Stakeholders who should be consulted include the local community, planning authorities, local government and other regulatory agencies.

Consultation with the local community and local interest groups is very important during the development of a wind farm. Separate community engagement guidelines, the Community Engagement Guidelines for the Australian Wind Industry (2012), are available on the CEC website.

Contractual

Some broad issues elating to contractual agreements that should be investigated are identified where appropriate.

1.6 Structure of the Guidelines

The Guidelines are composed of a main document and a series of appendices. Within the main document:

- **Section 2** provides a broad description of the approval process, regulatory agencies and other stakeholders who should be consulted during the development of a project.
- **Section 3** addresses the part of project development where formal interaction with stakeholders is required. It is intended to be directive where required or appropriate.

The Guidelines follow a chronological path through a sequence of development stages as shown in the following table.

Project Stage	Key Activities
Site selection 3.1	To ascertain the wind resource in the area (typically through a desktop assessment)
	To ascertain whether there are any critical impediments that would prevent development at the site
	To select a preliminary site boundary and negotiate with landowners
	To select a preferred development solution and to develop a preliminary indicative site design
Project Feasibility 3.2	To undertake high level desktop investigations into site constraints and regulatory/approval processes that will enable refinement of the development
	To gain a high level understanding of the likely costs of the development
	To perform onsite wind monitoring
Detailed Assessment 3.3	To undertake detailed site-specific investigations to enable assessment of the impacts of the project and optimisation of the wind turbine layout
Planning and Environmental Approval 3.4	To prepare the documentation necessary for regulatory and community assessment of the project
	To undertake any necessary environmental referrals and primary development approval processes as required
Construction 3.5	To finalise the costs of the project and determine if the project is to proceed
	To finalise the design and produce construction drawings
	To prepare the required management plans in accordance with the conditions of approval prior to construction
	To obtain all pre-construction approvals and consents (i.e. building approval)
	To undertake construction of the project as approved and in accordance with the endorsed management plans
	To monitor compliance with any relevant conditions of approval and management plans during the construction phase
Operation 3.6	To undertake the operation of the wind farm in accordance with any operational conditions of approval and management plans
	To monitor compliance with any conditions of approval and management plans relevant to operation
Decommissioning 3.7	To identify whether the site is to be redeveloped (following the above process from Section 3.2) or decommissioned
	To decommission and rehabilitate the site in accordance with any relevant condition of approval or management plan
	To monitor compliance with any conditions of approval and management plans relevant to decommissioning

Approvals, consents and stakeholder liaison

2

2.1 Approval pathways

As mentioned earlier in section 1.3, the Guidelines do not attempt to comprehensively identify all approval pathways and/or approval timelines across Australia. These are not only subject to change, but vary immensely based upon the nature, scale, location and potential impact of t he development.

Approval for a wind energy facility may be required from a number of agencies or authorities, each assessing a different aspect of the development. The nature, number and complexity of these approval processes will vary depending upon the proposal and may rely upon detailed site investigations to confirm, for instance, the presence of a threatened species or the degree of noise risk. Dependent upon the jurisdiction, an environmental approval process at a state level may be necessary as well as a separate development approval at a local level.

Generally a development approval will include all activities on the site and necessary infrastructure, such as transmission lines and electrical substations, except where exempted under specific legislation. That said, some planning authorities may allow separate applications for different components to be made.

At a preliminary level during the site selection phase, broad consideration of likely approval pathways can be undertaken and may assist in ranking the sites under consideration for prioritisation.

Once a site is selected and a general project description is known, the need for various permits, their timeframes and legislative requirements may be better identified, thus providing a "road map" for project approval. In some cases, detailed assessment criteria may have to be provided by a regulatory agency upon application.

Once identified, the approval regime will need to be reviewed upon changes to the project as well as periodically to ensure that there have been no changes to relevant legislation.

Not only do the assessment processes vary across different jurisdictions, but so does the terminology of approvals. In these Guidelines, the term "planning and environmental approvals" is used to incorporate all land use and works permits necessary for the construction and operation of a wind energy facility. A "development approval" is the term used to describe the primary land use and works permit issued by the responsible planning authority.

2.2 Landowner consent

Prior to detailed investigation, consent to access the nominated land will need to be negotiated with the landowner.

In most jurisdictions, approval of the landowner is required as part of an application for development approval. If the proposal includes crown land then a separate assessment may be undertaken by the public land authority prior to providing this consent. Negotiations will lead to formal legal agreements for the life of the project.

Regulatory authorities

2.3

2.3.1 Commonwealth Government

Currently, planning and environmental approval at a Commonwealth level is only needed when projects are deemed to potentially affect matters of national environmental significance under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The EPBC Act identifies, conserves and protects places of national heritage significance and provides for the management of Commonwealth heritage places.

The following is a current list of key environmental considerations under the EPBC Act:

- World Heritage listed properties
- internationally important wetlands
- nationally threatened plant and animal species
- listed migratory species
- Commonwealth marine areas
- nuclear matters.

Where there is potential for a significant impact on a 'matter of national significance', or it is unclear whether a proposal may have a significant impact, the proponent should refer the project to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities for their assessment and decision on whether the project is considered a 'Controlled Action' (that is, deemed to significantly affect matters of national significance in which case a further assessment is required under the EPBC Act) or 'Not a Controlled Action'. Detailed information and administrative guidelines can be found at www.environment.gov.au/epbc.

Bilateral agreements between the Commonwealth and state governments allow states to assess compliance with the EPBC Act. Currently, all states and territories have signed agreements with the Commonwealth Government. The proponent should seek clarification in writing from both levels of government to ensure that the assessment process is well understood and agreed upon prior to any submissions being made.

The proponent will have to investigate any aspects of the project that are subject to scrutiny under the EPBC Act. Proponents should be aware that the Commonwealth can instigate legal action and financial penalties if they believe a matter of national environmental significance has been significantly affected by a development.

The National Airports Safeguarding Advisory Group, comprising high-level Commonwealth, State and Territory transport and planning officials, has prepared the National Airports Safeguarding Framework which includes Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation. This document also contains references to the relevant government agencies for aircraft safety including CASA, Airservices and the Department of Defence. Further information on the framework is provided in Appendix 4.

2.3.2 State governments

The degree of state government involvement in planning and environmental approvals will vary considerably from state to state and usually depends on the scale of the project or potential for environmental impact. Involvement may be directly through an assessment process as part of the development approval, and/or through assessment of specific issues by one or more government departments.

The structure of such departments and regulatory agencies varies widely between states. In addition to direct involvement, relevant government departments covering areas such as heritage, infrastructure, environmental protection, and natural resource management may be consulted by way of a referral. Some state governments also assist by way of production of state policies which provide guidance on the assessment of certain matters.

Where a state agency is the responsible authority, assessment guidelines are normally issued by the authority specific to the project after an initial application is made. These guidelines provide the scope of the detailed assessment for the application. This process is commonly called an Environmental Impact Assessment (EIA) or similar and, in some states, is used to assist and inform other decision makers in their considerations.

State agencies may also be involved if a proponent wishes to amend the local planning ordinance. If the state government is involved in the planning and environmental approvals for a project, discussions should be held with the relevant department/s early in the development planning process.

2.3.3 Local authorities

State planning legislation will designate the threshold when the local planning authority becomes responsible for development approval. These thresholds vary significantly from state to state. Usually the local planning authority is the local council. Local assessment may also be necessary in conjunction with state or federal assessment processes.

Councils are required to base their assessment on a local planning ordinance which may take the form of a planning scheme, local area plan, development control plan and the like. In addition, councils will be guided by relevant local and state policies and strategies. If a proposal is required to be advertised, public representations will also be considered in the decision-making process.

Local councils are usually also the responsible body for the issuing of construction permits for building and plumbing. Councils may also be involved by way of the need to issue permits for works on local roads or infrastructure and are usually aware of other activities that may be impacted by the development. Discussions should be held with the local authorities early in the development planning process.

2.4 Community consultation

The proponent should provide accurate and timely information to the public and community groups regarding the proposed development. A key feature of a well planned project is the provision of opportunities for timely and meaningful public involvement.

There will inevitably be a range of public attitudes towards any wind energy development, and these views should be considered in the design and development of wind energy projects. Community and other stakeholder consultation should continue throughout the life of the wind farm until it is decommissioned.

Wind companies recognise that community engagement is one of the foundations for the success of wind farms, therefore separate community engagement guidelines, the Community Engagement Guidelines for the Australian Wind Industry (2012), have been prepared and are available on the CEC website.

Other stakeholders

2.5

Some of the important stakeholders who should also be consulted during the early stages of project development are described in this section. It is not an exhaustive list and does not address every stakeholder that should be consulted for a particular site.

2.5.1 Native title and cultural heritage

Native title may exist in places where Indigenous people continue to follow their traditional laws and customs and have maintained a link with their country. Native title is extinguished on privately owned land.

Native title cannot take away anyone else's valid rights. If there is a pastoral lease or a fishing licence over an area where native title is found to exist, the lease or licence continues unaffected. If native title rights and other, non-native title rights (for example, those under the lease or the licence) come into conflict, the non-native title rights of the other person prevail. Where native title does exist at a potential wind farm site, seeking professional advice is highly recommended. The Native Title Act 1993 (Cwlth) sets out detailed rules that must be followed by those who do anything that affects native title. Background information provided by the National Native Title Tribunal is located in Appendix 2 and may also be obtained by visiting the Tribunal's website at www.nntt.gov.au.

Regardless of whether native title is extinguished or not, a registered native title group may exist and have an interest in a potential wind farm site. Proponents should identify any native title applications or determinations relating to the site.

Cultural heritage comprises the legacy of physical and intangible attributes of an indigenous group that are inherited and managed for the benefit of future generations. Protection of indigenous and non-indigenous cultural heritage is provided under the relevant state and/or national heritage legislation. Relevant indigenous and cultural heritage groups with an interest in the potential wind farm site will be identified by the proponent.

Further information on native title and cultural heritage management is contained in Appendix 2.

There will inevitably be a range of public attitudes towards any wind energy development, and these views should be considered in the design and development of wind energy projects. Community and other stakeholder consultation should continue throughout the life of the wind farm until it is decommissioned.

Wind companies recognise that community engagement is one of the foundations for the success of wind farms, therefore separate community engagement guidelines, the Community Engagement Guidelines for the Australian Wind Industry (2012), have been prepared and are available on the CEC website.

2.5.2 Emergency services

Emergency services in the vicinity of the project will need to be informed of the proposal. Consultation should be undertaken with emergency services (e.g. rural fire service), both regional and local, throughout the development prior to construction to work towards agreed emergency response actions and keep the relevant services informed of proposed locations for the wind development.

2.5.3 Network Service Providers and regulators

Network Service Providers (NSPs) are the owners of the electrical assets to which wind farms are connected. In the National Electricity Market (NEM) they may be a transmission company or a distribution company (regulated businesses under the Electricity Act). In Western Australia and the Northern Territory, which are not connected to the NEM, it could be an electrical utility or a small grid owner/operator which may or may not be regulated. There are also grids in the NEM states which are not connected to the NEM (e.g. Queensland and the Bass Strait Islands) which are covered by contractual arrangements. NSPs in the NEM are required under the National Electricity Rules (NER) to give electricity generators the opportunity to connect and have access to the network services provided by those forming the national grid.

In the jurisdictions connected to the NEM (all states other than Western Australia and the Northern Territory), access to the transmission and distribution network is managed by the Transmission Network Service Provider (TNSP) or Distribution Network Service Provider (DNSP), while the Australian Electricity Market Operator (AEMO) oversees the technical compliance with standards for system security purposes. The Australian Energy Market Commission (AEMC) manages the National Electricity Rules within the market and the Australian Energy Regulator (AER) monitors compliance. In states or territories not connected to the NEM (Western Australia and the Northern Territory), access to transmission networks is controlled by various Access Codes.

In Victoria AEMO is also responsible for planning of the transmission networks. In this regard AEMO provides the function of a TNSP and a proponent may need to negotiate with both AEMO and the asset owner. This planning role was formerly provided by VENCorp.

In addition to obtaining a connection to the grid, a licence to generate electricity may also be required from the relevant state/territory authorities depending on the size of the wind farm.

2.5 Other Stakeholders

2.5.4 Electricity retailers

Electricity generated within the NEM is generally traded on the electricity spot market; however, a power purchase agreement (PPA) may be negotiated with an electricity retailer or other electricity market participant. The PPA is a commercial vehicle that allows the generator and the retailer to agree upon an alternative electricity pricing formula.

2.5.5 Local infrastructure agencies

Dependent upon the details of the proposal, the involvement of local infrastructure bodies may be required. These usually cover issues such as access to roads, water and sewers. Issues of traffic and transport may involve both the state and local road authorities.

2.5.6 Other third party land use groups

Usually, there are a number of other potential land users who may have an interest in the development or may be impacted by the construction activities. It is recommended that these stakeholders be identified early and consulted with to ensure any potential issues are addressed. Examples of these stakeholders are:

- recreational users
- local interest groups (e.g. landcare groups)
- local road users (e.g. school buses)
- agricultural aviators
- mining interests.

Stages of development

3

3.1 Site selection

The purposes of the site selection phase are to:

- identify the potential wind resource in the area
- identify the properties that might be included within the boundary of the potential development
- ascertain whether there are any critical impediments that would prevent development at the site
- select a preliminary site boundary and begin negotiations with landowners.

Site selection generally begins using a range of desktop activities. It usually involves carrying out studies of the technical, environment, statutory planning and community aspects of the site.

Based on this assessment the proponent should be able to determine whether a site is suitable for further investigation and what further activities may be required.

3.1.1 Technical considerations

The site selection process will largely involve desktop studies to determine whether a site satisfies the following five crucial technical criteria for successful development:

- good potential wind resource
- potential for a suitable size of generation facility
- cost effective electrical connection access
- suitable land ownership
- ease of construction

3.1.1.1 Potential wind resource

There are a number of publicly available sources of information about the wind resource in Australia. These include wind studies carried out for state energy departments and agencies, the Bureau of Meteorology's (BoM) general publications and raw data from Automatic Weather Stations, and various technical publications.

An estimate of the wind speed over the site can be obtained from databases and computer models; however, sensitivity of energy yield (and hence commercial viability) to wind speed requires a more accurate determination by actual site measurements. This is usually achieved through the installation of an onsite wind monitoring tower, typically during the project feasibility stage.

Other onsite monitoring methods such as SODAR or LIDAR can also be used to provide an alternative measure of the wind resource. These have the advantage of being portable, meaning they can be moved easily to measure wind speeds in different areas of a site or at a number of sites and they do not require a building permit. For further details on wind monitoring see Appendix 10.

3.1.1.2 Potential size of site

Consideration of the likely size of the site will help to establish whether the development will be commercially viable. Some of the key factors that should be considered include regulatory requirements, current land usage (including adjoining properties), the location of existing dwellings and proximity to environmentally sensitive areas.

3.1.1.3 Electrical connection

An examination of the local electricity transmission or distribution system and discussions with the local electricity network owner will indicate whether an electrical connection to the proposed site is technically and commercially feasible. To facilitate this, the Network Service Provider (NSP) will ask for an indication of the potential generation capacity of the site.

The first enquiry for grid connection should generally be in the form of a "connection enquiry" as described in the National Electricity Rules. The rules list information about the development that must be provided to the NSP in the connection enquiry, and defines the NSP's responsibilities to respond to the enquiry with adequate information and in a reasonable timeframe. The NSP's response will include information such as:

- a preliminary program showing proposed milestones for connection
- a list of technical requirements relevant to the proposed development
- a list of all information that would be required in a complete connection application
- the amount of the fee to be paid if a connection application is made.

The NSP may be able, in some cases, to give an order of magnitude indication of the likely cost of connecting the wind farm to the electrical grid, although this will depend on the degree of other network planning and upgrade issues under consideration. The proponent should also be aware of the potential impacts of other generation developments that may be under consideration in the area, as the capacity of the grid to accept the output of wind farms may be limited.

3.1.1.4 Land ownership

Proponents should consider the number of landowners likely to be involved in the development and their current and future options for usage of the land. In addition, the number, size and usage of adjoining allotments should also be considered, particularly in relation to regulatory requirements and/or the likelihood of a noise buffer being required around the wind farm. If it is Crown Land, then advice from the relevant state-based land authority should be sought.

Consideration should be given to identifying the cultural heritage values of the land and establishing the native title status of the site. Early consultation with the relevant cultural representatives is recommended. It is advisable to investigate past activities on or near the potential site that could influence the location of the turbines and their infrastructure (for example, past mining that may have occurred beneath the site).

3.1.1.5 Construction issues

A broad assessment of site access constraints should be carried out. In particular, elevated sites are often only accessible by narrow roads with sharp bends, which may make transportation of long wind turbine components difficult. Gradients and dips in access roads may also be critical in determining suitability of equipment such as low-loaders for large plant transportation.

Further, many areas of Australia that are suitable for wind farm development may only be accessible by dirt roads. The suitability of such roads for the heavy loads associated with wind farm construction and seasonal constraints such as potential for flooding should be considered.

Site selection should also consider the ability to provide, at the location of each wind turbine, a hardstand and flat lay-down area to position heavy lift cranes and pre-assemble turbine blades.

3.1 Site selection

3.1.2 Environmental considerations

At the same time as carrying out technical analyses, proponents will consider potential environmental and amenity impacts on potential sites. Many of the initial assessments will be made using available data such as previous environmental studies and mapping. Proponents should have regard to the presence of land managed for state purposes in the area, such as water catchments. Proponents should also consider existing and emerging national, regional and local planning and environmental policies.

Initially proponents should contact the local planning authority to determine planning and environmental issues. The proponent should obtain copies of the strategic development plan and/or town planning scheme for the locality. In addition, the relevant organisations should be contacted to gain insight into key environmental and amenity issues that may need to be addressed during the course of feasibility studies.

Studies will be initiated at a preliminary level to address a range of issues, such as those broadly described below. Each of the issues will be assessed in greater depth in subsequent phases of project development.

3.1.2.1 Planning constraints

At a basic level, the planning provisions of the local planning scheme or development plan should be examined to understand the potential for the development to be compliant, or whether significant changes to the planning provisions are necessary. This will primarily involve examining the provisions of site zoning (and zoning surrounding the site) and any relevant overlays or special areas. Consideration also needs to be given to the state and local policy framework as well as national environmental protection measures.

Mapping of approval pathways can be performed at this stage, based on the outcomes of the high level investigations. This will not only assist in understanding timeframes and application requirements but also allow for comparative analysis between sites.

3.1.2.2 Nearby land uses

An initial assessment of nearby land uses surrounding a site should be undertaken. This can be done using aerial imagery, by driving around the area, and/or through discussions with Council.

The identification of dwelling locations will be used in preliminary assessments of potential noise, shadow flicker and visual impacts (refer to Appendices 5 & 6). It will also help to determine whether the wind farm design meets the relevant regulatory requirements. As wind farms often have lifespans greater than 20 years, some consideration should also be given to the potential of future dwellings (such as vacant lots upon which a dwelling may be constructed without a planning permit) where required as a result of the planning framework.

Other land uses may also be impacted by the wind farm or its construction activities and will need to be addressed in any future application. Often discussions with existing landowners, councils and planning authorities can provide further information about land uses at the site and in the local area.

3.1.2.3 Landscape values

It is important that proponents obtain an early appreciation of the landscape values of a site and its surrounds. Early dialogue with the community and interest groups will enable the proponent to be aware of the local landscape values that members of the community and special interest groups hold. A detailed framework for landscape values assessment was developed by Auswind in partnership with the Australian Council of National Trusts, outlined in Appendix 5.

3.1.2.4 Ecology

Ecologically significant areas should be identified, including wetlands of international importance, national parks, conservation parks and protected areas. The Australian Government Department of Sustainability, Environment, Water, Population and Communities website contains a useful search tool for indicating areas of national significance that may occur in the vicinity of a proposed development site: www.environment.gov.au/epbc/pmst

Identification of any ecological values on or adjacent to the site that would significantly constrain the development of a wind farm should be undertaken by either desktop and/or an initial field survey. This will identify any threatened species in the area and any potential impacts of the development on them, and flag any need to initiate early baseline monitoring.

Any records of protected species of flora or fauna that are found in the area, or may potentially occur in the area, should also be considered. This can often be ascertained by making an enquiry to the relevant state agency, by searching state databases or performing a literature search. If the development may potentially disturb existing native vegetation then consideration must be given to its ecological importance, rehabilitation options and any approvals required for its disturbance. Assessment of ecological impacts should also include potential impacts to groundwater and the potential for soil erosion and sediment control if there are waterbodies/waterways at or near the site. For further details regarding ecological assessments refer to Appendix 7.

3.1.2.5 Cultural heritage

The existence of items and places of cultural significance to Aboriginal and non-Aboriginal communities will be investigated. A desktop assessment and/or site surface survey should be conducted by an archaeologist together with Aboriginal heritage workers or community representatives where indigenous heritage is involved. In researching areas of Aboriginal heritage, care should also be taken to preserve the confidentiality of culturally sensitive information. It should be recognised that a lack of desktop information does not indicate an absence of cultural heritage significance. Local representative groups should be consulted to identify the intangible heritage values of the site. For further guidance on cultural heritage issues refer to Appendix 2.

3.1.2.6 Conservation and recreational uses

The proponent should research the proximity of the site to designated conservation areas, such as state and national parks and local conservation reserves, as well as sites of international significance.

Recreational uses for the land around wind farms should also be investigated such as hiking trails mountain bike trails, hang-gliding/parasailing and use by local clubs (e.g. bird watching, Landcare) to determine whether the wind farm would have an effect on these activities.

3.1.2.7 Electromagnetic interference

Microwave, television, radar or radio transmissions may be affected by the presence of wind turbines. The location of microwave, mobile phone, radio and television antennas and links, and radar installations should be noted for input into the wind farm design. Although in many cases technical problems can readily be avoided or resolved, proponents should nonetheless make themselves aware of the potential for such interference. Further information on electromagnetic interference may be found in the Australian Communications and Media Authority database (www.acma.gov.au) and in Appendix 9.

3.1.2.8 Aircraft safety

Proponents should assess potential for aircraft safety issues by noting the proximity of the site to any major airports, aerodromes or landing strips. Proponents should contact the Civil Aviation Safety Authority, Air Services Australia and the authorities responsible for the operation of such facilities in the vicinity of the proposed site. Advice should be sought on contacting agricultural aviators who may operate in the area.

In addition, proponents should obtain advice from landowners on any farming-related uses of aircraft such as aerial spraying or mustering. In such cases, the district aerodrome supervisor should be contacted for advice on the potential impact of a wind energy development on these activities.

To provide more detailed guidance for wind farm proponents, a National Airports Safeguarding Advisory Group has prepared draft “Guidelines for land use planners and developers to manage the risk to aviation safety of wind turbine installations (wind farms)/wind monitoring towers”. These were agreed to by Commonwealth, state and territory Ministers at the Standing Council on Transport and Infrastructure (SCOTI) meeting on 18 May 2012 subject to their operation being reported back to SCOTI in 12 months. They can be found on the Infrastructure Australia website (www.infrastructure.gov.au).

3.1.2.9 Restricted areas

Consultation with relevant authorities should be carried out to determine whether any restrictions may apply to the development of a wind farm in the proximity of security areas, such as military installations, telecommunications installations and radar used for aircraft safety, maritime safety or weather predictions.

It is recommended that even in this early stage of investigation, a community engagement plan be developed. “Community Engagement Guidelines for the Australian Wind Industry (2012)” published by the CEC, and available on the CEC website, provides details on this process.

3.1 Site selection

3.1.3 Communication and consultation

3.1.3.1 Landowners

At this stage, the proponent should reach a formal agreement with landowners to allow investigations into the viability of developing a wind farm on the landowners land. To this end, the proponent will visit and introduce themselves to owners of land which they believe has potential for siting turbines. The proponent may also visit immediate neighbours, as appropriate.

It is important that the proponent not only makes suitable arrangements for communicating and consulting with landowners, but also puts in place appropriate commercial agreements.

A proponent should ensure that a written arrangement is in place with the landowner detailing the obligations and commitments of both parties.

Where there are multiple landowners involved, it is recommended that proponents adopt, as far as possible, a consistent approach to arrangements and communication strategies.

It is important for proponents to appropriately manage the expectations of landowners and other stakeholders. Proponents should avoid creating unrealistic expectations of the suitability and capacity of the land for wind development.

When communicating with landowners and other community stakeholders, project proponents should first refer to the "Community Engagement Guidelines for the Australian Wind Industry (2012)", published by the CEC.

3.1.3.2 Local planning authority and statutory stakeholders

Initial discussions should be held with the officers of the local planning authority and statutory stakeholders to explain the nature of the project and verify the zoning of the land in question and any planned changes. The local authority may be able to indicate planning and community approval risks. This initial contact will help make it easier to identify and agree on the potential issues that should be addressed in a planning application later in the project.

In particular, environmental and amenity considerations are likely to involve a variety of stakeholders other than the local planning authority itself. The local planning authority may be able to suggest some of the stakeholders that may be worthwhile approaching and provide clarification regarding building approvals and other regulatory measures. Good research and consultation at this initial selection stage can avoid spending time and expense on unsuitable sites.

In the case of Crown land, representations should be made early to the appropriate land authority. Often restrictions apply to Crown land that the proponent will need to assess, and the process of obtaining tenure can be protracted depending on the current purpose of the land in question. The proponent in this instance may be able to negotiate a lease option, have wind farm easements added in their favour, or even purchase the Crown land. During these negotiations any effects on adjacent neighbours will also need to be considered.

3.1.3.3 Native title and cultural heritage stakeholders

It is timely at this stage in the project to assess the state native title status to ascertain any requirements for consultation and negotiation. This may involve liaising with the traditional owners' authority and local Native Title Tribunal office. It would also involve identification of any cultural heritage interest groups (which may or may not differ from native title claimants).

Project feasibility

3.2

The purposes of the project feasibility phase are to:

- further examine the viability of a wind farm project through detailed site specific investigations
- compare the potential issue/outcomes of the investigations across sites, where there are multiple potential sites
- develop an indicative wind farm project layout
- determine the likely approval processes necessary to follow for the identified wind farm project
- ascertain the ability of the project to avoid, minimise, mitigate or offset environmental and amenity impacts.

Through the feasibility investigations the proponent should:

- obtain landowner and necessary regulatory approvals to undertake site investigations, including consultation with air safety authorities
- commence preliminary environmental and cultural assessments and site specific studies, required to further assess the merits of the proposed site
- continue the development and use of the community engagement plan for the project (see the "Community Engagement Guidelines for the Australian Wind Industry (2012)" published by the CEC and available on the CEC website.).

3.2.1 Technical considerations

3.2.1.1 Wind resource

The installation of a wind monitoring tower is likely to be required so that the wind resource on the site can be confirmed. Wind speed varies with height above ground level (a phenomenon known as wind shear). In general, the measurement of wind speeds as close as possible to the hub height of a modern wind turbine is desirable. Often this type of data is necessary to obtain external finance for a project. The proponent may initially elect to monitor at a lower level to confirm a site's potential prior to investing in more expensive wind monitoring at or close to hub height.

It should be noted, however, that in some areas of Australia thermal inversion effects may mean that measurements taken at lower levels bear little relationship to wind speeds at turbine hub height, particularly at night.

The proponent should consult with the responsible planning authority and the appropriate agencies relating to aircraft safety of the intention to construct a monitoring tower (see Appendix 4). In most jurisdictions the installation of a wind monitoring tower above a prescribed height is likely to require building approval and may also require planning approval. The proponent will also need to negotiate an agreement with the landowner to install the tower on their land.

Wind monitoring equipment may be mounted on guyed pole masts or climbable lattice towers. The advantage of the latter is that instruments can be replaced without lowering the tower, although they are somewhat more expensive than pole towers. One or more of these masts may be required depending on the size and complexity of the site topography.

The installation of a wind monitoring tower may have an impact on ecological and cultural heritage values, depending upon the results of proponent's preliminary environmental and cultural heritage assessments. If results indicate sensitivity, an assessment of any impacts arising from the installation of monitoring tower(s) would be conducted and mitigation plans put in place prior to works commencing. Where applicable, consultation with the traditional owner representative group is required.

On Crown land, often it is possible to obtain a temporary licence to install a wind monitoring mast from either the vested authority or the state-based land administrator. Further discussion of wind monitoring in relation to standards is provided in Appendix 10.

3.2 Project feasibility

3.2.1.2 Existing land uses

To determine how the wind energy project can integrate with existing land uses, detailed discussions should be undertaken with the landowner and other appropriate stakeholders as identified in the project community engagement plan. The objective of these discussions is to consider the compatibility of the proposed development in the area and the need for undertaking specific construction or operation mitigation measures and/or any other design considerations.

The level of engagement or opposition to the development concept can be gauged along with an understanding of the local and regional importance of the neighbouring land uses.

Consideration should also be given to any ecological values and/or cultural heritage significance the land may have to stakeholders.

3.2.1.3 Ground conditions

Geotechnical engineering investigations may be carried out on the site to help assess whether it is practical and/or economical to construct the foundations, erect the turbines and create access roads. Such investigations may need to take into consideration the foundation design. This may be required at each wind turbine location. As these details will not be known at this initial stage, some representative geotechnical testing may be appropriate. More detailed investigations can be carried out at a later stage. The results of geotechnical investigations may also be used to assess the risk of erosion and sedimentation during construction and operation of the wind farm and help inform the design of the project.

Geotechnical testing may have an impact on ecological and cultural heritage values, depending upon the results of preliminary environmental and cultural heritage assessments. An assessment of any impacts arising from the geotechnical works should be conducted and mitigation plans put in place prior to commencement. In some circumstances, it may be necessary to obtain approvals for vegetation clearance, gaining access to the sites to be investigated, and drilling of test holes. Where required, approvals should be obtained prior to commencing investigations.

3.2.1.4 Indicative project layout

The proponent will design an indicative layout of the wind farm. This may show the maximum and minimum footprint of the site and is likely to include possible wind turbine generator locations and size.

The indicative wind turbine generator layout will be based on results of the initial noise, shadow flicker and visual assessments. Also, preliminary environmental and cultural heritage results should be considered. Some degree of design and assessment iteration is expected at this stage.

An indicative project layout is fundamental as a starting point for discussions with landowners, authorities and the community, and will form the basis for later detailed assessments.

3.2.1.5 Site access and transport

The construction of a wind energy project requires access by over-dimensional and heavy vehicles to the site. Access to the site will need to be assessed to determine the suitability of existing public and private roads. The assessment will identify any road upgrades or special traffic control arrangements that may be required during construction. The relevant road authorities will be consulted.

Access between turbines must be practical and therefore the route for onsite access roads will need to avoid steep gradients in order to cater for the transportation of turbine components.

The transport and delivery of components from overseas will also need to be considered. Often components from overseas will be delivered to a nearby port and delivered to site. Port authorities should be contacted to ascertain the logistics options.

3.2.1.6 Electrical connection

Proponents will need to consider the requirements set out in the National Electricity Rules or state-based network access legislation for negotiating connection to the network with the Network Service Provider (NSP). A preliminary connection enquiry to the NSP should yield indicative costs, timing and other connection issues that the proponent may face.

System studies are required to verify exactly what issues exist, requiring a suitable mathematical model of the turbine type being considered. The need for such studies should be discussed with the network operator. Proponents should not underestimate the potential complexities associated with gaining access to the local electrical network, as these negotiations can be protracted and technically complex.

Within the wind farm site, turbines are normally connected by underground cabling. For larger projects, a group of underground cable lines may be connected to an onsite substation by an overhead line. The routing of cables (both underground and overhead) should be discussed with the landowner to identify any unforeseen constraints on the wind farm layout.

3.2.2 Environmental considerations

The environmental considerations of the feasibility phase are to undertake the minimum additional investigations necessary to understand the sensitivity of the site and surrounds to allow refinement of the design on a specific site. For some sites, particularly those with little or no published data available, it may be necessary to undertake preliminary ecological surveys in order to identify the environmental sensitivity of the site (refer to Appendix 7).

3.2.2.1 Local and state planning authorities

The proponent should make sure they are familiar with the likely planning process, including identifying which state government agencies the project may be referred to. Preliminary discussions may be held and some assessment guidance may be available from the local authority, the state planning authority or the likely referral agencies themselves. The structure of such agencies varies significantly between states.

3.2.2.2 Commonwealth authorities

During the project feasibility stage, based on the outcomes of preliminary ecological and cultural heritage assessments, the proponent should be able to determine if a proposal is likely to have an impact on a 'matter of national significance'. From this will be determined if a referral is required under the Environmental Protection and Biodiversity Conservation Act.

Protection of heritage values at the national level currently works through the identification and listing of significant historic, indigenous and natural environment places in the National Heritage List and Commonwealth Heritage List (see www.environment.gov.au/heritage/places). Proponents should ensure they are aware of the existence of any listings and seek advice on the effect of these on the project. The protection of places of national heritage significance is the responsibility of the Minister of the Department of Sustainability, Environment, Water, Population and Communities.

3.2.3 Other considerations

3.2.3.1 Landowner agreements

The timing of signing legal agreements with landowners to enable the construction of the wind farm will vary depending upon the requirements of the project. Often agreements are a two stage process. The first stage allows access to the land for feasibility studies to determine if the project will go ahead, and the second stage involves an agreement to lease the land for the life of the project if the project is found to be viable.

When negotiating landowner agreements, proponents should ensure they are entering into agreements with the party legally entitled to negotiate with respect to the land. A search of land titles needs to be undertaken prior to commencement of any agreement to determine ownership, title boundary and any encumbrances on the land.

A written arrangement should be put in place with the landowner detailing the obligations and commitments of both parties, including at the end of the agreement/project life. Refer to Section 3.1.3.1.

3.2.3.2 Cultural heritage

Further sub-surface surveys may be required based on the results of the earlier surface survey and consultation with cultural heritage stakeholder groups. It may be appropriate to enter into a formal agreement with Aboriginal traditional owners or representative groups to set out the terms and conditions for undertaking further site investigations. It is recommended that the proponent involve an archaeologist or anthropologist in developing such an agreement (see Appendix 2).

State and Commonwealth Aboriginal heritage legislation provides protection for all Aboriginal sites, objects, and remains (that is, traditional burials) that are significant to Aboriginal cultural tradition and/or significant in archaeological, anthropological or historical terms.

Any land may contain sites relating to Aboriginal history. If there is no native title claim or registered site on the proposed wind farm, that does not necessarily indicate that there are no sites or places of Aboriginal cultural heritage significance.

State and Commonwealth legislation also protects historic heritage (i.e. non-indigenous) that meets relevant local, state or national heritage criteria.

Further information on native title and cultural heritage is contained in Appendix 2.

3.2 Project feasibility

3.2.4 Communication and consultation

Separate community engagement guidelines, the "Community Engagement Guidelines for the Australian Wind Industry (2012)", have been prepared by the CEC and are available on the CEC website. These guidelines provide further detail on communication and consultation with the community.

3.2.4.1 Local planning authority

The proponent may, for large projects, notify the local planning authority of its intention to initiate a feasibility study on the selected site.

The proponent should ascertain whether development or building approval is required to erect a monitoring mast. Proponents should also obtain advice from the local planning authority on any advertising required for these approvals, and this should be included in the community engagement plan for the project.

3.2.4.2 Local communities

The proponent will engage with the local community by implementing the project community engagement plan. Local knowledge and feedback on how the community prefers to be consulted may be gathered from local council and local community leaders.

3.2.4.3 State and Commonwealth agencies

The degree of consultation entered into at state and Commonwealth government levels will depend on the particular planning approval processes involved. Early identification of the relevant government stakeholders will provide an insight into potential issues which may impact on the decision to proceed with a project, as well as the issues to be addressed in any application.

It is important at this stage to assess whether the proposal is likely to trigger the need for a Commonwealth approval under the EPBC Act and how it might be treated at the state level. Accordingly, the process of referral and likely consultation requirements can be identified.

3.2.4.4 Other agencies

The Royal Australian Air Force (RAAF) maintains a database of tall structures over 20 metres in height. Proponents should provide the RAAF Aeronautical Information Service with the timing, description and location details of any monitoring masts exceeding 20 metres.

Structures such as wind monitoring masts in the vicinity of an airfield or flight area may cause a safety hazard. It is recommended that the proponent contact the Civil Aviation Safety Authority to maximise aircraft safety. Further information regarding aircraft safety is provided in Appendix 4.

The proponent should address OH&S and emergency response issues through consultation with the appropriate authorities during the feasibility stage to ensure implementation of best practice and regulatory approval approaches. It should be noted that that the proponent is often best placed to respond to many emergency situations at the wind farm. Further discussion regarding consultation with emergency services is contained in Appendix 8.

Detailed assessment

3.3

A detailed assessment generally commences once the information obtained from site selection and feasibility studies indicate the proposed wind farm will be commercially, technically and environmentally viable and a decision has been made to progress. The detailed assessment phase seeks to:

- undertake site specific technical studies to fully assess the impacts of the development
- optimise the design of the wind farm project
- be in a position to seek the primary planning and environmental approvals for the development.

As mentioned earlier, depending upon the scale of the project, the potential for impact or the nature of the impacts, as well as the jurisdiction, the initial step in this phase may be a referral through a state and/or federal agency to commence the process of the preparation of assessment guidelines (by the agency or agencies). These guidelines detail the scope of the investigations that must be undertaken at this stage.

3.3.1 Technical considerations

The proponent will take into account, and respond to, recommendations that may arise as a result of the detailed studies and discussions with stakeholders.

3.3.1.1 Wind turbine generators

The final turbine model selected for a particular site will depend on a number of issues including wind speeds, amount of turbulence, topography, their availability and various commercial considerations. It is usual for a proponent to identify a number of potentially suitable models before going through an evaluation and tender process to identify the final preferred model. This process is not usually completed until after the planning and environmental approvals process and will likely form part of the commercial project development stage.

With respect to the early development and planning stages the proponent must therefore elect a “candidate turbine” or at least state maximum parameters, and it is most likely that an application will be made for a turbine of maximum tip height to allow flexibility in the final turbine selection process. This candidate turbine will then be used to inform the public during consultation and also within the planning application. It is noted that for some technical assessments, particularly noise, an actual turbine model must be specified in order to allow accurate modelling and demonstrate a compliant wind farm layout. The developer should carefully consider which turbine model and layout to use to allow for flexibility in the final turbine section process while ensuring that the installed wind farm is compliant with the planning permit.

Appendix 7 provides further details on noise assessments and Appendix 12 provides further details on wind turbine standards.

3.3.1.2 Electrical connection

Proponents should continue dialogue with the Network Service Provider (NSP) to work through any network connection issues using the requirements set out in the National Electricity Rules or, where relevant, alternative state-based codes. Detailed assessment is likely to involve computer simulations of the wind farm and its connection to the grid. This is to verify that the wind farm meets the technical standards required of generators connecting to the grid and does not cause disturbance to the electrical system or to adjoining customers or generators. Such studies take significant time and should be considered in project planning.

The studies should address any issues raised in the NSP’s “Response to Connection Enquiry” as they will ultimately form part of a formal connection application as described in the National Electricity Rules.

3.3 Detailed assessment

3.3.2 Environmental considerations

Consultation with local or state authorities during feasibility studies will have identified the scope for environmental assessment required to progress a planning application. Where authorities consider that the proposed wind farm could have significant effects on the environment or amenity due to factors such as its nature, size or location, a proponent will be required to submit a formal environmental assessment. In some cases, proponents may be required to carry out a full Environmental Impact Assessment (EIA) or equivalent, depending on the state environmental and/or planning laws. This process may be overseen by either a local or state authority (refer to the relevant state regulatory authority website to understand the framework for an EIA in that jurisdiction). Risk assessment and management via a well structured risk management framework (i.e. AS/NZS 31000) will prepare the proponent for subsequent legislated assessment processes.

An impact assessment will be required to identify all relevant environmental, social and economic effects associated with the proposal. It should be noted that during the course of detailed evaluation of these issues, it may be necessary for the proponent to amend the proposed wind project design, including the number and position of wind turbines. In addition the whole of the development life needs to be considered, from construction right through operation to decommissioning and rehabilitation or reuse.

Typically, the range of issues to be investigated for the development of a large wind farm will include the following:

- Landscape and visual assessment
  The existing landscape must be described, and the potential landscape and visual impact of the proposed wind farm assessed and evaluated. It is important that visual amenity is always considered in the context of the existing environment, particularly regarding the value that the local community puts on landscape character and attributes. Further detail of visual assessment is provided in Appendix 5.
- Noise assessment
  A noise assessment must demonstrate that the operational wind farm (including substation) is able to comply with the relevant noise guidelines in the location where it is to be constructed. The assessment should provide details of the methods used to model predicted noise outputs. More detailed information on wind farm operation noise assessment is provided in Appendix 6.
- Shadow flicker
  The predicted duration of shadow flicker at all nearby houses (relevant receivers) must be determined and assessed against relevant guidance. More detail on the assessment of shadow flicker is provided in Appendix 5.
- Flora and fauna
  The impact of the wind farm on the ecological values present within the disturbance footprint of the development should be assessed. Ecological values may include flora, fauna (including those that may utilise the site only intermittently), vegetation or fauna habitat. More information on the assessment of ecological values is provided in Appendix 7.
- Socio-economic
  The impact of the proposed wind farm on local infrastructure, such as health and emergency services, accommodation and community facilities, should be addressed. In addition, an assessment of the economic impact of the proposal on the local and regional economy may also be completed.
- Heritage assessment
  An assessment of the heritage values present at site should be completed. Heritage may include Aboriginal sites or artefacts and sites of historic heritage. Consultation with the Aboriginal community should be undertaken during Aboriginal heritage assessments and may include engaging endorsed Aboriginal representatives to accompany the field surveys. Further discussion on how such studies might be approached is given in Appendix 2.
- Transport impact assessment
  An assessment of the type and volume (number of movements per day) of traffic associated with the construction and operation of the wind farm should be completed. The assessment should include consideration of the potential impacts on the local and regional road network and any modifications to the road network that may be required (e.g. widening). The assessment should be undertaken in consultation with the relevant state transport department and local authority. In some cases a program of road maintenance or improvement may be agreed with the local authority to address any potential impacts caused by the movement of heavy vehicles on local roads.
- Electromagnetic interference assessment
  An assessment of the potential for communication and/or radar interference should be completed and should include discussion with communication system providers. A more detailed discussion of electromagnetic interference is provided in Appendix 9.
- Aircraft safety assessment
  An assessment of aircraft safety should be completed. Further information on aircraft safety including consultation with the Civil Aviation Safety Authority and other aviation agencies is provided in the Appendix 4.

- Hydrological assessment
  An assessment of the impact of the proposed development on nearby surface and ground water systems may be appropriate dependent on the location of the wind farm. The assessment should include the potential impacts of erosion and sedimentation of nearby water courses (including potential impacts on riparian vegetation) and potential contamination of groundwater.
- Emergency and incident management
  The planned management of potential emergencies and incidents should be addressed. Development of emergency response plans should be undertaken in consultation with relevant local and regional emergency services and any contractors working on the site, if a contractor is to manage the site they may develop the emergency response plan although it is recommended that this is reviewed by the proponent. More guidance on the management of fire is provided Appendix 8.
- Cumulative impacts
  Consideration of the cumulative impacts of the wind farm together with other development in the area may also be appropriate although this can be difficult in practice. Cumulative impacts can refer to landscape and visual effects, and a wide range of other environmental, social and economic impacts, both positive and negative. While many regulators require the assessment of cumulative impacts as part of a development application, few give guidance on how this should be undertaken. It can also be difficult for proponents to access information on other developments in the area. The best approach is to understand as far as possible how various impacts may theoretically change with the addition of another wind development in the area, and proactively discuss with regulators to work towards a positive outcome.

These studies will need to investigate the potential impact of the development (based on a common layout and project description), identify opportunities to avoid or minimise the impacts and specify mitigation measures or offsets for any residual impacts.

The mitigation measures will provide the basis for the environmental management framework (see Appendix 11), to be provided as part of the development application, which will articulate the translation of impacts into mitigation through design, through construction or through operation or identify offsets. At this stage, dependent upon the issue and the potential need for a management plan to be lodged as part of a secondary consent process (such as a Construction Environmental Management Plan, or CEMP), the mitigation measures should look at the performance outcomes rather than detail the method of mitigation. This is where consultation with the regulators can assist to determine the level of detail that they are expecting.

On the completion of the detailed assessment the proponent should be in a position to submit a development application and, if required, a report on the Environmental Impact Assessment (EIA). The EIA will provide:

- a source of information from which individuals and groups may gain an understanding of the proposal, the need for the proposal, the potential environmental impacts and the measures taken to mitigate any adverse effects
- a base for public consultation and informed comment on the project
- a framework against which decision makers can consider the proposal and determine the conditions under which any approval may be given.

Discussion of the assessment processes for many of the environmental issues relevant to wind energy projects are provided in other appendices. From these assessments, a final project design will result. Typically with wind farms, a degree of flexibility will be sought, particularly around micro-siting the turbines. Commonly this is achieved by specifying a development area and cable corridor, within which the development may occur with a final location to be determined following detailed design.

3.3.3 Communication and consultation

Community consultation will continue to be undertaken as per the Community Engagement Guidelines for the Australian Wind Industry (2012) developed by the CEC. The proponent should also maintain an ongoing dialogue with the appropriate statutory authorities throughout the environmental assessment process. Changes to the original design during the evolution of the project will be regularly communicated and discussed with stakeholders. Similarly any plan to withdraw from developing the wind farm will be communicated to stakeholders in a timely fashion.

3.4 Planning and environmental approvals

Once the detailed assessment has been completed, in accordance with any assessment guidelines provided, and the design of the wind farm project has been optimised in accordance with the outcomes of the detailed assessments, the planning and environmental approval applications can be sought.

In some jurisdictions, the environment assessment must be undertaken at a state level and a determination made prior to the development application being submitted. In other jurisdictions, the environmental assessment and the development application are determined together in the one process. Where Commonwealth approval is required, this may be undertaken concurrently with the state level environmental assessment through a process accredited under a bilateral agreement (if available), or may be dealt with separately. If possible, it is best to integrate the processes as much as possible in order to minimise duplication of effort, lengthening of overall assessment timeframes and potential inconsistencies of decision-making.

Regardless of the jurisdiction, the application normally comprises a main document containing:

- the project description
- plans, elevations and layout details
- the proponent and contact details
- project rationale
- a description of the legislative environment and approvals required (and their status)
- a description of the applicable planning scheme/ development plan provisions that apply to the project and relevant surrounding area
- a description of any other regulatory controls that may apply to the project (i.e. state policies)
- consideration of alternatives
- a summary of the investigations and their findings
- an explanation of the environmental management framework
- a consolidated list of mitigation measures
- a detailed address against the regulatory controls, planning provisions, objectives and decisions guidelines (if a planning application).

In some jurisdictions, a formal application document or format must be completed. The application should be supported by copies of all detailed assessments. The number of copies will vary depending upon the jurisdiction.

For large and complex applications, it is recommended that the proponent consider printing and making available a short, easy to read summary document, primarily for the purpose of public notification.

3.4.1 Application process

Most large developments, such as a wind farm, will be subject to a period of public notification during which formal submissions to the development may be lodged. Specific requirements around public notification, submissions and third party appeal rights will vary amongst jurisdictions, and proponents should become familiar with the processes relevant to their projects.

The development application process may raise submissions in relation to various issues and proponents would normally be required to respond to matters raised.

The assessment process may include the planning authority requiring further information to be provided by the proponent in relation to specific issues that may have been raised through the public notification or advertising process.

The State Government may be involved via referral agencies or as the planning authority, identified in the early part of the process. State agencies would provide information to assist the planning authority in assessing the application.

Some approvals, especially if undertaken at a Council level, are potentially subject to an appeal or review process, whereas others may not be. Regardless of the ultimate decision authority, there is potential for the project to be approved or refused dependent on the merits of the proposal.

Commonwealth assessment under the EPBC Act is a separate process to the assessment of a development application. Refer to Section 2.3.1 for more details on this process.

3.4.2 Conditions of approval

If a project is approved a number of conditions will be attached to the permit. These conditions will frame the type of approval, commencement requirements and expiry date and may require changes to the development or limit aspects of it in some way. Commonly the conditions will require details to be submitted as part of a secondary consent process, where engineering or other technical details of the project will be assessed and approved. A typical example of this would be requiring a detailed Environmental Management Plan (EMP) to be submitted specifying the details of the methods of impact mitigation throughout the construction process. Similarly, an EMP will be required specifying any ongoing management requirements through the operation of the facility, such as incident management, auditing and reporting.

The proponent will need to demonstrate that these conditions have been met prior to undertaking certain aspects of the development, such as prior to construction or prior to energisation of the turbines. Any modified designs, reports or plans required to be submitted will be endorsed and form part of the approval documentation.

Construction 3.5

3.5.1 Technical considerations

3.5.1.1 Wind turbine generators

Prior to the commencement of construction, proponents will have selected the final wind turbine model(s) for the site considering a number of factors including site environmental conditions in comparison to the wind turbine design parameters (typically IEC 61400-1) (for example wind speeds, amount of turbulence), topography, turbine availability from manufacturers and various commercial considerations (such as CAPEX, OPEX, delivery time frame, warranties, availabilities, operations and maintenance arrangements). Once the wind turbine model(s) are selected the final micro-siting of the wind turbine locations can be undertaken. Micro-siting involves on the ground siting of wind turbines to ensure compliance with permit conditions, ensure appropriate spacing between wind turbines, identify any peculiar local features that may assist/detract from energy production and to avoid any potential construction issues. Micro-siting will be carried out with regards to site constraints. The detailed design for the wind farm as a whole can also be undertaken including roads, hardstands, control, monitoring and communications systems, electrical infrastructure and site facilities such as offices and storage sheds. The wind turbine foundation design(s) will also be finalised based on geotechnical investigations.

3.5.1.2 Occupational health & safety and quality management

As with all construction projects, wind farm developments are considered to be a workplace and hence compliance with relevant Occupational Health & Safety (OH&S) legislation is necessary. Currently these can differ from state to state, however national work health and safety laws are currently being implemented. Further information can be found at Safe Work Australia (www.safeworkaustralia.gov.au).

The proponent should ensure that there is a safety management plan developed prior to the commencement of construction on site, if a contractor is managing the site then this would be undertaken by the contractor and reviewed by the proponent. Potential safety issues and the means taken to eliminate or mitigate them, as per the hierarchy of controls and a risk analysis based approach, should be included in the plan. The safety management plan should be based on risk management procedures and include safe work guidelines and processes covering areas such as access to site, inductions and permits to work, incident management and reporting.

All workers on site should be appropriately qualified for the tasks they are required to perform and the proponent should also give consideration to the training of the operations staff which may commence during the construction phase.

A safety assessment of the wind turbine model(s) chosen for the project will determine whether the wind turbines conform to both state and federal OH&S requirements. For example, while ladders, fall arrest systems, access to towers and numerous other features of the turbine may conform to European or international standards, they may not meet Australian requirements. See Appendix 10 for further information on OH&S standards.

Signage should be erected designating the area as a construction site and including applicable restrictions to entry. It should also include contact details for the proponent's site representative or other contact (noting that guidelines exist for construction signage in some states).

A quality management plan for the construction works should be developed covering all aspects of construction, based on ISO 9000 principles, including:

- component quality assurance
- component delivery acceptance
- construction quality assurance
- commissioning of the individual wind turbines
- commissioning of the wind farm as a whole
- commencement of warranty and maintenance period.

The OH&S and quality management plans should provide for the appointment of a position that is responsible for the management and implementation of these plans throughout construction.

3.5.1.3 Electrical connection

Proponents will finalise the network connection arrangements for the wind farm with the Network Service Provider (NSP) and finalise the detailed design for the electrical works.

3.5 Project feasibility

3.5.2 Environmental considerations

The construction of the wind farm will proceed through the conditions of the planning and environmental approvals and the details of mitigation and other commitments in the environmental management framework.

Multiple approvals from multiple regimes, along with those commitments proposed as part of the development, will create a significant and complex compliance challenge. Careful planning needs to be undertaken to ensure not only consistent commitments in the first place, but careful interpretation and translation of these commitments into contract specifications.

An internal audit of legal, environmental and other relevant aspects of construction of the wind farm should be carried out prior to the commencement of works.

3.5.2.1 Environmental management plan

Environmental management plans (EMPs) are usually required to be prepared to address all significant aspects of the construction project. The EMPs will identify risks and/or significant environmental aspects, actions to be taken (including mitigation), performance targets (where appropriate) and monitoring processes during the construction of the wind farm. EMPs also capture conditions of approval and commitments and ensure they are effectively communicated and complied with throughout construction.

Depending on the environmental risks and/or significant impacts identified, EMPs can include, but are not limited to, the management of:

- legal, permit and compliance issues
- erosion and sediment control
- dust and construction noise management
- controlling the extent of works
- vegetation management and rehabilitation requirements
- fauna management (including bird and bat monitoring, if required)
- wind farm noise compliance management
- storage of hazardous materials
- water runoff including stormwater management
- weed control
- waste management
- complaints handling
- reporting and works permit requirements
- emergency and incident management (including fire hazard management) audit and inspection programme.

The EMP should provide for the appointment of a position that is responsible for the management and implementation of the EMP throughout construction.

3.5.3 Contractual considerations

The proponent should ensure that all contractors are aware of and abide by the requirements of any planning conditions, environmental and legislative, and any regulatory requirements relevant to the work they are carrying out.

If a power curve verification test for the wind turbines is required, proponents will also need to arrange the installation of suitable wind monitoring masts.

3.5.4 Communication and consultation

The need for consultation and communication does not end with the development approval. Indeed, a great deal of community and media interest is likely to be generated throughout construction. The detailed stakeholder communication and consultation plan will need to be revised to suit this new phase of the project. This involves providing regular updates on construction progress in various forms to promote community stewardship and pride in the project.

Proponents should stay in close contact with wind farm landowners, providing adequate notice of onsite activities and work cooperatively with them to minimise disruption to farming practices. Proponents should also stay in contact with the local community and other local stakeholders identified during the site selection phase.

Proponents should refer to the “Community Engagement Guidelines for the Australian Wind Industry (2012)” published on the CEC website. Proponents should ensure that onsite and offsite works are undertaken with a minimum of disruption to the local residents.

The proponent should liaise with air safety authorities in accordance with any construction requirements they may have stipulated during the development stages.

The proponent should keep the local emergency services up to date with works schedules and site activities, particularly during times of high fire danger, and ensure that an emergency and incident management plan is developed for the site in consultation with emergency services and is kept up to date. The proponent will need to offer site familiarisation visits to emergency service operators.

Wind farm operation

3.6

3.6.1 Technical considerations

As with the construction of the wind farm, an occupational health and safety management system should be employed during the operational phase of the wind farm. A good reference for developing these systems is the international standard for safety management OHSAS 18001: 2007. An occupational health and safety management system should cover issues such as:

- adequate training of staff
- risk management
- safe work guidelines – access to site, induction, permit to work procedures, etc.
- emergency management plans
- incident management and reporting.

The proponent will ensure that all wind turbines are adequately maintained over the life of the wind farm.

Ongoing performance monitoring of the impact of the wind farm on the electricity grid connection is required by the NSP and AEMO.

Noise compliance testing may also be required for the project and/or wind turbine warranty purposes (as well as under the environmental management framework) - see Appendix 6.

3.6.2 Environmental considerations

An environmental assessment of the operation of the wind farm should be carried out, together with an understanding of related legal and other requirements. EMPs will be prepared to address all significant aspects of the operation of the wind farm, which may include specific monitoring if issues are identified which require further investigation once the wind farm is in operation. Proponents should also refer to the conditions and obligations under which development permission has been granted to guide the EMPs.

EMPs will identify risks and/or significant environmental aspects, actions to be taken including mitigation, performance targets and monitoring processes and the establishment of offsets (where appropriate), during the operation of the wind farm. Dependent upon the conditions of the permit, if the performance of the wind farm triggers a specific threshold, there may be significant operational responses or other mitigation measures required to be implemented to ensure compliance of the wind farm. For example, if it was found that the noise levels measured at a relevant receiver were higher than those permitted, then measures would need to be put in-place to ensure noise emissions were lowered to permitted levels.

It is a common requirement of approval authorities that the environmental performance of the wind farm is documented in a periodic environmental report.

3.6.3 Communication and consultation

Ongoing communication with stakeholders will also continue, in accordance with the stakeholder communication and consultation plan. Commissioning will also generate a high level of local community interest in the wind farm and the operator may consider conducting tours or open days to maximise community involvement. The wind farm should be a good and responsible neighbour. This involves ensuring that there is ongoing community consultation and engagement by the proponent, that landowners are consulted/informed of any major works or upgrades, and that the community is informed of any works which may have wider impacts (for example increased road traffic in the area).

Proponents should refer to the “Community Engagement Guidelines for the Australian Wind Industry (2012)” published by the CEC.

3.7 Decommissioning

If an operator decides that a wind farm will not be refurbished at the end of its operational life or will permanently cease operations, the site will be decommissioned. The decommissioning of the site is always the responsibility of the owner of the wind farm. While the decommissioning of a wind farm is likely to be undertaken 20 years or more after the construction of the wind farm, decommissioning should be considered during the project development phase.

Removal of wind turbines and associated wind farm infrastructure may require new approvals from statutory agencies.

Notice should be given to the planning authority and stakeholders before decommissioning work begins. Most approvals specify that a decommissioning and rehabilitation plan addressing all significant aspects of the decommissioning process must be developed and approved at the beginning of the project. Proponents should also refer to the conditions and obligations under which development permission was granted to guide the plan.

The plan should identify risks and/or significant environmental aspects, actions to be taken including mitigation and/or offsets (if required), performance targets (where appropriate) and monitoring processes during the decommissioning. It may also include a programme of community consultation.

Any decommissioning works should be undertaken in line with the operating wind farm's occupational health and safety, quality and environmental management systems and specific plans drawn up for the decommissioning process, as with the commissioning of the wind farm.

Communication with stakeholders should also be undertaken as per the "Community Engagement Guidelines for the Australian Wind Industry (2012)" published by the CEC.

Appendices

The information provided in the following appendices was correct at the time of writing. As some of this information may have changed in the interim, proponents should confirm the current status of the items addressed in the appendices before commencing investigations or works.

A1 Appendix 1: Glossary

AEMC	Australian Energy Markets Commission
AEMO	Australian Energy Market Operator (formerly National Energy Market Management Company NEMMCO)
AER	Australian Energy Regulator
Airservices	Airservices Australia
AIS	Aeronautical Information Service (RAAF)
Availability	The number of hours a wind turbine is available to generate electricity in a year, divided by the total number of hours in the year. The IEC has release a technical specification IEC 61400-26-1 "Time-based availability for wind turbine generating systems" to define a common standard for performance indicators to be used by owners, utilities, lenders, operators, manufacturers, consultants, regulatory bodies, certification bodies, insurance companies and other stakeholders in the wind power generation business.
Blade glint	Under certain circumstances sunlight may be reflected from wind turbine blades when in motion. The amount of reflected light will depend on the finished surface of the blades and the angle of the sun. All major wind turbine blade manufacturers currently finish their blades with a low reflectivity treatment making the risk of blade glint from a new wind farm development very low.
BoM	Bureau of Meteorology
Capacity factor	This is a measure of the energy actually delivered by a wind farm, expressed as a proportion of the theoretical maximum wind farm energy output. It not only depends on the wind speed distribution at the site, but is also affected by the time wind turbines are not productive due to maintenance downtime or other outages.
CASA	Civil Aviation Safety Authority
Certification	The processes involved in the design and production of the wind turbine generators are usually certified. The norms applied are a result of regulations for safety, damage, etc.
Controlled action	If an action/s of a project is determined to be likely to have a significant impact on one or more matter protected by the EPBC Act it may be deemed a 'controlled action' by the Minister. A 'controlled action' requires assessment and approval under the EPBC Act before it can proceed.

dB(A)	'dB' stands for decibel and is a measurement for the sound pressure. On the decibel scale, the smallest audible sound (near total silence) is 0 dB. A sound 10 times more powerful is 10 dB. A sound 100 times more powerful than near total silence is 20 dB. A sound 1000 times more powerful than near total silence is 30 dB. '(A)' refers to the A weighting. This is an adjustment of the measured sound to match perception by the human ear. The human ear does not perceive sound at low and high frequencies as loud as mid-range frequencies. For example: • 3 dB(A) is the smallest difference one can hear • 5 dB(A) is a difference which is noted • 10 dB(A) is heard as a doubling of the noise. Please note: 'Sound' is a judgment-free term, usually used in a technical context relating to a measured level. 'Noise', on the other hand, implies an environmental impact, and is used more frequently in the context of wind farms. Sound can be used in relation to an objectively assessed measured level, or as a subjective perception of nuisance.
Decommissioning	This is the final phase of the development when a site is cleared of above ground equipment associated with the wind energy project and the land is restored to an agreed use or condition.
Defence	Department of Defence (Australia)
DNSP	Distribution Network Service Provider
Electromagnetic interference	Telecommunications systems broadcast information at a variety of frequencies and in a number of ways. Telecommunications systems currently in operation over land use microwave, very high frequency (VHF) and ultra high frequency (UHF) systems. Interference with telecommunications systems is known as electromagnetic interference (EMI)
Energy production	The energy production of a wind turbine generator is very sensitive to the local wind speed conditions at the height of the rotor shaft and the power to wind speed relationship curve of the wind turbine generator is very site specific. Theoretically the following rules of thumb apply: • doubling the wind speed increases the theoretical energy by a factor of eight • doubling the rotor diameter increases the theoretical energy by a factor of four • increasing the hub height by one metre increases the theoretical energy by one per cent (assuming a hub height of approximately 60 m and a wind shear with a power law distribution with a coefficient 0.13).
Energy yield	This is the term to describe electrical output from a wind energy project. It is strongly influenced by the wind speed of the site.
Environmental Management Plan	An Environmental Management Plan (EMP) is a document that articulates agreed proposals to minimise the potentially significant negative environmental impacts of construction activities and working practices. The environmental management plan facilitates the integration and implementation of the environmental management commitments, conditions, and statutory requirements that a development may or must observe into the development, construction, operation and decommissioning of a wind farm.

A1 Appendix 1: Glossary

EPA	Environmental Protection Agency
EPBC Act	The Federal Environmental Protection and Biodiversity Conservation Act 1999.
GWh	Gigawatt hour is a unit of energy equivalent to one gigawatt of power being generated for one hour. Equal to 1000 MWh (Megawatt hours).
Hub height	This is the height of the wind turbine rotor axis above the ground.
IEC	International Electrotechnical Commission
Installed capacity	The installed capacity is the product of the number of machines and the nominal Wind Turbine Generator (WTG) rating. It is normally measured in megawatts (MW).
LGC	Large-scale Generation Certificate, issued by the Clean Energy Regulator to accredited renewable energy power stations based on the amount of renewable electricity produced.
Local electricity distribution system	This is the electricity distribution network, normally incorporating overhead poles and wires but also sometimes underground wires, which connect individual properties to the regional grid at various voltages.
Megawatt (MW)	A megawatt is unit used to measure power. One MW equals a million watts.
Monitoring mast	This is a mast upon which wind monitoring equipment may be mounted. It is erected to measure the wind speed and wind direction over a particular site. Monitoring masts are usually either tubular or lattice tower structures fixed to the ground with guy wires. Foundations, if needed at all, are usually minimal.
NEM	National Electricity Market
NER	National Electricity Rules
NSP	Network Service Provider
OH&S	Occupational Health and Safety. This is covered by legislation, regulations, standards and codes of practice at both a national and state level.
Power curve	The power curve is a way of showing the power output as a function of wind speed. It can be used to estimate the power delivered to the grid at a certain wind speed. It can also be used in combination with a wind speed histogram to calculate the expected energy yield in a year.
Proponent(s)	The term 'proponent(s)' used throughout the Best Practice Guidelines refers to the proponents, developers and operators of wind farms.
Shadow flicker	Under certain combinations of geographical position and time of day, the sun may pass behind the blades of a wind turbine and cast a shadow. When the blades rotate, the shadow flicks on and off. The duration of this effect, which varies according to the time of the year, can be calculated from the machine geometry and the latitude of the site.

SCOTI	Standing Council on Transport and Infrastructure
Sound power level	The sound power level of a wind turbine is a measure of the total sound power radiated by a sound source. The sound power level of a wind turbine generator is usually expressed in dB(A) and should be measured in accordance with international standard IEC 61400-11:2006.
Substation	The electrical substation connects the electrical system of the wind energy project to the local electricity network through a series of automatic safety switches.
TNSP	Transmission Network Service Provider
Wind speed	The wind speed of the site is a crucial factor in determining the economic viability of a wind energy project. This is underlined by the fact that the energy yield varies as the cube of the wind speed (see also 'Energy Production').
Wind turbine class	A means of classifying turbines in terms of the site wind speed and turbulence parameters they are designed for according to the international standard for wind turbine design IEC 61400-1.
WTG	Wind Turbine Generator

Details provided in in this appendix were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

A2 Appendix 2: Native title and cultural heritage

Native title

The following is a summary of information available at the Native Title Tribunal website.

The material is provided for information only and is not intended as advice. Proponents should consult with the National Native Title Tribunal to determine if a proposal may be affected by native title, or engage a competent consultant to advise on native title matters, where relevant.

Native title is the recognition by Australian law that some Indigenous people have rights and interests to their land that come from their traditional laws and customs.

The native title rights and interests held by particular Indigenous people will depend on both their traditional laws and customs and what interests are held by others in the area concerned. Generally speaking, native title must give way to the rights held by others. The capacity of Australian law to recognise the rights and interests held under traditional law and custom will also be a factor.

In some cases, native title includes the right to possess and occupy an area to the exclusion of all others (often called 'exclusive possession'). This includes the right to control access to, and use of, the area concerned. However, this right can only be recognised over certain parts of Australia, such as unallocated or vacant Crown land and some areas already held by, or for, Indigenous Australians.

Native title rights and interests differ from Indigenous land rights in that the source of land rights is a grant of title from government. The source of native title rights and interests is the system of traditional laws and customs of the native title holders themselves.

The principle of native title was established by the High Court of Australia in two important decisions: Mabo (1992) and Wik (1996). The Commonwealth Native Title Act 1993 (with subsequent amendments) (NTA) provides the legal principles for the recognition of native title and the integration of this form of property right into the existing development approval system.

Who holds native title?

Aboriginal and Torres Strait Islander people who, through their traditional law and custom, have maintained a continuing connection with their country may hold native title. They have to prove that the traditional laws and customs from which they get their native title are acknowledged and observed today and have continued since the time of European settlement.

Where does native title exist?

Native title may exist in places where Indigenous people continue to follow their traditional laws and customs and have maintained a link with their country, and where it has not been extinguished (refused recognition) because of acts done, or allowed, by government.

Areas where native title may exist include:

- vacant Crown land (or unallocated state/Crown land)
- some reserve lands
- some types of pastoral lease
- some land held by or for Aboriginal people or Torres Strait Islanders
- beaches, oceans, seas, reefs, lakes, rivers, creeks, swamps and other waters that are not privately owned.

What rights make up native title?

The set, or bundle, of rights that makes up native title may include the right to:

- possess and enjoy traditional country (exclusive possession), including the right to control access to, and use of, the area
- access the area
- visit and protect important places
- hunt and gather food
- take water, wood, stone and ochre
- teach law and custom on country
- collect bush medicines.

Native title to tidal and sea areas can only be non-exclusive. Native title is subject to Australian law. Native title does not give Indigenous Australians the right to veto future developments but it does mean that their native title rights and interests may have to be taken into account, for example, through consultation about proposed developments. Native title holders may have the right to be compensated for loss or impairment of their native title caused by acts done, or allowed, by the government.

Native title cannot take away other people's rights

Native title cannot take away anyone else's valid rights. So, if there is a pastoral lease or a fishing licence over an area where native title is found to exist, that lease or licence continues unaffected. If native title rights and other, non-native title rights (for example, those under the lease or the licence) come into conflict, the non-native title rights of the other person prevail. Public rights to access places like parks, recreation reserves and beaches are not affected by native title.

Native title cannot be claimed over certain areas including:

- residential freehold
- farms held in freehold
- pastoral or agricultural leases that grant exclusive possession
- residential, commercial or community purpose leases
- public works like roads, schools or hospitals.

Native title on pastoral and agricultural leases

Pastoralists and farmers in Australia have various lease arrangements which are governed by different state and territory laws. It is necessary to look at the lease and the legislation under which it was granted to assess the impact the grant of the lease had on native title. Some native title rights may still exist and, if they do, they will coexist with the rights of the leaseholder. Most pastoral leases around the country are non-exclusive and so the area covered by the lease can be claimed. However, it is important to understand that Indigenous people can usually only claim shared rights with the leaseholder over the lease area. They cannot claim exclusive possession of the lease area.

Only native title holders who have maintained their traditional laws and customs and their connection to the land may have native title rights to non-exclusive lease areas. Pastoralists and farmers may negotiate agreements with native title holders so that native title holders can have access to, and use of, their traditional homelands. That way both the leaseholders' and the native title holders' rights and interests in the land can be accommodated. Where the pastoral or agricultural lease gives the leaseholder a right of exclusive possession, then native title is completely extinguished and the area cannot be claimed. For example, the High Court found that pastoral leases in the New South Wales Western Division are 'exclusive' leases that completely extinguish native title.

Native title and future development

The NTA sets out the procedures to be used for making valid those developments that affect native title. Developments that may affect native title are called 'future acts'.

Native title parties have the right to negotiate about some future acts if:

- their application satisfies the registration test conditions
- their claim is registered on the Register of Native Title Claims.

The right to negotiate is not a right to stop, or veto, projects going ahead — it is a right to have some say in whether, and how, the project is done. If the right to negotiate applies, the government, the developer and the registered native title parties must negotiate 'in good faith' about the effect of the proposed development on the registered native title rights and interests of the claimants. The parties can ask the Native Title Tribunal to mediate during the negotiations. If the negotiations do not result in an agreement, the parties can ask the Tribunal to decide whether or not the future act should go ahead, or under what conditions it should go ahead.

Guidance on consultation is provided in the "Community Engagement Guidelines for the Australian Wind Industry (2012)" developed by the CEC. For more information about native title and services of the Tribunal please contact the National Native Title Tribunal:

GPO Box 9973 in your capital city
Freecall 1800 640 501

A2 Appendix 2: Native title and cultural heritage

Cultural heritage

Cultural heritage embodies places, objects and traditions inherited from previous generations that a community wishes to protect and manage for the future. It contributes to a community's understanding of its past and helps define its identity in the present.

Indigenous (Aboriginal) and non-indigenous (historic) cultural heritage is protected in Australia under a raft of Commonwealth, state and territory laws and procedures. It is an offence to disturb protected cultural heritage without the relevant permit or approval.

Indigenous heritage

Aboriginal heritage legislation in Australian states and territories provides blanket protection for sites, objects, and human remains. Commonwealth legislation and some state and territory laws also provide protection for places that are significant in terms of Aboriginal cultural tradition, including landscapes and areas containing cultural resources such as water, animal and vegetable foods and medicines, and stone, pigments and minerals used by Aboriginal people. Significant places may also relate to traditional cultural practices, spiritual beliefs, and ceremonial activities.

Before beginning any project or development that requires ground disturbance or excavation or substantial changes to landscape access and visual amenity, it is important to determine whether the area contains known Aboriginal heritage or has the potential to have heritage values. Conducting a risk assessment, landscape character and utilisation modelling prior to any field studies is essential to ensure that potential areas of importance to Aboriginal people are identified. These areas can then be assessed during field studies, and where necessary, avoided during construction.

Once preliminary desktop research has been completed by the proponent (where possible), it is recommended that professional heritage consultants (archaeologists & anthropologists) be engaged where needed to conduct the necessary research and consultation to identify Aboriginal heritage values and any associated management or regulatory requirements.

In addition to possessing appropriate professional qualifications and experience, the heritage consultants should work with, and be acceptable to, the traditional owners. This includes being sensitive to gender-specific cultural issues. Consideration of 'men's and women's business' and associated values is essential at all stages of community engagement and site investigations.

Due to their iterative and sometimes multi-stage nature, Aboriginal heritage assessments should be carried out at an early stage in the development design process to avoid critical path scenarios. Initially this would involve providing general information about the project followed by discussion and collaboration on planning any subsequent investigations required for the indigenous heritage assessment.

Guidelines and standards for Aboriginal heritage assessments are available from the relevant state and territory agencies responsible for managing indigenous affairs or heritage.

In general, Aboriginal heritage assessments will encompass the following steps:

- Desktop study

  A desktop study is conducted prior to carrying out any field survey or Aboriginal community consultation. The desktop study will examine the relevant heritage databases and reports to identify any documented heritage places or values, traditional owners or representative groups, and the status of any native title claim. Recommendations for site selection or further investigations may be made based on this study.

  Databases and reports identifying protected heritage are held by the state or territory agency responsible for Indigenous affairs or heritage. The agency will also identify the relevant traditional owners or representative groups. There is also the National Heritage List which is held by the Commonwealth Government. There may be more than one traditional owner or representative group, depending on the location and extent of the project.

- Aboriginal community engagement

  It is important to be aware of any mandatory state or territory procedures or guidelines for community consultation on heritage assessments and development projects. In general, where it is intended to proceed to a formal heritage assessment, the traditional owners or representatives should be contacted to obtain their views and input into the assessment methodology and participation in field assessments or other on-ground works. Aboriginal heritage agreements may be entered into before any field assessments, to establish terms of engagement for survey work and any future construction work monitoring required.

  Aboriginal traditional owners or representatives may make additional requests in relation to the proposed development, based around direct employment, land management and downstream economic opportunities, reflecting the scale of the project and any associated heritage impacts. Such issues should be negotiated at an early stage in the project.

- Field assessment

  Field surveys are carried out to identify Aboriginal heritage values and potential impacts, and associated permit or statutory management requirements. They enable developments to be designed and located, and procedures developed, to avoid or minimise heritage impacts. Guidelines and standards for undertaking field assessments exist for each state and territory.

  Prior to the commencement of field work, landscape character and utilisation studies and a risk assessment based on these studies, the desktop study and the aboriginal community engagement should be undertaken to develop the methodology for the field work and identify the areas which require assessment.

  It is normal practice for Aboriginal heritage officers or representatives of the traditional owners to work together with appropriately qualified heritage consultants during the field assessment and to facilitate consultation with the Aboriginal community.

  If the ground surface visibility is poor or there is potential for sub-surface cultural deposits to exist, based on landscape or other factors, the heritage assessment may recommend subsurface investigations or monitoring during earth works.

  Culturally significant places without visible artefacts may be identified through a process of anthropological research and Aboriginal community consultation. If there are cultural places or knowledge involved that are confidential to men or women in particular, it may be necessary for an anthropologist of the same gender to work with traditional owners to record such sites.

- Subsurface investigations

  All below-ground Aboriginal artefacts and cultural remains are legally protected. Subsurface investigations recommended by the heritage assessment, including archaeological test pitting or open area excavation, must be undertaken in accordance with the relevant state and territory permits and guidelines.

  As subsurface investigations are inherently destructive, they should utilise a rigorous scientific methodology developed in consultation with the traditional owners/ representatives. There may be a requirement for Aboriginal heritage officers or other community members to be employed during the study.

  Pre-construction subsurface investigations can also beuseful where high risk areas have been identified which may be disturbed during construction. If agreed with the local Aboriginal community, pre-construction disturbance with an Aboriginal Heritage Officer or endorsed community member should be undertaken to investigate these areas. This will allow these issues to be dealt with and, if necessary, avoidance or mitigation measures to be put in place prior to the commencement of construction.

A2 Appendix 2: Native title and cultural heritage

Cultural heritage

Indigenous heritage

Managing construction impacts

The management of impacts associated with construction of the development will be outlined in the relevant permit or approved heritage management plan.

The permit or management plan may contain a requirement to monitor ground breaking works. The Aboriginal community may wish to be involved in this activity. If sub-surface material is identified during monitoring, it will be necessary to halt works whilst the provisions of the management plan are implemented or relevant permits are obtained to enable works to continue.

Where monitoring is not required, there may be a requirement for the development to follow an unanticipated discovery plan, outlining the process to be followed in the event a protected heritage item is encountered during works.

Ongoing use

In some cases there may be a requirement to manage the impacts on Aboriginal heritage values throughout the life of a development. This may include ongoing access to land/country for local Aboriginal groups to continue their traditions. These will generally be outlined in a heritage management plan for the facility which is developed in consultation with the traditional owners/representatives and endorsed by the relevant state/territory or Commonwealth Heritage Agency.

Contact details for the relevant state and territory departments are provided at the end of this section.

A listing of representative bodies can also be found at www.ausanthrop.net/research.

Historic heritage

Historic heritage legislation in Australia provides varying degrees of protection for places and objects of non-indigenous cultural heritage significance. There are four basic levels of protection and administration for historic heritage; local, state, Commonwealth and World Heritage. There are also a range of non-statutory lists and databases of historic heritage places.

Local

Historic heritage that is considered significant to the local community is usually managed at the municipal level, through the establishment of planning scheme heritage lists or overlays that trigger specific planning or development provisions.

State/territory

Each state/territory maintains a heritage register listing places that are considered significant in terms of associated criteria, which may be linked to key developmental themes.

Commonwealth

The Commonwealth Heritage List comprises natural, indigenous and historic heritage places on Commonwealth lands and waters under Australian Government control.

The National Heritage List is Australia's list of indigenous and historic heritage places considered to have outstanding heritage value to the nation, and affects land owned by states/territories and private property.

World Heritage

The World Heritage List includes indigenous and historic heritage places that have special universal values above and beyond the values they hold for a particular nation. Only the Australian Government can nominate Australian places for entry on this list.

Non-statutory lists

Additional places with historic heritage value may be included on lists maintained by the Australian Council of National Trusts and public agency and utilities responsible for land and resource management, transport, power and water supply. The Register of the National Estate became a non-statutory public archive in February 2012.

Even where no statutory requirements exist, the best practice approach is to identify and manage heritage values based on their level of cultural significance.

It is recommended that development proponents contract professional heritage consultants (archaeologists & historians) where needed to conduct the necessary research and

Historic heritage assessment

consultation to identify historic heritage values and any associated management or regulatory requirements.

Historic heritage assessments should be carried out at an early stage in the development design process to avoid critical path scenarios.

Guidelines and standards for historic heritage assessments are available from the relevant state and territory agencies responsible for managing historic heritage.

In general, historic heritage assessments will encompass the following steps:

- Desktop study

  A desktop study is conducted prior to carrying out any field survey or community consultation. The desktop study will examine the relevant heritage databases and reports to identify any documented heritage places or values, and identify themes relevant to any subsequent investigations. Recommendations for site selection or further investigations may be made based on this study.

  Databases and reports identifying heritage values are normally held by the state or territory agency responsible for historic heritage management. Additional reports may be held by agencies or organisations responsible for public land or utility management.

- Community engagement

  It is important to consult with individuals and communities that may hold specific knowledge of heritage places, or for whom the places hold special cultural meaning. Local historical societies are often good places to consult at an early stage of the engagement process.

- Field assessment

  Field surveys are carried out to identify heritage places and potential impacts, and associated permit or statutory management requirements. They enable developments to be designed and located, and procedures developed, to avoid or minimise heritage impacts. Guidelines and standards for undertaking historic field assessments exist for each state and territory.

  If there is potential for sub-surface cultural deposits to exist, based on historical or other information, the heritage assessment may recommend subsurface investigations or monitoring during earthworks.

- Subsurface investigations

  Subsurface investigations recommended by the heritage assessment must be undertaken in accordance with the relevant state and territory approvals and guidelines.

  They should utilise a rigorous scientific methodology developed in consultation with the relevant stakeholders, including collecting instructions where the recovery of artefacts is involved.

Managing construction impacts

The management of impacts associated with construction of the development should be outlined in the relevant construction environmental management plan and associated approvals.

The approval may contain a requirement to monitor ground breaking works or have an unanticipated discovery plan in place during construction. If sub-surface material is identified during construction, it may be necessary to halt works whilst the provisions of the plan are implemented or relevant approvals are obtained to enable works to continue.

A2 Appendix 2: Native title and cultural heritage

Aboriginal heritage contacts

Victoria

Aboriginal Affairs Victoria
Department of Planning and Community Development

Phone: 03 9208 3333
Fax: 03 9208 3292

Email: aboriginal.affairs@dpcd.vic.gov.au
Website: www.dpcd.vic.gov.au/indigenous

Address: Level 9,
1 Spring St,
Melbourne VIC 3000

Postal: Aboriginal Affairs Victoria
GPO Box 2392
Melbourne VIC 3001

New South Wales

NSW Office of Environment and Heritage

Phone: 02 9995 5000
Fax: 02 9995 5999

Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au/

Address: Level 14,
59-61 Goulburn Street,
Sydney NSW 2000

Postal: OEH Head Office
PO Box A290
Sydney South NSW 1232

Western Australia

Department of Indigenous Affairs

Phone: 08 9235 8000
Fax: 08 9235 8088

Email: info2@dia.wa.gov.au
Website: www.dia.wa.gov.au/

Address: Level 1,
197 St Georges Terrace,
Perth WA

Postal: PO Box 7770
Cloister's Square
Perth WA 6850

Tasmania

Aboriginal Heritage Tasmania
Department of Primary Industries, Parks, Water and Environment

Phone: 03 6233 6613
Fax: 03 6233 5555

Email: aboriginal@heritage.tas.gov.au
Website: www.aboriginalheritage.tas.gov.au/index.html

Address: 5th Floor, Marine Board Building
1 Franklin Wharf
Hobart TAS

Postal: GPO Box 771
Hobart TAS 7001

Queensland

Department of Environment and Resource Management

Phone: 07 3896 3154
Fax: 07 3405 6899

Email: info@derm.qld.gov.au
Website: www.derm.qld.gov.au/

Address: Mineral House,
41 George Street,
Brisbane QLD 4001

Postal: GPO Box 2454
Brisbane QLD 4001

South Australia

Aboriginal Affairs and Reconciliation Division Department of Premier and Cabinet

Phone: 08 8226 8900
Fax: 08 8226 8999

Email: enquiries.aard@saugov.sa.gov.au
Website: www.premcab.sa.gov.au/dpc/department_aard.html

Address: Level 13,
State Administration Centre
200 Victoria Square
Adelaide SA 5000

Australian Capital Territory

ACT Heritage
Department of Environment and Sustainable Development

Phone: 13 22 81
Fax: 02 6207 2229

Email: environment@act.gov.au
Website: www.environment.act.gov.au/heritage

Address: Levels 2 and 3
Macarthur House Annex
12 Wattle Street
Lyneham ACT 2602

Postal: GPO Box 158,
Canberra City
ACT 2601

Northern Territory

Aboriginal Areas Protection Authority

Phone: 08 8999 5511
Fax: 08 8999 4334

Email: enquiries.aapa@nt.gov.au
Website: www.aapant.org.au/about-us.html

Address: 4th Floor, R.C.G Centre
47 Mitchell Street
Darwin NT

Postal: GPO Box 1890
Darwin NT 0801

Native title contacts

National Native Title Tribunal
Principal Registry

Phone: 08 9425 1000
Fax: 08 9425 1199

Email: enquiries@nntt.gov.au
Website: www.nntt.gov.au/Pages/default.aspx

Address: Level 5, Commonwealth Law Courts Building
1 Victoria Avenue
Perth WA 6000

Postal: GPO Box 9973
Perth WA 6848

Historic heritage contacts

Victoria

Heritage Victoria - Department of Planning and Community Development

Phone: 03 9208 3333
Fax: 03 9208 3292

Email: heritage.victoria@dpcd.vic.gov.au
Website: http://www.dpcd.vic.gov.au/heritage

Address: Level 9, 1 Spring St
Melbourne VIC 3000

Postal: Heritage Victoria
GPO Box 2392
Melbourne VIC 3001

New South Wales

Heritage Branch
NSW Office of Environment and Heritage

Phone: 02 9873 8500
Fax: 02 9873 8599

Email: heritage@heritage.nsw.gov.au
Website: www.environment.nsw.gov.au/

Address: 3 Marist Place
Parramatta NSW 2150

Postal: Locked Bag 5020
Parramatta NSW 2124

Western Australia

Heritage Council of Western Australia

Phone: 1300 524 000
Fax: 08 9221 4151

Email: heritage@hc.wa.gov.au
Website: www.heritage.wa.gov.au/

Address: 108 Adelaide Terrace
East Perth WA 6892

Postal: PO Box 6201
East Perth WA 6892

Tasmania

Heritage Tasmania - Department of Primary Industries, Parks, Water and Environment

Phone: 03 6233 2037
Fax: 03 6233 3186

Email: enquiries@heritage.tas.gov.au
Website: www.heritage.tas.gov.au/

Address: 103 Macquarie Street
Hobart TAS 7000

Postal: GPO Box 618
Hobart TAS 7001

Queensland

Queensland Heritage Council

Phone: 07 3330 5875

Email: admin@qldheritage.org.au
Website: www.qldheritage.org.au/

Postal: GPO Box 2454
Brisbane QLD 4001

South Australia

Department of Environment and Natural Resources

Phone: 08 8124 4960

Email: DENRHeritage@sa.gov.au
Website: www.environment.sa.gov.au/Home

Postal: GPO Box 1047
Adelaide SA 5001

Australian Capital Territory

ACT Heritage - Department of Environment and Sustainable Development

Phone: 13 22 81
Fax: 02 6207 2229

Email: environment@act.gov.au
Website: www.environment.act.gov.au/heritage

Address: Levels 2 and 3
Macarthur House Annex
12 Wattle Street
Lyneham ACT 2602

Postal: GPO Box 158
Canberra City ACT 2601

Northern Territory

Heritage Branch
Department of Natural Resources, Environment, the Arts and Sport

Phone: 08 8999 5036
Fax: 08 8999 8949

Email: heritage.nreta@nt.gov.au
Website: www.nretas.nt.gov.au/home

Address: Level 1 AXA Building
9 - 11 Cavenagh Street
Darwin NT 0800

Postal: PO Box 496
Palmerston NT 0831

A3 Appendix 3: Useful websites

Associations

Alternative Technology Association
www.ata.org.au

American Wind Energy Association
www.awea.org

Australian Conservation Foundation
www.acfonline.org.au

Australian Energy Regulator
www.aer.gov.au

Birdlife Australia
www.birdlife.org.au

Business Council for Sustainable Energy
www.bcse.org

CADDET Centre for Renewable Energy
www.caddet-re.org

Canadian Wind Energy Association
www.canwea.ca

Clean Energy Council (CEC)
www.cleanenergycouncil.org.au

Danish Wind Industry Association
www.windpower.org/en/

European Wind Energy Association
www.ewea.org

Global Wind Energy Council
www.gwec.net

Greenpeace Australia Pacific
www.greenpeace.org.au

International Electrotechnical Commission
www.iec.ch/renewables/wind_power.htm

National Farmers Federation
www.nff.org.au

National Wind Coordinating Committee (USA)
www.nationalwind.org

RenewableUK
(formerly British Wind Energy Association)
www.renewableUK.com

National bodies

Australian Energy Market Operator (AEMO)
www.aemo.com.au

Australian Energy Market Commission
www.aemc.gov.au

Air Services Australia
www.airservicesaustralia.com

Australian Communications and Media Authority
www.acma.gov.au

Australian Heritage Council
www.ahc.gov.au

Bureau of Meteorology
www.bom.gov.au

Civil Aviation Safety Authority
www.casa.gov.au

Commonwealth Scientific and Industrial Research Organisation
www.csiro.au

Department of Climate Change and Energy Efficiency
www.climatechange.gov.au

Department of Resources, Energy & Tourism
www.ret.gov.au

Department of Infrastructure & Transport
www.infrastructure.gov.au

Department of Sustainability, Environment, Water, Population and Communities
www.environment.gov.au

Greenpower
www.greenpower.com.au

Clean Energy Regulator
www.cleanenergyregulator.gov.au

RAAF Aeronautical Information Service
www.raafais.gov.au

Safe Work Australia
www.safeworkaustralia.gov.au

Standards Association of Australia
www.saiglobal.com/online

State planning authorities

Environment and Sustainable Development Directorate (ACT)
www.environment.act.gov.au

Department of Planning & Infrastructure (NSW)
www.planning.nsw.gov.au

Department of Lands and Planning (NT)
www.dlp.nt.gov.au

Department of Local Government and Planning (QLD)
www.dcilgp.qld.gov.au

Department of Planning, Transport and Infrastructure (SA)
www.dpti.sa.gov.au

Tasmanian Planning Commission (Tas)
www.planning.tas.gov.au

Department of Planning and Community Development (Vic)
www.dpcd.vic.gov.au

Ministry for Planning (WA)
www.wapc.wa.gov.au

Other state authorities

Australian Local Government Association
www.alga.asn.au

New South Wales

Department of Industry and Investment
www.trade.nsw.gov.au

Independent Pricing & Regulatory Tribunal (IPART)
www.ipart.nsw.gov.au

Local Government and Shires Association of NSW
www.lgsa.org.au

New South Wales EPA
www.environment.nsw.gov.au/epa

NSW Office of Environment and Heritage
www.environment.nsw.gov.au

Department of Transport, Roads & Maritime Services
rta.nsw.gov.au

Rural Fire Service
rfs.nsw.gov.au

Northern Territory

NT Local Government Association
www.lgant.nt.gov.au

Queensland

Department of Environment and Resource Management (QLD)
www.derm.qld.gov.au

Queensland Fire and Rescue Service
www.fire.qld.gov.au

QLD Local Government Association
www.lgaq.asn.au

South Australia

Country Fire Service
www.cfs.sa.gov.au

Essential Services Commission of South Australia
www.escosa.sa.gov.au

Energy SA
www.sa.gov.au/energy

SA Local Government Association
www.lga.sa.gov.au

South Australia EPA
epa.sa.gov.au

Tasmania

Department of Infrastructure, Energy and Resources
www.dier.tas.gov.au

Department of Primary Industries, Parks, Water and Environment
www.dpiw.tas.gov.au

Tasmanian EPA
epa.tas.gov.au

Tasmanian Fire Service
www.fire.tas.gov.au

Tasmania Local Government Association
www.lgat.tas.gov.au

Victoria

Country Fire Authority
www.cfa.vic.gov.au

Department of Primary Industries
www.dpi.vic.gov.au

EPA Victoria
www.epa.vic.gov.au

Sustainability Victoria
www.sustainability.vic.gov.au

Municipal Association of Victoria
www.mav.asn.au

Victorian Coastal Council
www.vcc.vic.gov.au

Vic Roads
www.vicroads.vic.gov.au

Western Australia

Fire and Emergency Services Authority
www.fesa.wa.gov.au

Local Government Association
www.walga.asn.au

Main Roads Western Australia
www.mainroads.wa.gov.au

Western Australia EPA
epa.wa.gov.au

WA Department of Finance Public Utilities Office
www.finance.wa.gov.au

Details provided in this appendix were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

A4 Appendix 4: Aircraft safety

Wind energy projects (including associated wind monitoring masts) need to be sited so as not to cause a hazard to aircraft safety; civil, military, agricultural and industrial.

To provide more detailed guidance for wind farm proponents, a National Airports Safeguarding Advisory Group has recently prepared "Guidelines for land use planners and developers to manage the risk to aviation safety of wind turbine installations (wind farms)/wind monitoring towers". These aviation safety guidelines were agreed to by Commonwealth, State and Territory Ministers at the Standing Council on Transport and Infrastructure (SCOTI) meeting on 18 May 2012 subject to their operation being reported back to SCOTI in 12 months. These guidelines provide comprehensive coverage of aviation safety for wind developments and should be the point of reference for wind farm proponents.

The Commonwealth agencies such as the Civil Aviation Safety Authority (CASA), Airservices Australia and the Department of Defence must be notified of the locations of all wind monitoring towers and proposed wind farms. It should be noted that where turbine(s) are planned to be over 150 m above ground level or built within 30 km of a certified or registered aerodrome, CASA may be required to provide a formal assessment of the project. If the wind monitoring tower or wind turbine(s) is within 30 km of a military aerodrome, then extensive consultation will be required with the Department of Defence.

The aviation safety guidelines provide guidance on:

- the notification process for tall structures (wind turbines and wind monitoring masts)
- the need for risk assessment to identify whether the wind turbines or wind monitoring masts will be considered to be hazards
- actions required if a wind turbine(s) or wind monitoring mast is considered to be a hazard – including the possibility that a wind turbine or monitoring mast should not be built
- marking recommendations for wind monitoring masts.

Consultation with aviation stakeholders is strongly encouraged in the early stages of planning for wind farm developments. This should include:

- early identification of any nearby licensed aerodromes
- consultation with any nearby aerodrome owners
- if potential risks to aviation are identified, a preliminary assessment by an aviation consultant of potential issues
- confirmation of the extent of the obstacle limitation surfaces (OLS) for any nearby aerodromes
- registration of all wind monitoring masts on the RAAF AIS database
- consultation with local agricultural pilots and nearby unlicensed airstrip owners
- consultation with CASA and Airservices
- consultation with the Department of Defence.

National Airports Safeguarding Advisory Group (NASAG), *The National Airports Safeguarding Framework, Guideline D – Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation,* May 2012. They can be accessed at www.infrastructure.gov.au.

Appendix 5: Landscape assessment

A5

The following is provided as an introduction to the detailed framework for landscape values assessment, the "Wind Farms and Landscape Values National Assessment Framework", which was developed by the CEC's predecessor Auswind in partnership with the Australian Council of National Trusts.

A comprehensive landscape assessment should describe the landscape and evaluate its capacity for change in relation to the visual impact of the proposed development. Visual amenity must always be considered in the context of the existing environment and with an appreciation of local community values.

The Framework was published in 2007, but still provides a comprehensive process for assessing, evaluating and managing the visual impacts of wind farms, whilst leaving the actual technical methods, tools and techniques for developers to decide upon. This allows for the evolution of such methods. It proposes a step-by-step process for assessing these values and impacts along with ways to manage and mitigate residual impacts.

The Framework is founded on a study of best practice from across Australia and overseas.

Professional expertise is recommended in undertaking the specific tasks of an assessment, including identification of landscape values, facilitation of community input, description of visual and other impacts and design of appropriate mitigation measures. However, proponents may undertake aspects of the assessment directly themselves.

Importantly, the proponents of wind farms will need to be prepared to listen and respond to community views. They also need to be able to document and support their chosen assessment methods and techniques.

A copy of "Wind Farms and Landscape Values: A National Assessment Framework" is available via the Clean Energy Council website.

Shadow flicker

Shadow flicker is the intermittent shading of the sun by the blades of the turbine. This flickering effect can cause annoyance to people where the shadows are cast, if the duration of the shadow flicker is excessive.

The proponent will need to assess the predicted duration of shadow flicker at relevant locations. The time at which shadow flicker may occur and the exact position of the shadow can be calculated very accurately for any location around a wind turbine using one of a number of specialised software packages. While planning regulations typically note shadow flicker as an issue that must be considered at proposed wind farms, only Victoria provides a limit for shadow flicker. The policy and planning guidelines for development of wind energy facilities in Victoria (August 2011) sets a limit for shadow flicker of 30 hr/yr experienced immediately surrounding the area of a dwelling (garden fenced area). Consideration of some mitigating effects, such as cloud cover, may also be allowable depending on local guidelines.

The common objective of all proponents should be that shadow flicker from wind farms does not detrimentally affect the amenity of nearby landowners.

A6 Appendix 6: Noise

Wind farm noise emissions are regulated on a state by state basis by various regulations and guidelines specified by each state government. An Australian standard also exists in relation to wind farm noise emissions; Australian Standard AS4959-2010 "Acoustics – Measurement, prediction and assessment of noise from wind turbine generators".

These guidelines provide advice for proponents on the steps that should be undertaken to demonstrate compliance with the appropriate legislation, guidelines and standards for wind farm noise emissions. Although regulatory requirements vary somewhat, the following general steps are required to demonstrate compliance with noise limits for a wind farm. Note that it is recommended that qualified consultants and acoustic engineers be engaged to provide detailed guidance and assist wind farm proponents through the process.

1. Define the applicable noise limits for the wind farm

Each state and territory of Australia is responsible for defining its own limits for acceptable noise amenity and the first point of contact should be with the relevant body. Consideration needs to be given to the existing environment (rural, industrial etc.). Potential cumulative effects from other existing or proposed wind farms in the area should also be considered, although this is not always stated in the relevant state guidelines.

Applicable noise limits for each state can be found by contacting the relevant authority below.

Australian Capital Territory*

Department of the Environment, Climate Change, Energy and Water
www.environment.act.gov.au

New South Wales

Planning and Infrastructure
www.planning.nsw.gov.au

Northern Territory*

Environmental Protection Authority (EPA)
www.epa.nt.gov.au

Queensland*

Department of Environment and Resource Management
www.derm.qld.gov.au

South Australia

Environmental Protection Authority (EPA)
www.epa.sa.gov.au

Tasmania

Environmental Protection Authority (EPA)
epa.tas.gov.au

Victoria

Department of Planning and Community Development (DPCD)
www.dpcd.vic.gov.au

Western Australia

Planning Commission
www.planning.wa.gov.au

* These states/territories currently have no formal assessment procedure.

Summary of state-based standards and guidelines

Most states specify their own guidelines for noise assessment. Victorian guidelines[1] recommend assessment using New Zealand Standard NZS 6808:2010, "Acoustics – Wind Farm Noise", which includes applicable noise limits.

The Tasmanian EPA has broadly adopted the draft National Wind Farm Development Guidelines (July 2010), which references AS4959-2010, as an approach to the identification and mitigation of noise impacts on sensitive receivers. Noise limits are set in the Tasmanian Environment Protection Policy (Noise) 2009.

The South Australian EPA prescribes its own procedure for noise assessment which was originally published in 2003 and was updated in 2009[2]. This predates AS4959-2010, but allows for alternate methods of assessment. The South Australian EPA guidelines include applicable noise limits.

The Western Australian EPA and the planning bulletin for wind farms both refer to the South Australian guidelines for noise assessment of wind farms 2003. The New South Wales also referred to the 2003 edition of the South Australian guidelines for noise assessment of wind farms however New South Wales has recently released (December 2011) a "Draft NSW Planning Guidelines: Wind Farms" for consultation. These guidelines provide a detailed approach to noise assessment, including applicable noise limits. They also closely follow AS4959-2010 and the South Australian guidelines (2009) for noise assessment.

The other states and territories have no formal assessment procedure but applications have typically been referred to the South Australian guidelines (2003) for noise assessment.

State based guidelines include descriptions of what constitutes a relevant receiver for noise studies. These are typically dwellings, but may include some other sensitive locations.

Some state guidelines provide that it is acceptable for noise limits for landowners involved in the wind farm to be higher than prescribed limits for wind farm neighbours, but usually in-line with World Health Organisation guidelines. In some such cases, agreements with landowners may be used to set such a noise limit. Alternative limits through such agreements should be entered into after a noise assessment is completed and the predicted noise level result is known.

[1] http://www.dpcd.vic.gov.au/planning/planningapplications/moreinformation/windenergy#policy

[2] http://www.epa.sa.gov.au/xstd_files/Noise/Guideline/windfarms.pdf

2. Noise characteristics

Some industrial noise emissions contain characteristics that may make the noise more annoying: tonality (humming, whining), modulation (regular variation in noise level or pitch) and impulsiveness (hammering, banging). In the case of wind farm noise emissions, wind turbine design generally ensures that these characteristics are minimised or not present. In cases where they are present, these characteristics will generally become inaudible due to masking by other background noise at a distance where acceptable noise limits are satisfied. However, the proponent should consult with the wind turbine supplier and acoustic consultant to ensure that any noise characteristics such as tonality, modulation, impulsiveness (if present in the wind turbine's noise emissions) are unlikely to affect relevant receivers (this is a requirement in some jurisdictions).

3. Background noise measurements

A unique characteristic of wind turbines is that their noise emission increases with increasing wind speed; therefore the increase in noise from turbines is often, but not always, accompanied by an increase in the background noise environment. A large component of this additional background noise is generated from wind blowing past or through objects, such as trees or buildings. As a result, the background noise near a dwelling may be high enough to 'mask' the sound of the wind turbines. Consequently, applicable noise limits often include reference to background noise levels, as well as a baseline limit (e.g. 40 dB(A) or 5 dB(A) above background noise). Therefore background noise monitoring must be undertaken to assess the noise emissions in relation to background noise as well as to allow for noise compliance monitoring during wind farm operation.

Background noise measurements should be undertaken by an acoustic consultant, in accordance with the state guidelines, at relevant receivers. Simultaneous wind speed measurements are generally required for the assessment, so it is important to ensure that wind monitoring (in place for feasibility purposes) is operating correctly when background noise measurements are made. Note that the descriptions of relevant receivers may vary between state guidelines and may also include sensitive locations other than dwellings. In some cases, where it can be shown that the acoustic characteristics at two locations are similar, background monitoring may not be required at both. Background noise monitoring will typically take a few weeks to complete, but the actual period can vary depending on the site conditions and data collected.

The potential for baseline acceptable noise limits to be exceeded can be established using noise prediction models, including topographical contours and all potential relevant receivers.

If in doubt, it is always best to measure background noise directly to verify or improve the accuracy of noise modelling and this is especially important if noise sensitive residences are close by.

A6 Appendix 6: Noise

4. Demonstrate likely compliance for planning approvals

Assessment of likely noise levels at relevant receivers should be carried out by a qualified and competent acoustic consultant. This will be conducted using noise modelling software and a range of assumptions about turbine sound power curves and noise transmission in the local environment, and will incorporate background noise measurements as applicable. The method of conducting the assessment is prescribed by the relevant state guidelines.

In many cases, changes to the wind farm design, layout or wind turbine operation may be required to demonstrate compliance. In such cases, an iterative approach of assessment and modification is required and necessitates a close working relationship with an acoustic consultant. In-house capabilities and software may also be employed to optimise the design with consideration to noise, prior to validation by an independent acoustic consultant.

The acoustic consultant should be asked to prepare a noise impact assessment report for inclusion in the development application.

5. Demonstrate compliance post construction

Post-construction noise compliance testing of a wind farm must show the wind farm to be compliant with the applicable noise limits at all neighbouring residences as specified in the project's development approval. Any instances of post-construction testing demonstrating non-compliance with the applicable noise limits must be immediately addressed and rectified by the proponent of the wind farm.

The relevant state guidelines will detail the method to undertake noise monitoring when a wind farm is in operation to assess compliance or otherwise. Mitigation measures to address any non-compliances are likely to include modification of the operating characteristics of one or more wind turbines or scheduling wind turbine operations.

6. Undertake sound power level testing

Sound power level testing refers to noise measurements at a single wind turbine, and may be required due to any or all of the following reasons:

- A condition of the supplier contract requires confirmation the wind turbine noise emissions are within the warranted range.
- It is required to demonstrate measured non-compliance at relevant receivers is not a result of wind turbine noise emissions.
- A requirement of the permit conditions is confirmation of the wind turbine noise emissions.

IEC 61400-11 Ed 2.0:2002 (as described below) prescribes the methods and requirements to undertake sound power level testing. The procedures are restrictive and may not be applicable to all wind turbine locations within a wind farm.

IEC 61400-11 Ed 2.0:2002 Wind turbine generator systems Part 11: Acoustic noise measurement techniques

This standard presents noise measurement procedures that enable noise emissions of a wind turbine to be characterised. Measurement locations are defined close enough to the machine to avoid errors due to noise propagation effects, but far enough away to allow for the finite source size. The procedures described are different in some respects from those that would be adopted for noise assessment in community noise studies. They are intended to facilitate characterisation of wind turbine noise with respect to a range of wind speeds and directions. Standardisation of measurement procedures will also facilitate comparisons between different wind turbines.

Australian Standard

There is an Australian Standard AS4959-2010 "Acoustics – Measurement, prediction and assessment of noise from wind turbine generators". While this is not currently referred to in most of the state legislation or guidelines, it is considered by some to represent current best practice for noise assessment of wind farms in Australia. The guidelines do not set limits for noise (leaving these to the relevant authority to set), and instead focus on the method of assessment. The method differs in a number of minor ways from the South Australian guidelines and the New Zealand Standard, which can, in some circumstances, have significant effects on the outcome of an assessment. Use of the Australian Standard for a noise assessment (as a substitute for other methods) should be discussed with the relevant authority and a noise consultant.

References:

Sonus, *CEC Wind Farms Technical Paper - Environmental Noise,* November 2010

Western Australian Planning Commission, *Planning bulletin 67 Western Australia Guidelines for Wind Farm Development,* May 2004

Environmental Protection Authority (WA), *EPA Guidance for the Assessment of Environmental Factors No. 8 – Environmental Noise,* Draft, May 2007

Environmental Protection Authority (SA), *SA EPA Wind Farms Environmental Noise Guidelines,* July 2009

Department of Planning and Community Development (VIC), *Policy and planning guidelines for development of wind energy facilities,* August 2011

Department of Planning and Infrastructure (NSW), *Draft NSW Wind Farm Planning Guidelines,* December 2011

Department of Environment, Parks, Heritage and the Arts (TAS), *Environment Protection Policy (Noise)* 2009, March 2009.

Appendix 7: Ecological assessments

A7

This section covers ecological assessments of onshore wind farm developments including:

- vegetation communities
- flora
- terrestrial fauna and their habitats
- birds and bats.

Wind farms can potentially affect ecological values through:

- bird and bat collisions with wind turbines
- the construction of roads and turbine hardstands requiring the clearing of native vegetation
- the construction of roads and turbine hardstands impacting on important flora species and fauna habitats
- indirect effects (potential alienation at a site), where wind farms change the use of habitats by birds and bats on or near a wind farm.

The results of the ecological assessments are used to describe the existing environment and to assess the potential impact on flora and fauna, including birds and bats. This information will support an application for development approval and will be included in the assessment whether the wind farm is likely to have an unacceptable impact on ecological values. The results of the ecological assessment will also inform a referral to the Australian Government Minister of the Environment for consideration under the Environment Protection Biodiversity Conservation Act 1999 if one is made for the assessment of potential impacts on matters of National Environmental Significance.

Objectives

The aim of the guidelines is to demonstrate to regulatory authorities and the community that ecological issues at wind farm sites are being assessed in a comprehensive and consistent manner. The fundamental principle of the guidelines is that rigorous, scientifically-based approaches are used in the assessment and monitoring of ecological issues at Australian wind farms.

The guidelines provide a structured approach to investigating the effects of wind farm construction and operation on ecological values, and the ongoing monitoring of effects after construction if required.

It is not the purpose of the guidelines to provide a description of all possible studies that could be undertaken during an investigation of a wind farm development, as it is more appropriate to select and design studies on a site, project and species-specific manner. Similarly, no detailed methods are provided as each study should be designed specifically to answer questions relevant to the proposal and the site. These guidelines recommend that input be sought from relevant experts and the relevant regulatory authorities when determining the surveys to be conducted and their design.

Approach

The ecological assessment guidelines follow the general approach for ecological assessment of any site regardless of the proposed use and includes:

- a desktop review of available information to identify any potential issues that may prevent the project being approved
- field surveys to map the vegetation and identify flora and fauna species
- species-specific studies to obtain more information about significant flora and fauna (particularly birds and bats) that may be at risk from the development or to avoid them or develop mitigation strategies
- development of avoidance, mitigation and offset strategies to minimise impacts on species if required; and
- development and implementation of monitoring programs for the construction and operational phases of the wind farm development.

The ecological assessment guidelines have been separated into two parts, birds and bats, and vegetation and terrestrial fauna. The assessment of bird and bat issues tend to form a major part of ecological impact assessments for many wind farm projects because of the potential for collisions with wind turbines.

A7 Appendix 7: Ecological assessments

Birds and bats

Desktop review

The aim of the desktop review is to identify if there is the potential for significant impacts to any listed bird or bat species that use the site. These impacts include the risk of collision with wind turbines or where the construction of a wind farm may affect the way species use the site. This could also apply to unlisted species that are important for other reasons, however the desktop review should focus on bird and bat species that are covered by state, territory and Australian Government legislation. A desktop assessment uses existing information in published reports or online databases, to identify if there are any significant bird and bat species on or adjacent to the proposed wind farm site that may constrain, impede or prevent the approval of a wind farm. Significant species are those listed as threatened under relevant legislation and those for which there is evidence that they are at risk from wind farm developments.

There are government agencies in each state or territory that are responsible for the management and regulation of protected and threatened[2] bird and bat species. Further information on the relevant legislation and responsible agencies can be found on state government websites. The Australian Government legislation that covers nationally listed flora and fauna species and ecological communities is the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act). Further information on the EPBC Act and its assessment process can be found on the Australian Government website (www.environment.gov.au/epbc).

The desktop review should encompass an area around the wind farm which includes particular habitats that may support significant bird and bat communities, such as Ramsar wetlands which will provide habitat for waterbirds, and caves which may provide roosting and breeding sites for bats. Examples of online databases are the EPBC Act Protected Matters Search Tool, and state-based databases, such as Tasmania's Natural Values Atlas, New South Wales' BioNet, and Victoria's Biodiversity Interactive Map.

Examples of bird and bat issues that may constrain a wind farm development include the use of the site by significant bird species which are at higher risk of collision with turbines, or the presence of large concentrations of significant bat species (e.g. cave dwelling bats) which may be at risk of collision with wind turbines. These issues may restrict the location of turbines at a wind farm site.

The desktop review can benefit from a site visit to validate and inform the results of the database. This could include the presence of important potential habitat features for birds and bats such as forest with old trees with hollows which may provide potential nesting, roosting breeding and habitat.

The desktop review will inform the wind farm feasibility process and may be the only study required if it identifies any bird and bat issues that would be likely to preclude the development from obtaining regulatory approval.

Field studies

The desktop review will inform the type of field studies that will be required to verify the bird and bat species at the proposed wind farm site and to explore how they use the site. At a minimum, field surveys should aim to:

- identify significant bird and bat habitats and habitat components
- undertake bird utilisation surveys and modelling to identify species at risk of collision and/or displacement (particularly listed threatened species)
- undertake bat surveys to identify any listed threatened species in the area.

Field surveys should aim to cover all planned areas of disturbance, including grid infrastructure, and may require a number of visits depending on the species being surveyed and any changes in the size and layout of wind farm. They should provide sufficient information to support an application for development approval and to assess whether a referral under the EPBC Act might be appropriate.

Bird surveys

Studies in Australia and overseas have shown that some birds are at risk of collision with wind turbines, with some species of birds shown to be at higher risk than others. Bird utilisation surveys aim to identify the avian species on site, the numbers present, the height that birds fly, and describe utilisation across the site. Utilisation studies often include a description of bird "behaviour" which usually refers to activities such as feeding, resting or moving, as these can aid the understanding of potential wind farm effects.

The survey design may need to include reference (or control) points and treatment points to allow for a Before and After Control Impact (BACI) design if the site supports significant bird species. A BACI design includes reference sites placed at a sufficient distance from the proposed turbine locations to obtain data outside the zone of influence of the turbines. Data are quantitative and are collected at pre-determined fixed points. The surveys are conducted during relevant seasons (for the species being studied and the location of the site), and would normally involve sampling of different relevant habitats on the site. Data are usually recorded in a way that allows them to be input into a collision risk model for estimating the potential collision risk of a species.

Monitoring of the impacts of a wind farm should only occur in the operational phase of the development, and only where there has been a specific need identified by the regulators. Monitoring regimes will be informed by the earlier survey and modelling work.

Bat surveys

Similarly to birds, studies in Australia and overseas have shown that some bat species are at risk of collision with wind turbines or barotrauma. Field surveys can be carried out to determine which bat species use the site and includes those species that breed and roost on the site and those that do not live on the site but forage and/or move across the site. Methods that can be used to identify the bat species on the site and give an indication of their use of the site include:

- mist nets or harp traps placed across presumed flight paths of bats
- using bat detection systems to record and analyse the echolocation calls of bats.

Note that mist nets and harp traps will require permits to catch and handle bats from state wildlife regulatory authorities and will also require Animal Ethics Approval. Non-intrusive methods such as bat call detecting will generally not require a permit because they do not involve the catching or handling of bats.

It should be noted that bat utilisation data cannot be obtained by using the above techniques (i.e. they are only useful for species identification and to gain an appreciation of populations). Currently the only possible means of quantifying the density of bats on a site is using techniques such as radar, but even these systems have their limitations.

Species-specific studies

The results of the field surveys may lead to additional species specific surveys being required to assess the potential effect of the wind farm on significant species such as listed threatened species, or species at particular risk (e.g. birds of prey, wetland birds or bats at risk of collision with wind turbines). A species-specific study may be required to demonstrate that the wind farm is not going to have a significant impact on a bird or bat species that has been identified as at risk from the field surveys.

Bird studies

Collision risk of birds and bats at wind farm sites is dependant on several factors, some of which are not yet well understood. Some of these factors include species type, population densities, utilisation of the area, and whether a particular species flies at rotor height. Risks can be reduced by gaining an understanding of how the site is used by birds and bats through the implementation of utilisation studies for particular species.

Collision risk modelling

The data from either general bird utilisation studies or specific species utilisation studies can be input into Collision Risk Models (CRMs) which aim to estimate the number of birds at risk of colliding with wind turbines on a site. They are generally used for testing potential impacts on significant species. CRMs generally use bird observational data from the site and bird size, flight speed, population sizes, and avoidance rates, along with inputs about the technical specification of wind turbines (e.g. turbine height, blade length, blade dimensions) and wind direction. CRMs can provide an indication of the magnitude of the collision risk by particular bird species at a site. In the absence of observed data, scenario modelling can be done, where a series of assumptions about bird use at a site are input into the model to assess collision risk. The inputs can be varied to test a range of scenarios.

Bat studies

Bat studies that are particularly designed to measure whether the site is used by species of concern can also be implemented at sites. These may include studies to assess the use of a site by concentrations of threatened species, such as those that may use a maternity cave within the vicinity of a proposed wind farm which may place greater numbers of individuals at risk of collision with wind turbines. These studies may involve the design and implementation of a study that employs the deployment of bat call detectors at a number of strategically located sites over the period when bats are breeding and are most active, in the spring and summer months.

Population viability analysis

Population Viability Analysis (PVA) was developed as a modelling tool for determining the viability (extinction probability) of populations of threatened species, where information was available on a range of population variables. It provides a means of organising and analysing information about the population of a threatened species. PVA is a useful modelling approach to explore a range of scenarios that may arise from the impacts of a wind farm (particularly collision risk) on bird populations. It is a well-researched, formalised approach and its information requirements are well-documented. However, for most threatened species there is an absence of measured population and demographic variables that are required as inputs into a PVA and the results of the PVA need to be interpreted with consideration of the limitations of the data that have been used.

A7 Appendix 7: Ecological assessments

Vegetation and terrestrial fauna

Desktop review

The aim of the desktop review is to identify if there are any vegetation and terrestrial fauna values on or adjacent to the site that would significantly constrain the development of a wind farm. The desktop review should focus on flora and fauna species and ecological communities[2] that are covered by state, territory and Australian Government legislation. There are government agencies in each state or territory that are responsible for the management and regulation of protected[4] and threatened[5] flora and fauna species and ecological communities. As noted above the EPBC Act is the Australian Government legislation that covers nationally listed flora and fauna species and ecological communities.

The desktop assessment uses existing information in published reports or online databases, to identify if there are any significant vegetation communities, flora and fauna species on or adjacent to the proposed wind farm site that may constrain, impede or prevent the approval of a wind farm. Examples of online databases are the EPBC Act Protected Matters Search Tool, and state-based databases, such as Tasmania's Natural Values Atlas, New South Wales' BioNet, and Victoria's Biodiversity Interactive Map. The desktop review should also aim to identify if there are any important conservation areas adjacent to the proposed wind farm site which may impact on the approvals process such as the presence of national parks, nature reserves and Ramsar sites.

Examples of vegetation and terrestrial fauna values that may constrain a wind farm development or require rigorous management practices are the presence of patches of significant native vegetation communities or fauna habitats (e.g. native grasslands) which may limit the location of wind turbines and associated infrastructure such as roads.

The desktop review can benefit from a site visit to validate and inform the results of the database. This could include the presence of native vegetation and important potential habitat features such as native grasslands and patches of woodland and forest with old trees with hollows which may provide potential foraging resources, nesting, shelter and roosting habitats for fauna species that may be affected by a wind farm development.

As noted above the desktop review will inform the wind farm feasibility process and it may be the only study required if it identifies any vegetation and terrestrial fauna issues that would be likely to preclude the development from obtaining regulatory approval.

Field studies

The desktop review will inform the type of field studies that are required to describe the vegetation and flora and fauna species that occur at the proposed wind farm site. The aim of field studies is to identify if there are threatened flora and fauna species and ecological communities that are present on site that are listed under Commonwealth, state or territory threatened species legislation. In addition, all states and territories have legislation to protect native vegetation.

The outcomes of field studies for vegetation field and terrestrial fauna can be used to:

- map the vegetation
- identify threatened flora species
- identify threatened fauna habitats
- confirm the presence and habitat condition of surface water resources onsite and in the vicinity of the wind farm site.

Field surveys should aim to cover all planned areas of disturbance, including grid infrastructure, and may require a number of visits depending on the species being surveyed and any changes in the size and layout of wind farm.

Vegetation mapping

Vegetation mapping involves using existing vegetation mapping to identify what communities have been mapped across the site, a survey of all vegetation types within the wind farm footprint to verify the existing vegetation boundaries (if previously mapped) or to identify unmapped vegetation communities. The identification of vegetation communities is generally done by recording all flora species from within representative plots for each stratum[6], their height and cover, which is used to identify dominant species within the vegetation community which can then be related to a vegetation mapping unit.

Flora survey

The aim of the flora surveys is to document the flora species that occur on the site and identify significant species. An initial flora survey can be done in conjunction with the vegetation mapping. Flora surveys are best done in spring when most flowering plants will be in flower and other times for species which flower at other times of the year.

Due to varying flowering times and seasonality of occurrence of plants it is unlikely that all flora species that occur at the site will be encountered in a single site visit. In particular short lived annuals, such as orchids, lilies and annual herbs are likely to only be identifiable when they are in flower. Consequently, targeted surveys at known flowering times may be required to determine if these species are present (see next section regarding species-specific surveys).

Fauna habitat survey

The aim of the fauna habitat survey is to identify important habitat components that are on the site including:

- vegetation communities that support a particular suite of fauna (e.g. native grassland species) and specific fauna species (e.g. the pygmy blue tongue lizard (Tiliqua adelaidensis)
- trees with hollows which provide shelter sites for arboreal mammals, nest sites for birds and roost/maternity sites for bats
- lakes, dams, ponds and streams that may provide habitat for waterbirds and frogs.

If habitats are identified that may support listed threatened fauna species at particular risk from the wind farm development, then follow up species-specific surveys may be required to map the extent of habitats and estimate the level of occupancy or population size so that a risk assessment can be carried out.

Species-specific studies

The results of the field surveys may lead to additional species-specific surveys being required to assess the potential effect of the wind farm on significant species such as listed threatened flora and fauna species. A species-specific study may be required to demonstrate that the wind farm is not going to have a significant impact on a flora or fauna species that have been identified at risk from the field surveys.

Targeted flora and fauna surveys

Species-specific studies may be required for listed threatened flora species such as orchids, lilies, annual herbs, grasses and sedges which can only be identified when they are in flower, or in the case of grasses and sedges, when the seed or fruit has set (grass seed and sedge fruits are used to taxonomically distinguish most species). Therefore surveys targeted at a particular species will be required at the time when the reproductive feature (flowers, seeds or fruits) is present.

Targeted surveys for some fauna species may also be required, for example wetland birds in winter or spring when wetlands have water in them or in spring/summer when migratory waders from the northern hemisphere may be present. Other examples may include targeted reptile surveys for grassland and woodland species listed under the EPBC Act. For example, targeted hand searching for the Flinders worm lizard (Aprasia pseudopulchella) within known grassland and woodland habitats and checking spider holes in grassland habitats to see if they are occupied by the pygmy blue-tongue lizard (Tiliqua adelaidensis).

Avoidance, mitigation and offset

The intent of the vegetation, flora and fauna studies outlined above is to identify significant ecological values and design a wind farm (the layout of wind turbine, roads, cabling, substations and control centres) that aims to avoid them. If the significant values cannot be avoided then mitigation measures that minimise impacts to acceptable levels should be developed with expert ecological input, and implemented. Occasionally there may be situations where following the implementation of avoidance and mitigation measures there remains an unavoidable impact on a particular flora or fauna species or vegetation community. In this situation an offset may be required by the regulating authority, which could be the Australian Government, state or territory regulator. The EPBC Act Environmental Offsets Policy (DSEWPC, 2011) explains the requirements for offsets (although currently in draft at the time of publication).

The aim of the offset is usually to achieve a commensurate gain in what has been lost through the wind farm development. The Australian Government defines environmental offsets as "actions taken outside a development site that compensate for the impacts of that development – including direct, indirect or consequential impacts"[7]. In addition, the states have their own frameworks for achieving offsets and methods for calculating the magnitude of the required offset will vary between states in accordance with their regulations.

Actions that are considered as offsets can be "direct" or "indirect" offsets. Direct offsets may include the long-term protection of existing habitat (either by acquisition and inclusion in the reserve system or covenants on private land), the restoration or rehabilitation of existing habitat or the re-establishment of habitat. Indirect offsets[7] may include:

- the implementation of recovery actions for an affected species or community
- contributions to research or education programs for the affected species
- the removal of a threatening process or processes for an affected species or community
- on-going management activities such as monitoring, maintenance, preparation and implementation of management plans.

Offsets generally aim for the replacement of like for like. Therefore, the clearing of 1 hectare of a native grassy woodland community in excellent condition (the community is intact and has a floristic composition and habitat value as an undisturbed example of this type) would require the offset of 1 hectare of similar community in the same condition. Offsets can be applied for the loss of a listed threatened ecological community, flora or fauna species or fauna habitat.

A7 Appendix 7: Ecological assessments

Monitoring

The development approval for the wind farm may involve the implementation of monitoring programs during construction of the wind farm. These can include the monitoring of site clearing works so that native vegetation, significant flora species and significant habitat components (trees with hollows) are not inadvertently cleared. The monitoring of known nests for breeding activity may also be required.

Once a wind farm has been approved, the conditions of approval are likely to require post-construction monitoring if significant species are present at or adjacent to the site. Post-construction monitoring is generally carried out where a need to do so has been identified. This may be required to monitor the effects of the operating wind farm on specific ecological values (e.g. listed threatened species).

Post-construction surveys may involve (but not necessarily be limited to):

- the monitoring of bird and bat collisions with turbines
- the assessment of the effects of the wind farm on bird and bat utilisation rates to determine if they have been affected by the operation of the wind farm.

It is important that the post-construction monitoring includes:

- the identification of clear and measurable objectives
- the development of scientifically rigorous methods that will obtain data that addresses the objectives
- input from experts (e.g. ecologists and statisticians) to assist with the design and completion of surveys.

Post-construction monitoring will need to satisfy the requirements of any conditions that are placed on the wind farm by the development approval.

Sources of desktop data

Information of records of ecological values can be obtained from a range of sources and include (but are not limited to):

- publicly accessible online databases held by government agencies (e.g. Atlases of NSW or Victorian Wildlife, electronic databases held by state government agencies)
- the web-based Protected Matters Search Tool of the Australian Government Department of the Environment and Heritage on matters of national environmental significance
- databases held by a range of non-government organisations (e.g. Birds Australia's The New Atlas of Australian Birds [Barrett et al. 2003])
- published and unpublished reports on the biodiversity of the region concerned (e.g. Biodiversity Action Plans in Victoria, or the Regional Biodiversity Plans in South Australia)
- scientific papers (such as Austral Ecology, Wildlife Research, etc.)
- personnel from State Parks and/or wildlife agencies, particularly regional fauna and/or biodiversity officers with local knowledge of wildlife in a region
- personnel or local members of national or regional non-government wildlife or field naturalist organisations.

[2] Native flora and fauna species that are at risk of further decline or extinction are generally given a greater level of protection under legislation that protects threatened species.

[3] Ecological communities includes vegetation communities, ecological vegetation communities and faunal communities (e.g. the Victorian Flora and Fauna Guarantee Act 1988 listed "Butterfly Community No. 1")

[4] Most native flora and fauna species are protected under State and Territory legislation and a permit is required to "take" them.

[5] Native flora and fauna species that are at risk of further decline or extinction are generally given a greater level of protection under legislation that protects threatened species.

[6] A vegetation layer such as the ground layer, understorey layer, shrub layer and canopy.

[7] Draft Policy Statement: Use of environmental offsets under the Environment Protection and Biodiversity Conservation Act 1999. August 2007. Department of the Environment and Water Resources, Australian Government.

Appendix 8: Fire management guidelines

A8

The prevention and management of fire is a critical part of the wind farm planning process. In Australia, wind farms are commonly constructed in rural and bushland environments where fire is a significant concern. Despite the low fire risk that wind farms present, the development of an effective fire prevention and emergency response is essential.

A detailed risk assessment (using ISO 31000 risk management standard or similar) should be conducted for the project across all stages of the development to evaluate the fire risk and to guide mitigation requirements, including emergency response plans. The risk assessment should be iterative and include collaboration with local and regional fire management and prevention authorities. As all sites and project configurations are different, standard approaches need to be avoided. Often the proponent is best placed to respond to an emergency at the wind farm and this should be considered in the preparation of the emergency response plan for the project.

Fire management will be in compliance with relevant state and territory fire protection Acts and should also consider any guidelines issued by the state's country fire service. Well planned and effective fire management aims to ensure that appropriate measures are in place to prevent fire and minimise damage in the unlikely event of an emergency.

Listed below are actions which wind farm proponents should consider during the development, construction, operation and decommissioning of wind farm projects.

Wind farm planning

Wind farm developments need to comply with all relevant Acts (e.g. VIC Electricity Safety Act) and supporting regulations (e.g. NSW Rural Fires Regulation 2008) and consideration of all guidelines. This is in relation to both wind farms and transmission or distribution lines.

Consult the relevant regional and local fire service to notify them of the project and seek advice regarding fire and emergency response management requirements. Country fire services may also have specific wind farm fire management guidelines available to assist developers in planning for fire management.

Fire management requirements may include:

- provision of details of the wind farm site (such as wind farm location, turbine and access track/gate locations and onsite identification) to assist fire service internal strategic and response planning
- development of an emergency response plan, which would include agreed notification protocols, contacts and response actions
- design of internal access tracks to allow emergency vehicle access including consideration of:
  - all weather surface
  - minimum track width (including corners)
  - maximum gradient (including entry and exit of dips)
  - minimum weight bearing for crossovers
- provision of turn around on dead end tracks
- commitment to adhere to fuel load regulations and local fire service requirements regarding fuel loads, around electrical compounds, transmission and distribution lines, buildings and other structures (consideration should be given to native vegetation clearance restrictions and landowner consent prior to clearing)
- identification of water reserves in the local area which could be used for fire fighting, or provision of static water supply tanks and appropriate fittings for fire fighting at agreed locations.

A8 Appendix 8: Fire management guidelines

Pre-construction

Provide the appropriate regional and local fire services with up to date information which may include:

- a construction works schedule
- maps of final turbine layout and identification information for individual turbine sites
- access road plans and locations of access gates
- security information such as location of locked gates and restricted access areas
- location of any additional water supplies installed for construction activities
- location of potential landing pads for fire fighting aircraft or helicopters.

Construction and decommissioning

During construction and decommissioning phases, proponents should:

- provide the local rural fire services with access keys or cards to locked gates and restricted areas (where appropriate)
- ensure contractors develop an emergency response plan that is consistent with the proponent emergency response plan, and confirm notification and response protocols with the local fire service
- ensure all staff are familiar with fire prevention and emergency response actions (e.g. by including in staff inductions) and that plans developed are available to all staff and local and regional fire services
- provision of basic fire-fighting equipment at each active site, including fire extinguishers, knapsacks, and other equipment suitable for initial response actions
- provision for mobile telephone and UHF radio communications at construction sites
- keep local rural fire services updated about any changes to works schedules or access arrangements
- compliance with state Acts regarding high risk work activities on high fire danger days.

Operation of a wind farm

During wind farm operations, proponents should ensure the following fire management actions are carried out:

- ensure an up to date emergency response plan or procedure is available on site at all times (note: revisions should be completed in consultation with local and regional fire services)
- ensure operations staff are familiar with emergency response procedures and have access to relevant plans or procedures
- ensure the regional and local rural fire service has up-to-date maps, access gate keys/cards and turbine numbering information
- inform the local rural fire service of the wind farm maintenance schedule (if available) and any planned activities.

Useful references

NSW Bushfire Coordinating Committee, *Bush Fire Risk Management Policy,* Policy No. 1/2008

NSW Rural Fire Service (RFS), A *guide to Developing a Bushfire Evacuation Plan, Planning & Environment Services* – NSW Rural Fire Service, 2004

VIC - *Emergency Management Guidelines for Wind Farms,* Country Fire Authority (CFA), Version 4, February 2012. http://www.cfa.vic.gov.au/documents/CFA_Guidelines_For_Wind_Energy_Facilities.pdf

Appendix 9: Electromagnetic interference

A9

Telecommunication systems often use high points in the landscape which can be in the vicinity of potential wind farm sites and telecommunications service providers, and users may have concerns about electromagnetic interference (EMI) and degradation of signals as a result of a proposed wind farm development.

A diverse range of telecommunications including radio and television companies, mobile phone companies, local and national utilities, and emergency services such as ambulance and coastguard using microwave communication systems could be involved in any particular development. In rare cases proponents may be faced with complying with statutory separations from certain communications equipment for example those associated with microwave sites, or airport or meteorological radar. Such considerations are rare because wind farms tend to be located a considerable distance from the location of such infrastructure (particularly radar).

The scope for wind turbines to impact such systems is summarised as follows:

- the wind turbine tower may obstruct, reflect or refract the electromagnetic waves used in a range of communications systems for transmission
- the rotating blades may have similar effects, on a time-variable basis. In some cases ghosting of TV receivers close to the wind farm may occur where metal blades (or those with metallic cores or metal components such as the lightning protection system) act as an aerial to on-transmit the communication signal
- the wind turbine's electrical generator can produce electromagnetic interference, which may need to be suppressed by shielding design and maintenance of wind turbines (although in practice, a generator is little different from a typical electrical motor and it is quite rare for a wind turbine generator to present such a problem).

It is normally possible to minimise the potential for EMI, if not eliminate the possibility altogether, through technical solutions and appropriate wind turbine siting.

In general the effects of wind turbines on electromagnetic waves will usually be small. The design of the tower and blades are slim and curved, and consequently will disperse rather than obstruct or reflect electromagnetic waves. Where blades are of a material transparent or absorbent to the waves, as is commonly the case, problems are likely to be minimal. However, the location, size and design of the wind turbines may be important, depending on the location and nature of the communication transmission facilities.

To minimise potential EMI, the following summary steps are advised:

- identify all stakeholders potentially affected by the wind farm
- assess the potential EMI impacts
- consult with the relevant stakeholders
- mitigate against any potential EMI effects.

Potential stakeholders affected

Services potentially affected by EMI include (but are not limited to) to the following:

- point to point broadcast services – e.g. analogue television and radio services, digital television and radio in low signal areas
- point to point radio link – e.g. mobile phone communications, emergency services and defence radio communications, commercial dedicated communications infrastructure
- aviation radar – detection of planes and potential obstructions
- meteorological radar – detection of local weather events

Potential stakeholders may be identified through a search of the Australian Communications and Media Authority's (ACMA) Register of Radiocommunications Licences. The database can be accessed at www.acma.gov.au, or through the purchase of a CD of the database. This register may not identify all stakeholders and local consultation may be used to identify any omissions.

Typical stakeholders may include:

- relevant TV or radio broadcasters
- relevant telecommunications carriers (e.g. Telstra)
- other radiocommunications service providers (details obtained from ACMA database search)
- Department of Defence
- Air Services Australia
- Bureau of Meteorology.

A9 Appendix 9: Electromagnetic interference

Assessing potential impacts

As a guide the following criteria should be used to determine whether a stakeholder may be affected:

- a wind turbine is within 2 km of a radiocommunications transmission site; or within 2 km of a radiocommunications receiver and in line with the transmission site
- a wind turbine is within the maximum second Fresnel zone of a point to point radio link.

Aviation or meteorological radar operation can be affected by wind turbines. Even wind farms within 100 km of a radar installation may impact on its operation and this can depend on a number of factors including the type of radar used, distance from the radar installation, terrain, layout of the wind turbines and the size of the turbines. The owners of radar installations (e.g. the Bureau of Meteorology and Airservices) can generally assist in the assessment of the potential impact if required.

Mitigation options

For all electromagnetic effects, means of mitigation, avoidance, and remedy can be found. In the case of potential impacts to significant infrastructure, advance planning is warranted.

As well as consultation with the relevant stakeholder to determine the likely magnitude and impact of any effect, mitigation may include:

- location of particular wind turbines to avoid services
- design or selection of wind turbine (including shape of tower or nacelle, or type of blade material)
- relocating, adjusting or enhancing existing communications installations.

For domestic receptors it is generally possible (and cost effective) to address any reception problems after installation. This may include enhancing reception by upgrading the quality of existing television aerials, installing a repeater or offering alternative satellite or digital television reception options.

It may also be necessary to undertake testing before and after construction to quantify any effects and instigate any mitigation actions required.

The electromagnetic radiation resulting from generation and export of electricity from a wind farm does not pose a threat to public health. Typically electrical cabling between wind turbines will be buried in the ground and grid connection cabling is at similar voltages to those routinely used by utilities in existing distribution networks. However, as part of the engineering specification, proponents will require that installation contractors adhere to prescribed electrical cabling standards.

Useful reference

Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems - Radio Advisory Board of Canada (RABC) & Canadian Wind Energy Association (CanWEA), 2007

Appendix 10: Wind turbine standards

A10

Currently there is no accreditation system for wind farms or wind turbines in Australia (with the exception of AEMO requirements). In the absence of these, International Electrical Commission (IEC) Standard IEC WT01:2001 is accepted as the default for the design of wind turbines which specifies an extensive accreditation process which covers the design, manufacture and prototype testing of a wind turbine.

To cover any gaps/differences between these standards and what is required for a wind turbine to operate in Australia there are accepted practices to ensure wind turbines and wind farms are designed and commissioned to an acceptable standard, which will comply with local laws. This appendix provides guidance on generally accepted practices within the wind industry in Australia to demonstrate that a wind farm has been appropriately designed.

Apart from ensuring the wind farm is designed to be fit for purpose, there are other potential reasons for ensuring the wind turbines and the wind farm are designed in accordance with recognised standards:

- Meeting AEMO requirements to allow connection to the grid and export of power.
- To demonstrate compliance with relevant OH&S and building legislation.
    - Each state has its own requirements, although it is likely that if compliance can be demonstrated in one state, the requirements of other states will also be satisfied.
    - To minimise any potential legal risk to the proponent should an untoward event occur that results in loss of life, serious injury or significant damage.
- As a requirement of financing for a project; whether by a banking institution or if financed off a balance sheet:
    - The uncertainty of energy estimates must be quantified to provide confidence to investors (see box on wind monitoring below).
    - Typically it will be a requirement to demonstrate that the wind turbine has Type Certification .
    - There may also be a requirement to demonstrate that the power curve of the wind turbines installed is within the warranted power curve.
    - It may also be a requirement to demonstrate that the site conditions are within the design limits of the wind turbine to be installed.

Further to these considerations, understanding of standards for wind data monitoring is also a crucial aspect in the development of a wind farm. Wind data is required for estimating the energy output of the wind farm, noise assessments and other environmental studies, as well as some other aspects of the wind farm design (such as site suitability).

The most critical aspect for wind monitoring is if project finance is required or when proving a business case. When assessing the project's ability to pay back debt, the financial institutions will consider the levels of uncertainty associated with the energy estimate to determine confidence levels. Most of the uncertainty will be associated with the wind monitoring. The standards and guidelines for wind monitoring will assist in reducing this uncertainty and improve the quality of data recorded as part of a wind monitoring programme.

AEMO requirements

The Australian Energy Market Operator (AEMO) is responsible for the management of the National Electricity Market (NEM) (operating on the eastern seaboard of Australia). It has strict guidelines for generators wishing to connect to the NEM to ensure the safe and reliable operation of the grid.

Details of the process for connection to the NEM can be found on AEMO's website (www.aemo.com.au/connections/network_connections).

In most cases, network connection will be assessed by the local network service provider. The proponent should contact them as soon as possible to understand the requirements of the wind turbine generator to allow the wind farm to connect and to begin the process of connection.

Occupational health and safety (OH&S) and building legislation

Compliance with OH&S legislation and building codes is mandatory in every state of Australia. This is to provide a suitably safe workplace for all people attending a work site – in this case a wind farm.

In general, the OH&S legislative requirements impose a duty of care on designers to reduce risk associated with their design As Low as Reasonably Practicable (ALARP). To demonstrate this, the following steps are required:

- identification of the hazards associated with a design
- an assessment of the risk associated with each hazard
- reduce risk ALARP.

Records must be maintained to show the duty has been discharged. Where a particular hazard is addressed in an Australian Standard, compliance with that standard or practice will be sufficient to show discharge of the duty.

A10 Appendix 10: Wind turbine standards

To demonstrate compliance with building codes (structures on wind farms require a building permit – typically the first requirement being for wind monitoring tower(s)), it is usual to provide an assessment by a suitably qualified and registered independent engineer. While state building laws are being standardised nationally, it may still be necessary in some cases to have an assessment by a locally registered engineer. Contact with the local council of the proposed wind farm will help identify all requirements for building permits.

The only unique feature of a wind farm that requires particular consideration here is the wind turbine. It will be necessary to assess the wind turbine against specific OH&S legislation requirements. In most cases this will refer to particular Australian Standards, however IEC standards also play an important role. Relevant standards that may be referred to are described below.

Australian and New Zealand standards

Presently there is no Australian or New Zealand standard for the design of large wind turbines (rotor swept area above 200 m^2). In the absence of these, IEC Standards are accepted as the default for the design of wind turbines.

There are some Australian Standards that may be applicable to specific components of a wind farm, but these are not unique to wind farms and are not discussed in this appendix. Proponents can access titles and summaries via www.saiglobal.com where all of the standards published by Standards Australia can be purchased online in either hard copy or electronic form.

For small wind turbines (rotor diameter up to 200 m^2) the following Australian Standard is applicable:

AS 61400.2(Int)-2006
Wind turbines - Design requirements for small wind turbines

This Interim Standard specifies design requirements for small wind turbines (viz with a swept area up to 200 m^2). Adapted from the IEC standard 61400-2 Ed. 2 (2006).

International Electrotechnical Commission (IEC)

The IEC (www.iec.ch) is a global organisation that prepares and publishes international standards for all electrical, electronic and related technologies. Its membership consists of more than sixty participating countries, including all the world's major trading nations and a growing number of industrialising countries. The IEC's mission is to promote, through its members, international cooperation on all questions of electrotechnical standardisation and related matters, such as the assessment of conformity to standards, in the fields of electricity, electronics and related technologies.

Around 200 technical committees (TCs) and subcommittees (SCs), and some 700 working groups carry out the standards work of the IEC. The TCs prepare technical documents on specific subjects within their respective scopes, which are then submitted to the full member National Committees (IEC's members) for voting with a view to their approval as international standards. The main technical committee for wind turbine systems is TC88, which publishes the standards listing in this section.

The following IEC Standards are likely to be the most useful for wind farm proponents. There are other IEC Standards associated with wind turbines that may need to be sought by proponents that are not included here.

IEC WT 01:2001
System for Conformity Testing and Certification of Wind Turbines — Rules and procedures

Defines a certification system for wind turbines (IEC WT). It specifies rules for procedures and management to carry out conformity evaluation of WTs, with respect to specific standards and other technical requirements, relating to safety, reliability, performance, testing and interaction with electrical power networks.

IEC 61400-1:2005
Wind turbines Part 1: Design requirements

Specifies essential design requirements to ensure the engineering integrity of wind turbines. Provides an appropriate level of protection against damage from all hazards during the planned lifetime. Is concerned with all subsystems of wind turbines such as control and protection mechanisms, internal electrical systems, mechanical systems and support structures.

IEC 61400-2:1996
Wind turbines Part 2: Design requirements for small wind turbines

Deals with safety aspects, quality assurance, and engineering integrity and specifies requirements for the safety of small wind turbines including design, installation, maintenance and operation under specified external conditions. Provides the appropriate level of protection against damage from hazards from these systems during their planned lifetime.

IEC 61400-12-1:2005 Wind turbines Part 12-1: Power performance measurements of electricity-producing wind turbines

Specifies a procedure for measuring the power performance characteristics of a single wind turbine and applies to the testing of wind turbines of all types and sizes connected to the electrical power network. Also describes a procedure to be used to determine the power performance characteristics of small wind turbines (as defined in IEC 61400-2) when connected to either the electric power network or a battery bank.

The WTG power performance characteristics are determined by the measured power curve and the estimated annual energy production (AEP). The measured power curve is determined by collecting simultaneous measurements of wind speed and power output at the test site for a period that is long enough to establish a statistically significant database over a range of wind speeds and under varying wind conditions. The AEP is calculated by applying the measured power curve to reference wind speed frequency distributions, assuming 100% availability.

The standard describes a measurement methodology that requires the measured power curve and derived energy production figures to be supplemented by an assessment of uncertainty sources and their combined effects.

Project financing requirements

Most wind farms in Australia are funded using project finance from financial institutions (the remainder from company balance sheets). By their nature financial institutions seek to protect their investment and ensure that the proponent is able to service the debt. Some of the technical risks that are typically assessed include:

- The uncertainty in the energy estimate – see subsection below, on wind monitoring.
- The design of the wind turbine – does it have Type Certification?
- The power output of the wind turbine – will the wind turbines generate the warranted power output?
- The site conditions – are the conditions within the design limits of the wind turbine to be installed?

Type Certification

It is typical of wind turbines installed within Australia to demonstrate that they have Type Certification (assessed by an appropriately accredited company). Type Certification provides an independent design review and evidence that the design and structural integrity of a wind turbine has been undertaken to a recognised international standard (such as IEC standards). The certification should include the main components and manufacturing processes involved with producing the wind turbine as well as Type Testing (mechanical load measurements, power performance measurements and blade testing) of the wind turbine.

The process for Type Certification is outlined in IEC WT 01:2001 (outlined earlier).

Power Curve Verification

Power Curve Verification (PCV) is increasingly being requested as part of the financing process of wind farms in Australia. It may also be requested if a wind farm is underperforming against expectations and it is thought that the wind turbines are not producing the expected output.

The procedure for undertaking PCV is outlined in IEC 61400-12-1:2005 (as detailed earlier). The process involved is quite demanding and requires sufficient planning and notice to be undertaken. The intention of the procedure is to replicate testing conditions at the wind farm site by accounting for local terrain and other features.

Site conditions

IEC 61400-1 (described earlier) outlines the design limits for the different classes and categories of wind turbines. It is possible to measure these characteristics on site to evaluate whether a wind turbine will be suitable for the site conditions.

Typical measurements include (but are not limited to) the following:

- average wind speeds and wind speed distribution
- extreme wind speeds and gusts
- ambient turbulent intensity
- vertical wind shear
- inflow angles
- temperature, pressure and air density.

It should be noted that these are usually only measured at the mast location and that there are likely to be differences at each particular wind turbine location. Software and engineering judgement can be used to assess the risk at each wind turbine location, but in some instances it may be necessary to undertake additional wind monitoring.

Furthermore, analysis should include investigation of directional influences, time of day occurrences or seasonal events.

Wind monitoring

Before undertaking wind monitoring the purpose of the programme needs to be understood. Reasons for installing a wind monitoring mast can include:

- assessing the viability of a site
- proving the feasibility of a site and providing input for a business case
- assisting with environmental studies (e.g. noise)
- to assess the site conditions and assist with selection of a suitable wind turbine
- to undertake power curve verification
- to evaluate the performance of a wind farm
- to forecast the wind regime for generation dispatch.

A10 Appendix 10: Wind turbine standards

Each of these have their own set of requirements of the data collected that need to be considered when setting up a wind monitoring programme. This section will focus on assessing the feasibility of a wind farm and providing input into a business case as this is the most common purpose for undertaking wind monitoring. Data collected for this purpose can be utilised for most other activities listed above.

When designing a wind monitoring programme to prove the feasibility or otherwise of a wind farm, the major considerations will be the cost involved and the uncertainty associated with the data collected. There will always be some uncertainty associated with measurements, but the design of the wind monitoring set up can significantly reduce the uncertainty. Reducing the uncertainty provides greater confidence to those making decisions about whether to proceed with funding a wind farm and in turn can either reduce costs associated with borrowing (if required) or provide for better terms (again if borrowing is required).

The factors that need to be considered when setting up a wind monitoring programme related to the uncertainty include (but are not limited to) the following factors:

- the proximity, quality and length of a long term wind record (typically a Bureau of Meteorology weather station)
- the height of the proposed wind turbine
- the number of wind turbines proposed and the spacing of the wind turbines
- the terrain of the wind farm (flat, undulating, mountainous, etc.)
- whether there are any significant structures or obstructions present
- the type of mast to be installed – lattice or tubular
- the number of masts to be installed
- whether alternative monitoring methods will be utilised such as SODAR or LIDAR
- the type of instruments to be used – cup or ultrasonic
- the number of instruments to be installed (and the heights installed at)
- the quality of the instruments and their associated uncertainty in manufacturing
- the mounting of instruments and other equipment on the mast to minimise wind flow disturbance
- the data acquisition system technical performance and sampling set-up
- the maintenance regime to minimise instrument downtime.

All of these factors will affect the uncertainty in the wind measurements and in turn energy modelling and forecasts.

Guidance on how to minimise uncertainties from these considerations can be found in IEC 61400-12-1:2005 (detailed earlier) and in Recommended Practices for Wind Turbine Testing and Evaluation 11. Wind Speed Measurement and Use of Cup Anemometry 1st Edition 1999. Further advice can also be found in the publication by Coppin, P A, Ayotte, K A and Steggle, P, (2003), Wind Resource Assessment in Australia - A Planner's Guide, Wind Research Unit, CSIRO Australia.

In general the following recommendations are made:

- mast siting should be in a location representative of the most wind turbines and not necessarily in the location likely to measure the highest wind speed
- at least one mast should be installed at close to hub height (and at a minimum 2/3 of the hub height)
- at least two wind speed instruments should be installed (one at the uppermost height of the mast) with a preference for two instruments at the top height and at least two other instruments.
- wind direction instruments should not be installed at the same height as wind speed measurements
- instruments should be calibrated before installation (preferably at a MEASNET accredited facility – described below) and be replaced at least every two years
- boom lengths should take account of shielding as described in the Recommended Practices for Wind Turbine Testing and Evaluation
- the use of SODAR and LIDAR is increasing in the wind industry but should be used as a secondary measurement regime with at least one mast installed
- measurements should be recorded for at least 12 months to remove seasonal bias. Comparisons with long term records should assist in deciding the ultimate length of a measurement period.

MEASNET

The international Measuring Network of Wind Energy Institutes produces procedures for taking high quality wind measurements. These procedures outline the interpretation of standards and recommendations on techniques. The aims of these procedures are to ensure interchangeability of results taken by different organisations. MEASNET also acts as an accreditation body for organisations which undertake wind measurements for wind farm projects. The MEASNET website is at www.measnet.com

Appendix 11: Environmental management framework

A11

Potential environmental and social impacts are likely to be identified in assessments at each stage of a wind farm development. Potential impacts should be managed through an avoid, mitigate, offset approach.

Potential impacts should be avoided by making changes in the project design by 'designing out' the risk at the source, thereby reducing or avoiding the identified impact. Where changes to the project design cannot be made without compromising its feasibility, measures to reduce or mitigate potential impacts should be addressed in the construction and operation processes. If mitigation measures cannot be put in place then (where necessary and specified through legislation) the proponent may look at offsets. Further detail on the avoid, mitigate, offset approach is provided in Appendix 7.

If a significant impact cannot be successfully avoided, mitigated or offset when following best practice principles, the proponent will need to reassess the project.

The key mechanisms for managing impacts during these phases involve the preparation of and commitment to detailed Environmental Management Plans (EMPs) and the establishment of necessary supporting plans and procedures. This framework for environmental management is outlined in Figure 3.1.

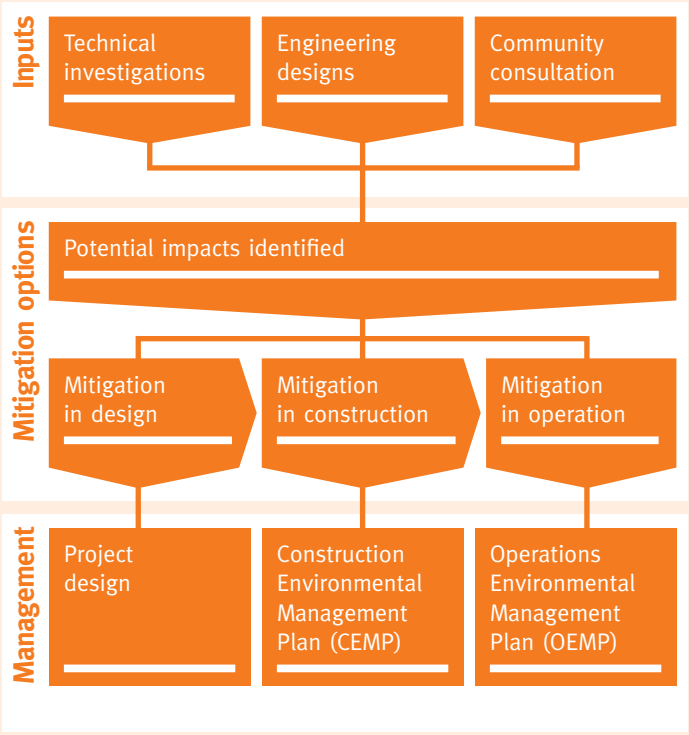

Figure 3.1: Environmental management framework

As a guide, an EMP should:

- nominate the objectives of the EMP and criteria by which performance can be assessed
- describe the organisational structure, including a description of the responsibilities for each role and nomination of an accountable person to each role
- define the site included in the EMP and provide a description of the activities covered by the EMP (i.e. construction works such as access track construction for a CEMP and operation activities such as turbine maintenance for an OEMP
- document the environmental commitments and obligations associated with the project. These include commitments required by the approving authorities (e.g. in conditions contained in the project approval) and obligations determined by the relevant Acts and regulations
- identify all potential negative environmental impacts associated with the project (e.g. sedimentation of nearby waterways during construction, bird strike during operation, and so on)
- describe the processes by which potential negative environmental impacts can be successfully mitigated and the project can meet its commitments and obligations (this is often achieved by including sections or sub-plans in the EMP for each potential impact together with specific management measures)
- define the procedures for monitoring and reporting, if required, to ensure processes implemented are effective and to provide a mechanism for demonstrating compliance to regulatory authorities
- set out the audit process for the implementation of the EMP and develop a procedure for managing non-conformances and providing for continual improvement in environmental performance
- ensure all employees and contractors are aware of their obligations under the EMP
- develop stakeholder consultation and complaint management procedures
- describe incident management and emergency response procedures
- provide a timeline for the implementation of the plan or period of currency prior to review.

For larger more complex projects it is often simpler to prepare a separate EMP for the construction (CEMP) and operation (OEMP) phases of the wind farm development. An EMP may also be required for the decommissioning of the wind farm.

A12 Appendix 12: Wind energy reference publications

The following list of publications may help to better understand the wind industry and wind farm impacts (both positive and negative). They do not necessarily represent publications referred to when preparing these guidelines. The list is by no means exhaustive and if further information is needed on a particular topic, please feel free to contact the CEC via our web page.

Australian publications

Clean Energy Council, *Wind Energy Community Research in Victoria, New South Wales and South Australia,* April 2012

Clean Energy Council, *Wind Farm Investment, Employment and Carbon Abatement in Australia,* June 2012

Clean Energy Council, *Wind Farms Technical Paper Environmental Noise,* Sonus, November 2010

Country Fire Authority (CFA) (2012), *Emergency Management Guidelines for Wind Farms,* Version 4

CSIRO, *Exploring community acceptance of rural wind farms in Australia: a snapshot,* January 2012

CSIRO, *Wind Resource Assessment in Australia – A Planners Guide,* v1.1, 2003

Department of the Environment and Heritage, *Wind farm collision risk for birds - Cumulative risks for threatened and migratory species,* March 2006

Department of Sustainability and Environment (VIC), *Interim Guidelines for the Assessment, Avoidance, Mitigation and Offsetting of Potential Wind Farm Impacts on the Victorian Brolga Population* 2011, Rev. 1, 2012

Department of Planning and Community Development (VIC), *Policy and Planning Guidelines for development of wind energy facilities in Victoria,* 2011.

Department of Planning and Infrastructure, *Draft NSW Wind Farm Planning Guidelines – Department of Planning and Infrastructure, NSW Government,* 2011

Department of Urban Affairs and Planning, *EIA Guideline for Wind Farms,* NSW Government, Sydney, 2002

Environmental Protection Authority (WA), *EPA Guidance for the Assessment of Environmental Factors No. 8 – Environmental Noise,* Draft, May 2007

Environmental Protection Authority (SA), *SA EPA Wind Farms Environmental Noise Guidelines,* July 2009

Environment Protection Heritage Council, *Draft National Wind Farm Development Guidelines,* Australian Government, 2010

National Airports Safeguarding Advisory Group (NASAG), *The National Airports Safeguarding Framework, Guideline D – Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation,* May 2012

NSW Bushfire Coordinating Committee (2008), *Bush Fire Risk Management Policy, Policy No. 1/2008*

NSW Rural Fire Service (RFS) (2004), *A guide to Developing a Bushfire Evacuation Plan, Planning & Environment Services – NSW Rural Fire Service,* 2004

Planning SA, *Advisory Notice, Planning Wind Farms,* Department for Transport, Urban Planning and the Arts, 2002

RenewablesSA, *Renewable Energy Plan for South Australia,* Government of South Australia Strategy Paper, October 2011

Sustainable Energy Development Authority, *NSW Wind Energy Handbook,* 2002

Western Australian Planning Commission, *Planning bulletin 67-Western Australia Guidelines for Wind Farm Development,* May 2004

International publications

European Wind Energy Association, *European Best Practice Guidelines for Wind Energy Development,* 2002

Gipe, P. *Wind Energy Comes of Age,* New York, 1995

Gipe, P. *Wind Power For Home & Business,* Chelsea Green Publishing, 1993

HGC Engineering, *Wind turbines and sound: Review and best practice guidelines,* CanWEA 2007

Irish Wind Energy Association (IWEA), *Best Practice Guidelines for the Irish Wind Energy Industry,* March 2012

Nacfaire, H., *Grid Connected Wind Turbines,* Elsevier Applied Science, London, 1988

Pasqualetti et al, *Wind Power in View: Energy Landscapes in a Crowded World,* Academic Press, 2001

Radio Advisory Board of Canada (RABC) & CanWEA, *Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems,* CanWEA, 2007

RenewableUK (formerly British Wind Energy Association), *Best Practice Guidelines for Wind Energy Development,* 1994

Scottish National Heritage, *Assessing the Cumulative Impact of Onshore Wind Energy Developments,* March 2012

World Wind Energy Association, *Sustainability and Due Diligence Guidelines,* 2005

Journals

Acoustics Australia - published 3 times per year by the Australian Acoustical Society, NSW

Ecogeneration – Monthly by Australian Business Councils for Sustainable Energy

Energy Generation – Quarterly by Australasian Power Technologies (APT) Publications, Brisbane QLD

Global Wind Report - Annual Market Update, Global Wind Energy Council (GWEC)

ReNew – Quarterly by Alternative Technology Association

ReCharge – Fortnightly newspaper, NHST Media Group, Recharge AS Christian Kroghs gt. 16 NO-0186 Oslo

Wind Directions – Quarterly by British and European Wind Energy Associations

Wind Power Monthly – Monthly by Vrinners Hoved, 8420 Knebel, Denmark

Details provided in this appendix were correct at the time of writing, however, there is potential for some elements to change. Proponents should confirm the current status of the items addressed in this appendix prior to commencing investigations or works.

The Clean Energy Council (CEC) is the peak body for the renewable energy and energy storage industry in Australia.

For more information contact
info@cleanenergycouncil.com.au

CLEAN ENERGY COUNCIL