# *12. Safety Aspects*

This chapter of the EA provides a description of potential impacts of the project on human safety and the measures to mitigate those impacts

## 12.1 Introduction

The principal safety issues identified in connection with the proposed wind farm development relate to:

- aviation
- physical safety associated with the turbines themselves
- bushfire risk
- electrical safety
- road safety
- use of plant and equipment on steep slopes on the site
- shadow flicker
- noise

The project will be implemented in accordance with the relevant safety requirements to ensure the safety of the workforce at the site and the local community. Consideration of the specific aspects listed above is provided in the following sections.

## 12.2 Air Safety

The development of the Capital Wind Farm involves the construction of about 63 wind turbine structures that each has a height of about 124 metres to the top of the area swept by the turbine blades. Due to the height of the structures the potential implications for aviation safety have been examined. Air safety issues that have been assessed for the proposed project include:

- proximity of the proposed wind farm to landing fields
- potential intrusion into air traffic zones and regulatory requirements
- potential effects on activities such as aerial spraying of agricultural areas

These issues are described in the sections below.

### *12.2.1 Proximity to landing fields*

Landing fields may be classified according to whether instrument landings are available. The nearest air fields providing instrument landings are Goulburn, some 35 kilometres to the north of the site and Canberra, approximately 35 kilometres to the south-west. Yass airfield is further to the west of the wind farm site but is not classified for instrument landings.

Obstacle Limitation Surfaces (OLS) are conceptual (imaginary) surfaces associated with a runway, which identify the lower limits of the aerodrome airspace above which objects are regarded as potential obstacles to aircraft operations, and must be reported to the Civil Aviation Safety Authority (CASA).

The operator of a certified aerodrome must monitor the airspace around the aerodrome to ensure that buildings and structures do not infringe the OLS. In the case of Goulburn and Canberra airfields, the project site and the wind turbine structures are well beyond and below the respective OLS for Goulburn and Canberra air fields and the proposed structures are not expected to represent obstacles or hazards for these airfields. The Yass airfield, which is not classified for instrument landings will have an OLS of lesser extent than those with instrument landings and will not be affected by the development.

Minor airfields are located on various properties throughout the region, many of which are marked on topographic mapping. The only local strip within 5 km of the wind farm is approximately 2 km to the west of the Hammonds Hill group of turbines and 2 km to the south of the Ellenden group of turbines.

As the small planes that could use the runways use visual rather than instrument based landings and the turbines are readily identified at close distance, there is not expected to be any safety risk for planes that may use local air strips.

### *12.2.2 Tall Structures outside the OLS*

Under Civil Aviation Safety Regulations any person who proposes to construct a structure, the top of which will be greater than 110 metres above ground level, must inform CASA of that intention and the proposed height and location of the structure.

The Civil Aviation Safety Authority (CASA) has been advised of the details of the initial layout of the wind farm and updated on the revised location of structures for the wind farm and the height of the structures.

Based on the information supplied, CASA is able to assess the potential for the proposed structures to represent hazardous objects due to location, height or lack of lighting and any mitigation by RPV would be as agreed with CASA. Consultation with CASA is continuing

### *12.2.3 Aerial Agricultural Operations*

The wind turbine structures are not considered to be safety hazards to aerial agriculture operations as the structures are readily visible and the pilots can easily avoid them. In some cases they may limit the areas of paddock that can be treated using aerial based methods. As the turbine sites are used mainly for grazing and no cropping is undertaken, aerial spraying would be less likely to be required.

The Aerial Agricultural Association of Australia (AAAA) has been provided with details of the proposed wind farm and invited to comment on the proposal. Prior consultation with the AAAA and individual members in relation to Crookwell and Blayney wind farms has obtained positive support for the developments.

### *12.2.4 Recreational Activities*

Recreational use of air space can involve hot air balloons, micro-light and ultra light aircraft, gliders and parachuting. While these activities could occur within the locality no such activities have been observed during site visits. The wind farm will be readily apparent to participants in such activities who could avoid the turbine sites.

### *12.2.5 Records of Data relating to Wind Turbine Structures.*

CASA, Airservices Australia and the Royal Australian Air Force (RAAF) all maintain databases and or maps of objects that may be relevant to the safety of flying operations.

At the time of construction of the proposed wind farm, Renewable Power Ventures will provide a plan of the final locations of the wind turbines and details of the height of each wind turbine to CASA, Airservices, RAAF and AAAA so that these organisations can record the details in their databases and on relevant maps.

Having regard to the foregoing, it is considered that the proposed development will not present a hazard to aviation.

## 12.3 Physical Safety

As with any tall structure, the safety implications of structural or mechanical failure need to be addressed in the design and installation of the wind turbines.

The issue of physical safety will be addressed primarily through ensuring that all plant and equipment meets the relevant Australian and/or overseas standards. In particular, the turbine structures will be designed and constructed in accordance with the following Standards:

- ASNZS 1170.2 - Structural Design Actions, including earthquake load considerations
- AS 2550 - Cranes - Safe Use
- AS 3600 - Concrete Structures
- AS 4100 - Steel Structures (except Tower)
- Steel Tower – DIN 18 800
- IEC 61400-1 Wind Turbine Generator Systems - Safety Requirements

In addition, construction works will be carried out in accordance with all relevant requirements of the WorkCover Authority and other statutory requirements.

Other physical safety issues which may be relevant in relation to wind turbines include potential for tower failure, blade separation, ice throw and contact with moving blades. These issues are discussed below.

World wide, rare instances of tower failure and blades being separated from turbines have been reported. Damage may occur as a result of storms, materials fatigue, poor maintenance practices or lightning. However, the risk of such an event occurring is extremely low for the following reasons:

- Catastrophic structural failures of major turbines very rarely occur and when they do it is usually for a very specific reason. For example, a 500 kW Mitsubishi turbine collapsed in Portugal largely as a result of a blade being wrongly installed during routine maintenance (International Energy Association, 2005)

- In Australia wind turbines are sited in rural areas away from built up areas. Siting turbines in less densely populated areas means there will be less visitation to the wind farms, which reduces the likelihood of a person being present in the highly unlikely event of turbine failure

- During storm events, it is very unlikely that a person or people will be in the exposed areas of land where wind turbines will be located. There would have to be exceptional circumstances for people to be in the vicinity of a turbine during a storm event. The people who would be at most risk would be the landowners, their visitors and maintenance personnel. During periods of high wind speeds the turbines are designed to shut down to avoid damage that might otherwise occur

Risks are further reduced by a number of design features of modern turbines. For example, the potential for damage due to lightning is reduced by fitting the blades with metal lightning strips and the risk of blade separation is reduced through built in detection systems that warn of impending failure and shut the equipment down for maintenance.

In cold climates, ice may be thrown from the blades. In these instances a distance equal to the maximum height (i.e. about 124 metres) is generally accepted as the area that could be affected.

The physical safety of the Capital Wind Farm particular installation will be further enhanced by:

- its location distant from public roads and other areas likely to be frequented.
- the incorporation of a design feature whereby the turbine automatically shuts down when maximum wind speeds for safe operation are exceeded.

Another potential physical safety issue is that associated with contact with the moving turbine blades. During operation, there will be at least 35 metres clearance between the turbine blades and ground and, accordingly, the risk of people or equipment coming into contact with the moving blades will be negligible.

### 12.4 Electrical Safety

Because of the well known dangers inherent in the use of electricity, electrical safety will be a key design consideration. As with mechanical and structural considerations, electrical safety will be achieved through ensuring that plant, equipment and the overall installation are in accordance with the relevant standards or where necessary, that approval is obtained for an alternative specification. The standards considered will include:

- AS 3000 - SAA Wiring Rules – Some components are pre-wired (eg Nacelle and Control Cabinets) and where non-compliance has been identified they are being re-designed such that they either abide with AS 3000 or approval for any exemptions is obtained via the relevant Electricity Authority
- IEC 61024-1 (1990-04) - Protection of Structures against lightning – Part 1: General Principles
- Further lightning standards also apply for the S88 2.1MW wind turbine
- IEEE STD 80 - Guide for Safety in AC Substation Grounding
- IEC 60034 - Rotating Electrical Machines
- BS 4999 - General Requirements for Rotating Electrical Machines. Under review
- BS 5000 - Specification for Rotating Electrical Machines of Particular Types or for Particular Applications Compliance with BS 5000 subject to review.
- IEC 60076 –1 (2000-04) - Power Transformers - Part 1 General
- IEC 60146.1.1 Semiconductor converters - General requirements and line commutated converters.
- IEC 62271.100 - HV Alternating Current Circuit Breakers
- IEC 60282.1 - HV Fuses (for Rated Voltages >1000V).
- IEC 62271.200 - AC Metal Enclosed Switchgear & Control Gear >1 kV
- IEC 60529 - Degrees of Protection Provided by Enclosures
- IEC 60947 (2001-12)- Low Voltage Switchgear & Controlgear
- IEC 60439.1 - Low Voltage Switchgear & Control Gear Assemblies
- IEC 60269.1 - Low Voltage Fuses - General Requirements

In addition to addressing the above Standards, protective equipment will be installed to detect faults and disconnect the faulted equipment from the system.

The proposed substation will be equipped with an underground earth grid which will extend for a distance of one metre beyond the perimeter fence. Public access to the live electrical equipment within the substation will be prevented by the perimeter fence which will be of chain wire construction some 2 metres high, surmounted by four strands of barbed wire.

As with any tall structure in an exposed location it can be anticipated that, from time to time, the wind turbines could be struck by lightning and lightning protection is a standard design feature of all modern wind turbines including:

- metallic conductors running throughout the turbine blades and electrically connected to the metalwork of the structure.
- supporting structures sufficiently well earthed to limit the voltage rise during a lightning strike.
- internal electrical equipment protected against voltage rises due to lightning.

In addition, the 33,000/330,000 volt substation will be protected by surge diverters, lightning masts and an underground earth grid.

### *12.4.1 Electric and Magnetic Fields (EMF)*

Wherever electrical equipment operates, electric and magnetic fields (EMFs) are created in the surrounding environment. Over the past 30 years, the question has been raised as to whether or not these fields may be harmful to human health. Despite extensive research and numerous public inquiries, adverse health effects have not been established, but the possibility has not been ruled out. In these circumstances, a prudent approach is warranted in designing and siting new facilities.

The main sources of EMFs that will be associated with the proposed wind farm will be the electrical equipment within the turbine structures, the substation and the interconnecting underground and overhead wiring. The fields associated with all of these items will be quite localised.

The Capital Wind Farm will be distant from public areas and located on ridge tops that are only occasionally visited by landowners and farm workers. The substation will be about one kilometre from the nearest public road and on private land. The route of the 33,000 volt overhead line has been chosen in accordance with prudent avoidance principles. All equipment will be constructed according to industry accepted practices. The EMFs associated with the proposed wind farm will be well within the relevant health standards and, in many cases will be localised to areas not often frequented by people. On this basis, the possibility of human health effects due to EMF, is not considered to be an issue for the project.

## 12.5 Bushfire Risk

A bushfire risk management plan will be prepared for the project in consultation with the local Rural Fire Service. The plan will be incorporated in the project EMP. Issues associated with the bushfire risk may involve:

- the potential for the construction activities to initiate a bushfire
- the potential for operational facilities to initiate a bushfire
- the impacts on the facility from a bushfire affecting the site, whether originating from the site or elsewhere

These issues are reviewed in the following sections.

### *12.5.1 Bush fire risks associated with construction activities*

Fires may eventuate from 'hot work' activities, fires within engines or from sparks from friction igniting dry-grass. Accordingly, during the construction phase, the following measures will be implemented to manage any bushfire risk:

- The Contractor will be required to comply with all relevant sections of the Bush Fires Act and the Fire Brigade Act and all Regulations thereto and will be required to liaise with the Rural Fire Service.

- Where necessary, access tracks and work sites will be slashed to remove grass, etc. in excess of 100 mm high.
- All construction vehicles will use diesel fuel.
- During periods of high fire danger, firebreaks will be created around each turbine site, the substation site and the facilities building during work at such sites.
- A mobile 1,000 litre tanker unit complete with motor-driven pump, hose and nozzle will remain at the site during construction work.
- Knapsack sprays and McLeod tools will be kept on hand at each actual work site.
- In the event of welding, flame cutting or grinding being carried out in the open during periods of fire danger, an observer holding a knapsack spray will be on hand.
- The Contractor will be required to maintain the exhaust systems of all vehicles on site in sound condition and to avoid any build up of dry vegetation under vehicles.
- The use of explosives will not be allowed during periods of high bushfire risk

### *12.5.2 Bush fire risks associated with operational activities*

The potential fire risk associated with electrical failure will be managed by the following measures:

- Use of fully enclosed electrical equipment on turbine structures and padmount transformers
- Extensive use of underground cabling between turbines
- Design of any overhead lines in accordance with industry standards
- Exclusion of vegetation from within the substation enclosure
- Use of circuit breakers and fuses to interrupt any electrical fault
- Adoption of the lightning protection measures described in 12.4 above

### *12.5.3 Bush fire risk for installed facilities*

The risk of damage to the facilities in cleared grazing land is low. However, where turbines are located adjacent to steep slopes that have considerable vegetation cover, there can be a significant risk. For the proposed development, all wind turbine locations are in mostly cleared grazing land or in areas with sparse or scattered tree cover and are considered to have a low risk of bushfire damage.

Suitable buffers between vegetation and installed equipment will be maintained as part of facility ongoing service and maintenance.

## 12.6 Road Safety

The principal road safety issues associated with the proposed development relate to the construction period and include:

- increased traffic on rural roads
- presence of over-size/heavy loads at certain times during construction
- site entry points from local roads used by long loads associated with delivery of turbine equipment

Traffic and Transport issues have been assessed and reported in Appendix I and a summary of the issues, including road safety, is provided in Section 9 of the EA.

The transport of materials and equipment over public roads is already regulated by the various traffic safety authorities and Renewable Power Ventures and its contractors will observe all relevant safety

requirements of such authorities. In addition, a Traffic Management Plan will be established for the construction stage of the wind farm development. The Plan will be prepared in consultation with the local Traffic Management Committee.

At other wind farm sites consideration has been given to motorists stopping along busy local roads to view the wind farm from an unsafe vantage point or being distracted by it. The Capital Wind Farm is generally more than one kilometre from public roads and the local roads have low to moderate small traffic volumes. The potential for the wind farm to be a distraction to local traffic and to impact on road safety is considered to be low.

### 12.7 Use of Vehicle or Plant and Equipment on Steep Slopes

At some turbine sites and for parts of some access tracks located on or close to steep slopes there is a risk of accidents for mobile plant or vehicles leaving the track or work area and descending the slope. All such areas will be identified and measures implemented to mitigate the risk. This may include induction relevant to the risk, installation of barriers, warning signs, tapes to alert drivers to the hazard and in some cases observers to watch for and warn drivers of proximity to steep slopes. Access tracks on steep slopes will also be benched into the slopes to provide safe trafficable passage.

### 12.8 Shadow Flicker

Shadow Flicker is a visual effect that occurs when rotating turbine blades cause intermittent shadowing as the blades momentarily pass between the sun and the observer. The effect will occur under circumstances where the turbine location is such that at certain times of the day the sun's rays pass through the blades and affect the viewpoint.

There has been concern in the past that shadow flicker may induce seizures in people with photosensitive epilepsy. The turbines that would be used in the Capital Wind Farm will rotate at between 8 and 20 revolutions per minute. With three blades, this corresponds to a maximum flicker frequency of 1 cycle per second (1 Hz). It is uncommon for epileptics to be photosensitive at frequencies less than 5 Hz (The National Society for Epilepsy (UK), 2005). Therefore, the risk of shadow flicker inducing seizures is considered to be insignificant.

Appendix D provides a review of the potential for shadow flicker effects at the Capital Wind Farm and indicates that it is not a significant issue for the development. Consequently, health risks posed by shadow flicker on residents or passing motorists within the project area are considered minimal.

### 12.9 Noise

The noise impacts of the development have been assessed in Appendix H and a summary of the results and the proposed mitigation measures is provided in Chapter 10 of the EA. The assessment of the noise impacts indicates that the wind farm is able to operate within the relevant noise criteria and that its impacts are likely to be acceptable. A post commissioning performance review will assess the wind farm noise compliance including noise arising from the substation. Construction noise will occur over the approximately eight month construction period and controls will be incorporated to limit its impact.