Design Guidelines and Model Requirements

Renewable Energy Facilities v4

OUR COMMUNITY • OUR CFA

Version 4, August 2023

CFA Specialist Risk and Fire Safety Unit

Foreword

Victoria is rapidly transitioning towards energy generation from renewable alternatives. Although the focus has been on the domestic generation of solar energy using photoelectric voltaic panels often supplemented with a battery energy storage system, the role commercial generation of energy plays cannot be underestimated.

Large commercial and industrial projects are being planned and built across the country. They range in size from small installations to supplement an individual company's needs, to projects capable of supplying power to hundreds of thousands of Victorian homes annually. These projects include one of the largest operating battery energy storage facilities in Australia to date, located in Moorabool, and other large facilities planned across the country area of Victoria, helping the state meet its renewable energy target of 65% by 2030.

New and emerging renewable energy technology has outpaced the development of fire and emergency management standards and guidance. To bridge this gap, CFA has worked with stakeholders nationally and globally to develop guidelines that can be used when designing a new facility or modifying or operating an existing one. These guidelines advocate a holistic approach to fire and emergency risk management.

As renewable energy facilities become critical electricity infrastructure, CFA are expected to facilitate prevention and suppression of fire should any incident occur. Ensuring that designers, owners and operators consider these guidelines is critical to supporting CFA's mission to protect life and property.

It's important that all those with responsibilities in designing, constructing, and operating these facilities – large or small – are fully aware of, and understand, their responsibilities and obligations to ensure fire safety within their premises.

Fire safety not only makes good sense from a community safety point of view, it's also a good risk management business decision. CFA invites key stakeholders to consider these guidelines and work together to maintain and improve a satisfactory level of fire safety.

Finally, CFA gratefully acknowledges the support of our regulatory partners and industry in the development and application of these guidelines. CFA is particularly grateful for the support and expertise of Professor Paul Christensen, Professor of Pure and Applied Electrochemistry at the University of Newcastle UK and Senior Advisor to the National Fire Chiefs Council UK, in ensuring these guidelines reflect the latest research in lithium-ion battery fire safety.

Jason Heffernan
CFA Chief Officer

Please Note:
This guideline, *CFA's Design Guidelines and Model Requirements for Renewable Energy Facilities v4 (May 2023),* supersedes the following CFA guidance:

- *CFA Design Guidelines and Model Requirements for Renewable Energy Facilities v3, March 2022*
- *CFA Guidelines for Renewable Energy Installations v2, March 2021*
- *CFA Guidelines for Renewable Energy Installations v1, February 2019*
- *CFA Emergency Management Guidelines for Wind Energy Facilities, May 2015*

Content Guide

1 Introduction

This guideline provides standard considerations and measures for fire safety, risk and emergency management in designing, constructing and operating new renewable energy facilities, and upgrading existing facilities.

Facilities that support the generation of electricity in Victoria include wind energy facilities, solar energy facilities and facilities with battery energy storage systems. These facilities are the focus of this guideline.

The principles and model requirements within this guideline can also be applied to emerging renewable technologies such as geothermal and biomass, where applicable.

These guidelines are designed to:

- Facilitate consideration of fire risk management in the design, construction and operation of renewable energy facilities.
- Reduce the occurrence and consequences of fire at renewable energy facilities through risk-based design, and enable safe and effective emergency response through the provision of fire protection systems.
- Inform fire and risk management processes for all phases of a facility's lifespan, through the preparation of Risk Management Plans by designers, and Fire Management Plans by facility operators.
- Support operators to prepare Emergency Plans that effectively consider fire risk from the facility, and bushfire.

1.1 How to use these guidelines

The guidelines are arranged according to facility development stages - planning and design, construction and commissioning, and operation.

The Model Requirements in this guideline are CFA's minimum requirements for renewable energy facilities in low-risk environments, and must be specified in the Risk Management Plan.

Model Requirement (Sample)

A Risk Management Plan must be developed for all renewable energy facilities.

Modifications to Model Requirements must be in consultation with CFA.

Where there are ***additional*** (or where specified, ***alternative***) requirements specific to a facility type - that is, the technology proposed - they are represented under the following banners:

All Facilities

Wind Energy Facilities

Solar Energy Facilities

Battery Energy Storage Systems

1.2 Fire Risk Management Principles

While these guidelines have been developed based on the latest information available, it has not been possible to capture every possible renewable energy facility configuration or battery chemistry due to the rapid evolution of the technology.

These guidelines are designed so that where they do not address a specific arrangement or technology, the principles can still be applied.

Fire Risk Management Principles

1. Effective identification and management of hazards and risks specific to the landscape, infrastructure, layout, and operations at the facility.
2. Siting of renewable energy infrastructure so as to eliminate or reduce hazards to emergency responders.
3. Safe access for emergency responders in and around the facility, including to renewable energy and firefighting infrastructure.
4. Provision of adequate fire-fighting infrastructure for safe and effective emergency response.
5. Vegetation sited and managed so as to avoid increased bushfire and grassfire risk.
6. Prevention of fire ignition on-site and spreading to adjoining properties.
7. Prevention of fire spread between site infrastructure (solar panel banks, wind turbines, battery containers/enclosures).
8. Prevention of external fire impacting and igniting site infrastructure.
9. Provision of accurate and current information for emergency responders during emergencies.
10. Effective emergency planning and management, specific to the site, infrastructure, operations and hazards (including bushfire).

1.3 Key Terms

Based on information and definitions from:

- *Australian Renewable Energy Agency* (ARENA)
- *AS 5139-2019: Electrical installations - Safety of battery systems for use with power conversion equipment.*
- *FM Global 2020, Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems.*

Cell

Unit consisting of one or more energy storage cells connected in series, parallel or series parallel arrangement.

Module

One or more cells linked together. May also have incorporated electronics for monitoring, charge management and/or protection. Generally they are stored in racks within containers/enclosures.

Battery Energy Storage System

A system comprising one or more cells, modules or batteries, power conversion equipment (PCE) and isolation and protection devices. Battery energy storage systems convert energy into electrical energy and stores the energy internally.
For the purposes of this guideline:

- Large-scale battery systems: >1 MWh
- Small-scale battery systems: ≤1 MWh

Battery Energy Storage System Container/Enclosure

A dedicated enclosure, often resembling a shipping container, containing the battery system (eg., racks), associated components and free space.

Battery Energy Storage System Cabinet

A dedicated enclosure smaller than a container/enclosure with little to no free space, containing the battery system and associated components.

NOTE: *The exact terminology used to describe battery energy storage systems varies with manufacturer, but in general, the smallest unit of a battery is the cell, many cells make a module. The cells can be arranged in series or a combination of series and parallel configurations. The modules can have incorporated electronics for monitoring, charge management and/or protection. Modules are generally stored in racks within enclosures: the latter are typically either container- or cabinet- based.*

Power Conversion Unit/Equipment (PCU/PCE)

Electrical device converting and/or manipulating one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and/or frequency.

Renewable Energy

Renewable energy is produced using natural resources that are constantly replaced and never run out. Common technologies include solar, wind and hydropower. Emerging technologies include geothermal, bioenergy and ocean energy.

Renewable Energy Facility

A site or installation dedicated to the generation and/or capture of renewable energy. Stand-alone battery energy storage systems are considered renewable energy facilities for the purposes of this guideline.

Solar Energy Facility

A facility where solar panels convert sunlight into direct current (DC) electricity; then power conversion equipment (inverters) convert the power into alternating current (AC). The facility may include grid connection infrastructure to feed power into the electricity grid. Solar energy facilities may utilise either solar photovoltaic or solar thermal technologies.

- Large-scale solar: >5 MW
- Micro solar: ≤5 MW

Solar Panel Bank (Pod or Zone)

A 'bank' of solar panels may be that connected to a single power conversion unit/inverter.

Wind Energy Facility

A facility where wind turbines use the energy of the wind to spin an electric generator which produces electricity, then power conversion equipment (inverters) convert the power into alternating current (AC). The facility may include grid connection infrastructure to feed power into the electricity grid.

Refer to FM Global 2020, Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems for pictographs of battery energy storage system components.

These guidelines must be read in conjunction with the following documents from the Department of Transport and Planning:

Solar Energy Facilities Design and Development Guidelines

Outlines the assessment and development process for large-scale solar energy facilities in Victoria.

Development of Wind Energy Facilities in Victoria, Policy and Planning Guidelines

Provides a framework, requirements and guidance on preparing planning applications for wind energy facilities.

2 CFA Involvement with Renewable Energy Facilities

2.1 Why is CFA involved in renewable energy proposals?

The Country Fire Authority Act 1958 gives CFA statutory responsibilities for taking and enforcing all necessary steps for the prevention and suppression of fires in the country area of Victoria.

For renewable energy facilities, CFA's Specialist Risk and Fire Safety Unit leads CFA's involvement through facility planning, design and operation. This single point of contact ensures that firefighter safety and fire risks are considered and managed by:

- Providing fire risk management expert advice during facility planning, design and operation.
- Participating in statutory planning processes.
- Engaging with CFA districts and regions.

Involving CFA early in planning and design can save time and money in avoiding retrofitting of safety systems, and developers can benefit from CFA's expertise.

2.2 How do I engage with CFA?

These guidelines have been developed to inform various design, planning application, construction and operational requirements.

The following table contains CFA's expectations for involvement. CFA encourages consultation throughout a renewable energy facility's lifecycle, from planning to construction and operation.

Engagement with CFA's Specialist Risk and Fire Safety Unit is via firesafetyreferrals@cfa.vic.gov.au.

	Pre-Planning/Planning Application	Prior to Development Commencing	Prior to Use Commencing	During Operation
Consultation	Initial discussions with CFA's Specialist Risk and Fire Safety Unit.	Further discussions with CFA's Specialist Risk and Fire Safety Unit regarding fire risk management specific to the facility.	Further discussions with CFA's Specialist Risk and Fire Safety Unit, as required.	Invitation for local CFA brigade and CFA's Specialist Risk and Fire Safety Unit to visit the facility.
Risk Management Plan	Provision of draft Risk Management Plan, incorporating bushfire assessment at *VPP Clause 13.02-1S*, to CFA's Specialist Risk and Fire Safety Unit.	Provision of draft Risk Management Plan, incorporating risks to and from battery energy storage systems (Fire Safety Study), to CFA's Specialist Risk and Fire Safety Unit.	Implementation of all fire protection measures shown on the endorsed plans.	
Fire Mgt Plan	Provision of draft, or commitment to develop Fire Management Plan in consultation with CFA.	Provision of draft Fire Management Plan to CFA's Specialist Risk and Fire Safety Unit.		
Emergency Plan	Provision of draft, or commitment to develop Emergency Plan in consultation with CFA.	Provision of draft Emergency Plan for facility construction to CFA's Specialist Risk and Fire Safety Unit.	Provision of draft Emergency Plan for facility operation to CFA's Specialist Risk and Fire Safety Unit.	

2.2 How do I engage with CFA? (Continued)

2.2.1 Pre-Planning

Consultation with CFA's Specialist Risk and Fire Safety Unit, by requesting a meeting or providing draft documents, should occur early in the planning and facility design phase, before or during the development of planning applications.

Early consultation, prior to the submission of the planning permit application, ensures that CFA can effectively consider fire risk management and emergency response implications.

2.2.1.1 What information does CFA need for initial consultation?

While consultation with CFA is encouraged at any stage of a project's life cycle, the availability of the following information during initial consultation supports the provision of specific advice:

- The site address/land parcel information (eg., a current *VicPlan Property Planning Report*).
- Locality plan, showing the facility within the landscape.
- Details of the facility, its type and size (eg., the area, perimeter, number of solar panels/arrays, wind turbines, battery containers, power conversion equipment/units).
- Site plans, showing the proposed location of site vehicle access points, internal roads, solar arrays/wind turbines/battery containers, substations, buildings, fire water supplies, vegetation.
- Specifications/technical data sheets on battery energy storage systems (where applicable and available).

2.2.2 Planning Applications

A planning permit application for a renewable energy facility does not require referral to CFA under Section 55 of the Planning and Environment Act 1987 (*PE Act*). However, applications may be notified to CFA under Section 52 as part of the application process.

To ensure fire risk management can be effectively assessed by CFA, CFA expects that all planning applications address all relevant aspects of fire safety, including landscape and bushfire hazards, and hazards to and from the proposed technologies.

To enable CFA to provide relevant and timely comments on a proposal, an appropriate level of information must be provided within the planning application. The level of information will vary depending on the type of facility, proposed technology, scale, location and complexity of the proposal.

2.2.2.1 What does CFA expect in planning applications?

The planning application must be prepared with consideration to the design advice and model requirements provided in this guideline, so far as practical at the planning stage.

Model Requirements

a) Where located within a Bushfire Prone Area, bushfire risk is addressed according to the *Victoria Planning Provisions, Clause 13.02-1S (Bushfire Planning)*, through bushfire hazard identification and assessment (including a bushfire hazard site and landscape assessment). This assessment must include risks to the proposed technologies from the landscape (bushfire/grassfire).

b) Address risks from proposed technologies through a comprehensive risk management process, documented in a Risk Management Plan.

c) Indicate where the exact specifications of elements within the renewable energy facility will be determined during the detailed design phase, such as solar panel and wind turbine model/manufacturer and battery chemistry.

d) Explicitly state that the following documentation will be prepared in accordance with this guideline, in consultation with CFA, before development starts:

- Risk Management Plan
- Fire Management Plan
- Emergency Plan

Modifications to Model Requirements must be in consultation with CFA.

While renewable energy facilities are not referenced under the use and development policy contained within *Clause 13.02-1S Bushfire Planning*, other policies in the control still apply.

CFA expects that the risk of bushfire to people, property and community infrastructure is considered, and that appropriate bushfire protection measures to address the identified bushfire risk to and from the proposed development are proposed to at least the level within this guideline within the planning application.

2.2 How do I engage with CFA? (Continued)

2.2.2.2 CFA's response to planning applications

CFA will review planning applications and supporting information, develop conditions, and recommend the conditions to the responsible authority. Where CFA determines that the requirements in this Guideline have not been satisfactorily addressed in planning applications, CFA will recommend conditions to the responsible authority specific to those matters.

2.2.3 Prior to Development Commencing

CFA expects that the following documentation will be developed in consultation with CFA, to the satisfaction of the responsible authority:

- A Risk Management Plan for the facility developed in accordance with **Section 3.3**.
- A Fire Management Plan developed in accordance with **Section 6.1**.
- An Emergency Plan developed in accordance with **Section 7**.

Draft versions of these documents can be provided to CFA for preliminary comment at any stage of their development.

Documentation submitted to CFA for review must clearly outline how the proposed facility meets the requirements of this guideline, and where it does not, it needs to effectively demonstrate how risk is managed to ensure the safety of emergency responders.

CFA will consider the specific technologies, infrastructure, landscape hazards and operations of your facility in the provision of advice.

2.2.4 During Operation

CFA's Specialist Risk and Fire Safety can visit your facility to provide advice on existing and additional fire risk management. Requests for site visits can be submitted to firesafetyreferrals@cfa.vic.gov.au, marked attention to the 'Specialist Risk and Fire Safety Unit'.

2.3 Additional emergency services consultation that may be required

2.3.1 Building Fire Safety

All buildings on site are required to comply with the *National Construction Code (NCC)*. Where fire safety matters listed under Regulation 129 in the *Building Regulations 2018* do not meet the deemed to satisfy provisions of the NCC, the report and consent of the fire authority Chief Officer is required.

Further Guidance Material

The following publications offer support in developing a bushfire hazard assessment.

Victoria Planning Provisions, Clause 13.02 (Bushfire Planning) (2023)

Department of Transport and Planning, Planning Permit Applications Bushfire Management Overlay - Technical Guide (2017)

Department of Transport and Planning, Bushfire Hazard (2023)

CSIRO Assessing Bushfire Hazards (2023)

2.3.2 Dangerous Goods Storage and Handling

Where the facility includes a battery energy storage system or other significant quantities of dangerous goods, a request for emergency services written advice under Regulations 52 and/or 53 of the *Dangerous Goods (Storage and Handling) Regulations 2022* may be required.

The quantity of dangerous goods must be determined for the purposes of requesting emergency services written advice. For lithium-ion based battery energy storage systems, the net weight of the lithium-ion battery cells (rather than the gross weight of the battery enclosure/container) must be provided. For example, if a battery enclosure/container is 12t, the battery cells may only be 3t (25% of the gross container weight).

Section 6.2 contains considerations for dangerous goods storage and handling during facility operations.

2.4 Other statutory requirements

Sections 113A and 83BA of the *Electricity Safety Act 1998* require major electricity companies and specified operators of at-risk electric lines to prepare and submit a Bushfire Mitigation Plan to Energy Safe Victoria for acceptance.

Sections 6 and 7 of the *Electricity Safety (Bushfire Mitigation) Regulations 2023* contain the requirements for Bushfire Mitigation Plans.

A list of relevant legislation is provided in **Appendix D**.

3 Fire Risk Management

Fire risk must be identified and measures to eliminate or reduce its occurrence and consequences must be incorporated into facility design and operations.

3.1 Why should fire risk be managed?

Identifying and managing fire risk at renewable energy facilities protects site personnel, firefighters and the community. Under occupational health and safety legislation, designers have a duty to ensure that buildings and structures are safe and without risks to health.

"A person who designs a building or structure or part of a building or structure who knows, or ought reasonably to know, that the building or structure or the part of the building or structure is to be used as a workplace must ensure, so far as is reasonably practicable, that it is designed to be safe and without risks to the health of persons using it as a workplace for a purpose for which it was designed."

s28 OHS Act

A risk management process that meets occupational health and safety requirements for eliminating or reducing risk so far as is reasonably practicable provides the foundation for effective fire management and emergency planning.

3.2 How can fire risk be managed?

CFA expects that a comprehensive risk management process is undertaken to identify the hazards and risks specific to the facility and develop, implement, maintain and review risk controls. The following two documents are the outputs of this process.

A **Risk Management Plan** describes the risk management process and its outcomes, including the specific site hazards/risks and their analysis, control measures, and the monitoring and review process. The Risk Management Plan must inform the design of the facility.

A **Fire Management Plan** is based on the outcomes of the Risk Management Plan. It outlines the activities, processes and accountabilities for the ongoing management of fire risk at the facility. See **Section 6.1** for more information on developing a Fire Management Plan.

Risk Management Process

CFA recommends the adoption of a risk management process, in line with AS/ISO 31000-2018: Risk Management Guidelines, to identify and address fire risk at renewable energy facilities.

The risk management process includes:

Risk identification to understand the potential sources of fire including on-site hazards (eg., electrical faults, operational faults, chemical releases, operational practices/processes, animal management); off-site hazards (eg., bushfire, grassfire, storm, lightning, flood), and any other operational, financial or strategic risks that could affect the ability of the organisation or operation to meet its objectives.

Risk analysis (and evaluation) to identify the nature of risk and its characteristics. Analysis includes investigation and evaluation of controls, based on assessment of their effectiveness and the practicality of their implementation.

Risk treatment/control to eliminate or mitigate risks, by identifying evidence-based controls for risks based on the hierarchy of controls, and industry good practice, and selecting and implementing effective controls for each identified risk.

Monitoring and reviewing, recording and reporting throughout the design and operation of facilities to ensure that emerging risks are identified; existing risks are effectively controlled; and controls are appropriate and effective by conducting regular and comprehensive review of risks and controls through monitoring of site hazard and risks.

The risk management process should be:

- Comprehensive and consultative, involving those involved in the design, construction, operation and management of the facility (including employees and contractors).
- Include analysis of infrastructure, activities and operations at the facility, and take into consideration lessons from previous fires and other emergencies at similar facilities in Australia and globally.
- Project- and organisation-wide, supported by organisational management at all levels, documented, underpinned by organisational policy, and integrated into organisational decision-making.

3.3 Risk Management Plan

All Facilities

Model Requirement

A Risk Management Plan must be developed for all renewable energy facilities.

Modifications to Model Requirements must be in consultation with CFA.

A Risk Management Plan is critical in informing fire risk management in the design and operation of facilities, particularly where infrastructure or operations pose additional hazards to the landscape, occupants and emergency responders.

A Risk Management Plan also supports CFA to effectively understand and provide advice in relation to on-site risks and hazards and potential emergency response matters.

3.3.1 Content of Risk Management Plans

The Model Requirements within this guideline are CFA's minimum requirements for renewable energy facilities in low-risk environments, and must be reflected in the RMP. The RMP structure may reflect the framework outlined in *AS/ISO 31000-2018: Risk Management - Guidelines*.

CFA will only consider reducing the requirements of this guideline where alternative controls that provide at least an equivalent level of fire safety are proposed and supported by evidence, within a Fire Safety Study.

3.3.2 Risk Factors

The following factors must be considered in the risk-based design of renewable energy facilities.

3.3.2.1 Location and Siting within the Landscape

Is the site in a designated Bushfire Prone Area or within the Bushfire Management Overlay? Is there a risk of grassfire from neighbouring properties? Is the site (or BESS) within the Land Subject to Inundation Overlay? Is there peat on the property? Is the site located near hazardous industries?

3.3.2.2 Facility Layout

Does the proposed layout of the site impact fire risk? Is fire service infrastructure safely accessible? Are there hazards or infrastructure that may impact safe evacuation?

Model Requirements

The Risk Management Plan must:

a) Describe the infrastructure (natural and built), landscape, nature of operations and occupancy of the facility.

b) Describe the risks and hazards at the facility to and from the renewable energy infrastructure (including battery energy storage systems).

c) Specify and justify, in accordance with **Section 4.2** of this guideline:

- The **location** of the facility in the landscape, and the proposed infrastructure on-site.
- **Emergency vehicle access** to and within the facility that:
  - Includes site access points of a number suitable to the size and hazards of the facility (a minimum of two).
  - Provides access to renewable energy infrastructure, substations and fire service infrastructure.
- **Firefighting water supply** for the facility.
- A **fire break width** of 10m or greater, based on radiant heat flux (output) as an ignition source:
  - Around the perimeter of the facility.
  - Between any landscape buffer/vegetation screening and infrastructure.
- The **separation distance**, based on radiant heat flux (output) as an ignition source, between:
  - Adjacent renewable energy infrastructure (eg., between adjacent battery containers/enclosures).
  - Battery containers/enclosures and related battery infrastructure, buildings/ structures, and vegetation.
- **All other controls** for the management of on- and off-site hazards and risks at the facility (including all proposed battery energy storage system safety and protective systems).

d) Provide an evidence-based determination of the effectiveness of the risk controls against the identified hazards, including justification for the omission of any battery safety and protective system/s.

e) Form the basis for the design of the facility.

Modifications to Model Requirements must be in consultation with CFA.

3.3 Risk Management Plan (Continued)

3.3.2.3 Vegetation On-Site

Does the prevalence, type, density or location of vegetation (including screening vegetation) impact fire risk?

3.3.2.4 Infrastructure: Electrical, Chemical, Technological

Does the infrastructure on site contribute to fire risk, or potentially impede firefighting operations? Are dangerous goods stored on site?

3.3.2.5 Site Activities and Operations

What activities undertaken on-site contribute to fire risk? How is electricity infrastructure de-energised and isolated? How often is critical maintenance undertaken?

3.3.2.6 Site Occupancy

Will the facility be occupied or unoccupied? Will there be vulnerable occupants?

3.3.2.7 Local Weather Conditions

What is the prevailing wind speed and direction? Rainfall during the year? What is the humidity and temperature during the Fire Danger Period?

3.3.3 Hazards Specific to Facility Type

Determining the fire hazards at your facility can be achieved with various tools and techniques, some of which are detailed in *SA/SNZ HB 89-2013 Risk management - Guidelines on risk assessment*.

Hazards will be specific to each facility due to the unique location, infrastructure and operations. However, there are common hazards to each type of facility that must be considered due to their potential to ignite, spread or intensify fire.

The following is not an exhaustive list; hazards must be identified through the risk management process.

Wind Energy Facilities

Fire hazards at wind energy facilities may include:

- Electrical hazards, such as wind turbine electrical faults; power surges; hot surfaces; lightning strike.
- Chemical hazards, such as the leakage of oils and lubricants within the turbine/ancillary equipment.
- Potential fire spread, due to air flow impact or falling debris from fire-impacted turbines.
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers or radiant heat.
- Falling blades.
- Wind turbines as a potential obstruction for aerial firefighting. See **Section 4.2.5** for guidance on mitigating this hazard.

Solar Energy Facilities

Fire hazards at solar energy facilities include:

- Electrical hazards, such as panel/inverter electrical faults; power surges; lightning strikes; water ingress; retained DC electricity in solar panels after shut-down/isolation.
- Potential fire spread and limited emergency response due to proximity of panel banks to each other, on-site infrastructure and vegetation (including screening vegetation).
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers or radiant heat.

Battery Energy Storage Systems

Fire hazards at facilities with battery energy storage systems include:

- Electrical hazards, such as battery faults; overcharging; rapid discharge; loss of remote monitoring systems; internal short circuits; overheating; water ingress; lightning strike (leading to thermal events/runaway).
- Chemical hazards, such as the inherent hazards of the stored dangerous goods; spills and leaks of transformer oil/diesel, refrigerant gas/coolant; chemical reactions.
- Explosions, from ignition of venting gases.
- Potential fire spread due to proximity of batteries (and containers/enclosures) to each other, on-site infrastructure and vegetation (including screening vegetation).

- Mechanical damage to battery containers/ enclosures due to vehicular impact.
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers, radiant heat and flame contact.

Abuse of a lithium-ion cell can send it into thermal runaway, where heat and gases are produced causing the cell to vent. Heat is propagated (thermal propagation) from cell-to-cell. Immediate ignition of the gases can result in jet-like flames. If the gases do not ignite, thermal propagation with the evolution of explosive and toxic gases, can continue with delayed ignition causing explosion.

If fire is extinguished without preventing thermal propagation, the hazard switches from fire to explosion.

Where the consequences of electrical, chemical and explosion hazards pose additional risks to firefighters, these must also be addressed in the Risk Management Plan. Consequences may include off-gassing of explosive, toxic gases.

The management of fire water runoff must also be addressed, refer to **Section 4.2.4.6**.

3.3.4 Review of Risk Management Plans

Risk management plans should be reviewed prior to any changes in the design or at the site that can impact on fire safety.

3.3.5 Additional Requirements Specific to Facility Type

Battery Energy Storage Systems

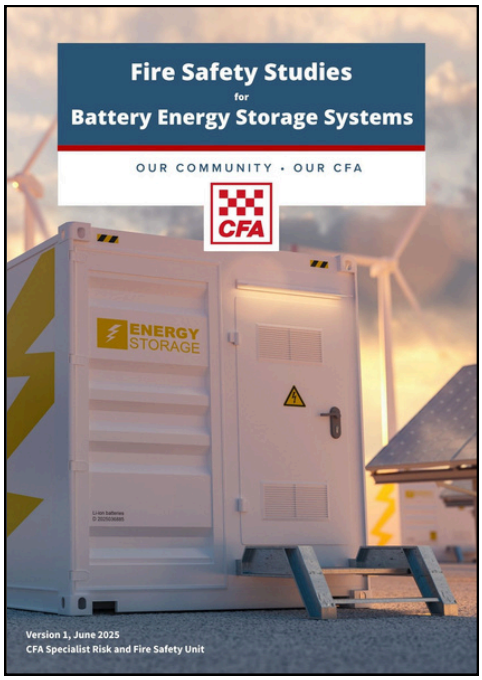
3.3.5.1 Fire Safety Study

A fire safety study is an analysis that considers the specific hazards present at a facility and identifies the requirements of the fire systems to manage those hazards properly. A fire safety study is useful to analyse the adequacy of proposed and actual fire and explosion protection systems.

Following review of a Risk Management Plan, CFA may request the preparation of a fire safety study for large-scale battery energy storage systems (BESS) over 1MWh where the design, capacity, complexity, location or proposed operations necessitate an enhanced, detailed analysis of requirements for fire and explosion safety systems.

A fire safety study complements the broader risk management process (captured in a Risk Management Plan) by determining appropriate, effective, fit-for purpose fire risk controls (encompassing fire and explosion prevention, detection and protection), that are then incorporated into facility planning and design.

Refer to *CFA's Fire Safety Studies for Battery Energy Storage Systems Guideline* (v1, 2025) for more information.



4 Facility Location and Design

4.1 Facility Location

Renewable energy facilities are to be located in low-risk environments wherever possible, to reduce the risk of external fire impacting the facility and its consequences.

Choosing the right location for a renewable energy facility requires careful consideration of a number of factors, including wider environmental conditions and other potential sources of fire hazard in the surrounding area.

CFA acknowledges that renewable energy facilities are often limited as to their placement by the existing power transmission infrastructure. However, directing their development to low-risk environments wherever possible helps to minimise the risk and consequence of fires that start outside of the site. It also helps limit the impacts of fires that may start within the facility on the environment and the wider community.

Low-Risk Environment Attributes

Indicators of a lower risk environment where development should be directed, include:

- Grassland.
- No continuous other vegetation types within 1-20km of the project site.
- Generally flat topography, some undulation may be present.
- Slopes are less than 5 degrees.
- Good road access with multiple routes available to and from the project site.
- No Bushfire Management Overlay applies.
- No Land Subject to Inundation Overlay applies.

Wind Energy Facilities

Wind energy facilities can be located on open grassed areas, such as grazed paddocks, where practicable. Vegetation throughout the facility must be managed according to planning permit conditions and **Section 6.2** of this guideline.

Where wind energy facilities are located within high-risk environments (including timber plantations) requirements for vegetation management may be increased. Refer to **Section 4.2.4**.

Solar Energy Facilities

Where practicable, solar energy facilities can be sited on grazed paddocks. Vegetation throughout the facility must be managed in line with planning permit conditions and **Section 6.2** of this guideline.

Battery Energy Storage Systems

Wherever possible, battery energy storage systems must be sited in low risk location, such as where the BMO and LSIO do not apply.

The Risk Management Plan must inform the siting of battery energy storage systems.

4.1.1 High-Risk Environments

All Facilities

Model Requirements

Planning applications for all renewable energy facilities proposed in high-risk environments must address the following:

a) An assessment against policy at *Clause 13.02-1S (Bushfire Planning)* where the facility is located in a Bushfire Prone Area (BPA).

b) The impact of any ignitions arising from the infrastructure (solar panels, wind turbines, battery energy storage systems, electrical infrastructure) on nearby communities, infrastructure and assets.

c) The impact of bushfire on the infrastructure (eg., ember attack, radiant heat impact, flame contact).

d) Assessment of whether the proposal will lead to an increase in risk to adjacent land and how the proposal will reduce risks on site to an acceptable level.

Modifications to Model Requirements must be in consultation with CFA.

4.1 Facility Location (Continued)

Renewable energy facilities in high-risk environments present increased safety risks that may impact effective firefighting operations.

Where renewable energy facilities are located within high-risk environments, strengthened or additional risk mitigation measures will be required. High-risk environments include:

- The Bushfire Management Overlay and Bushfire Prone Areas.
- The Land Subject to Inundation Overlay.
- Areas with peat.

As landscape risk increases there must be a corresponding increase in the bushfire mitigation. For example, where there is forest vegetation in the landscape, timber plantations, long fire runs, or areas of higher fuel load, a tailored set of requirements is likely to apply.

Consultation with CFA for fire risk management for renewable energy facilities in high-risk environments must occur at the facility planning and design stage.

4.1.1.1 Bushfire Prone Areas and the Bushfire Management Overlay

Properties identified as within a Bushfire Prone Area (BPA) or the Bushfire Management Overlay (BMO) are those likely to be subject to bushfire.

Whether a facility sits within these areas can be determined through *VicPlan*.

Understanding the level of risk and likely fire behaviour at the site are critical factors in determining whether the location of a proposed facility is appropriate.

The requirements of the BMO can be used to guide responses to bushfire risk within planning applications and Fire Management Plans, even when no permit is triggered under the control.

4.1.1.2 Peat

Peat is generated gradually in wetlands through the build-up of partially decayed vegetation. Peat is vegetation with a high carbon content that has decomposed and become a section of the soil profile. Peat sources can be found above ground or buried many metres below the soil surface. Wetlands close to each other may be interconnected by subsurface peat deposits.

Once ignited by the presence of a heat source (eg., a bushfire penetrating the subsurface), it smoulders. These smouldering fires can burn undetected for very long periods of time (months, years, and even centuries) propagating in a creeping fashion through the underground peat layer.

Peat may experience a fire at any stage of its life and the suppression methods employed to achieve success will vary. Peat fires are extremely difficult to extinguish, and fire authorities require large amounts of water to suppress fires within peat.

Developers of renewable energy facilities must undertake an assessment to ascertain the presence of peat within subject lands.

Where peat is found:

a) All reasonable steps must be taken to ensure that facility infrastructure is not located in peat areas on-site.

b) An exclusion zone of at least 10 (ten) metres, or greater as determined through a risk management process, must be provided between peat areas and facility infrastructure.

c) The risk assessment process, documented in a Risk Management Plan, must inform the provision and capacity of fire protection systems and equipment at facilities with peat areas.

4.2 Facility Design

Renewable energy facilities must be designed to eliminate or reduce the risk of fire occurring and if it does occur, its consequences.

4.2.1 Emergency Vehicle (Fire Truck) Access

All Facilities

Providing adequate fire truck access to and within facilities assists CFA to safely and effectively respond to areas within the site that may be threatened by fire.

Model Requirements

a) Construction of a minimum four (4) metre perimeter road within the perimeter fire break.

b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes (eg., no compacted earth).

c) Constructed roads should be a minimum of four (4) metres in trafficable width with a four (4) metre vertical clearance for the width of the formed road surface. Ensure any fencing along access routes allows for width of fire vehicles.

d) The average grade should be no more than 1 in 7 (14.4% or 8.1°) with a maximum of no more than 1 in 5 (20% or 11.3°) for no more than fifty (50) metres.

e) Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.

f) Roads must incorporate passing bays at least every 600 metres, which must be at least twenty (20) metres long and have a minimum trafficable width of six (6) metres. At least one passing bay must be incorporated where roads are less than 600 metres long.

g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, battery energy storage systems and related infrastructure, substations and grid connection areas.

h) Provision of at least two (2) but preferably more access points to each part of the facility. The number of access points must be informed through a risk management process, in consultation with CFA.

Modifications to Model Requirements must be in consultation with CFA.

Vehicle access to a hardstand should be designed to allow for a fire truck to leave the hardstand in a forward direction. This can be achieved with loop roads, perimeter roads and the like. Where this cannot be achieved, the maximum distance that a fire truck can be expected to reverse safely is 60m.

Where vehicle access to a hardstand is greater than 60m, such as dead-end roads or a single access, a turning area complying with one of the following options should be provided. No parking is permitted in the turning area and appropriate 'NO PARKING' signage is to be provided.

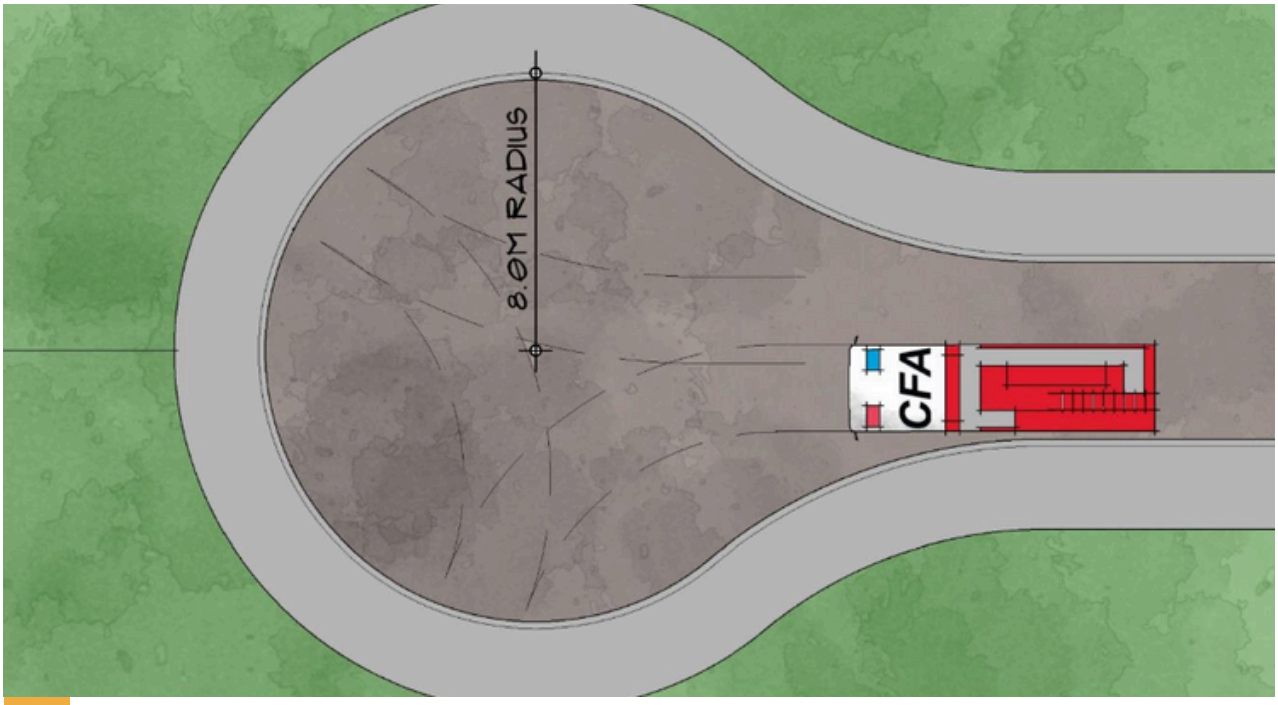


Figure 1: *Court-bowl style, minimum 8m radius.*

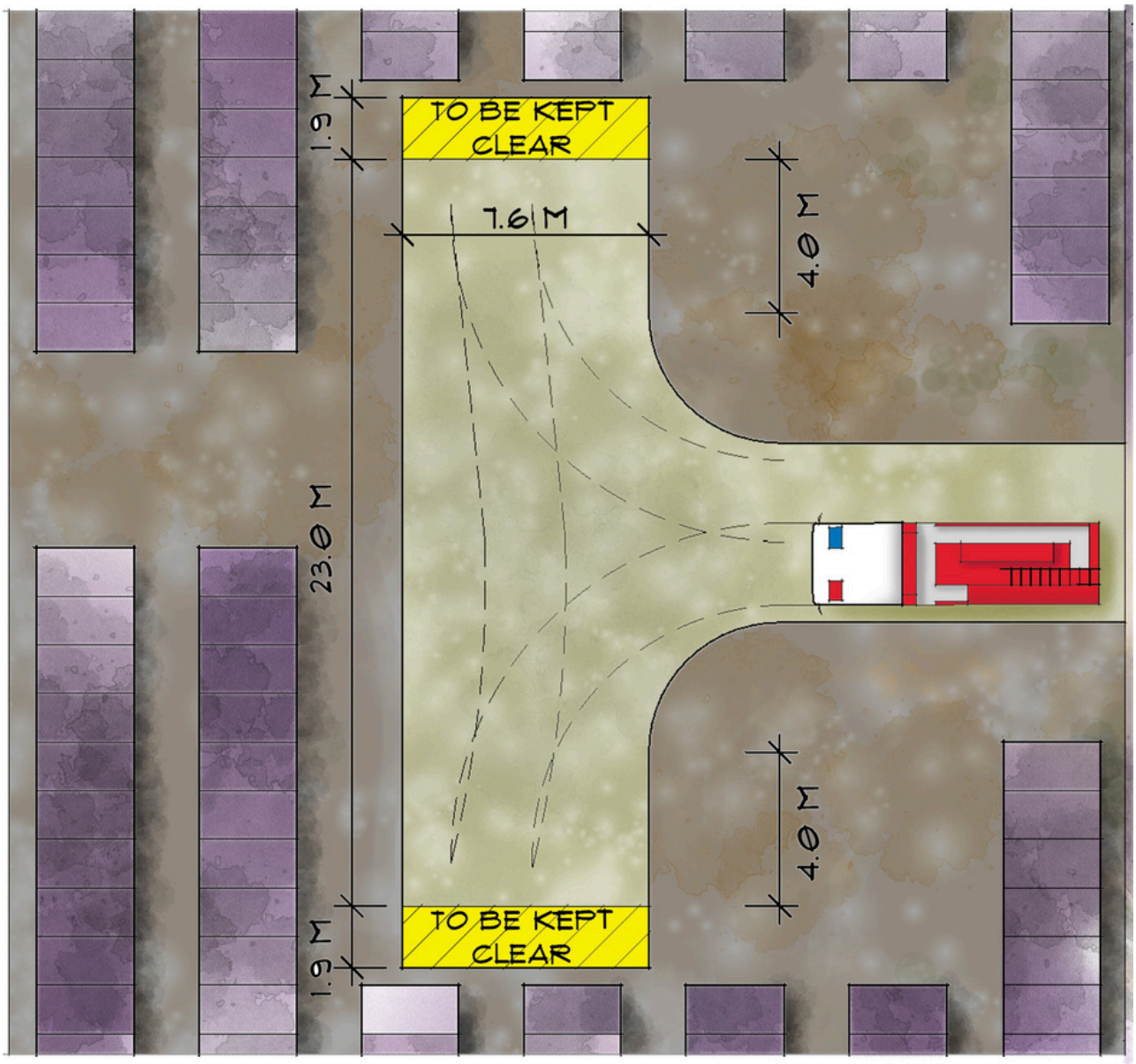


Figure 2: *'T' head style.*

4.2 Facility Design (Continued)

Wind Energy Facilities

Construction of a four (4)-metre perimeter road is not required for wind energy facilities **(4.2.1(a))**. However, suitable fire truck access is required to each turbine and building on-site.

Model Requirement

Constructed roads developed during the construction phase of facilities must be maintained post-commissioning and throughout the operational life of the facility, to allow access to each turbine for maintenance and emergency management purposes. The number and location of vehicle access points must be determined in consultation with CFA.

Modifications to Model Requirements must be in consultation with CFA.

Solar Energy Facilities

Model Requirement

Where solar energy facilities are designed over several land parcels separated by private or public roads, overhead powerlines, and/or water courses, vehicle entrances are to be provided into each section. The number and location of vehicle access points must be determined in consultation with CFA.

Modifications to Model Requirements must be in consultation with CFA.

Solar Energy Facilities (Micro)

Construction of a four (4)-metre perimeter road **(4.2.1(a))** and the incorporation of passing bays to perimeter roads **(4.2.1(f))** may be disregarded for micro solar facilities without battery energy storage systems.

Where micro solar facilities include battery energy storage systems, perimeter roads may be disregarded where roads suitable for emergency vehicles are provided to fire service infrastructure, and to and around the BESS **(4.2.1(g))**, with turning circles for dead-end roads.

Battery Energy Storage Systems

Model Requirement

At least two access points are to be provided into each section where battery energy storage systems are located. The number and location of vehicle access points must be determined in consultation with CFA.

Modifications to Model Requirements must be in consultation with CFA.

4.2.2 Firefighting Water Supply

All Facilities

In the event of a fire (structure fire, grassfire or bushfire), sufficient water must be available and safely accessible to emergency responders and trucks to ensure that fire suppression activities are safe, timely, effective and not hindered in any way.

Firefighting infrastructure must be designed to allow effective response to the risks and hazards at the facility. Fire water must be provided to cover buildings, control rooms, substations and grid connections

The quantity of water supply must be established through a comprehensive risk management process that considers all relevant hazards, documented in the Risk Management Plan, in consultation with CFA.

Minimum fire water quantity requirements are specified under each facility type below.

Model Requirements

a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.

b) Static water storage tank installations must comply with *AS 2419.1-2021: Fire hydrant installations – System design, installation and commissioning*.

c) The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.

d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.

e) The static water storage tanks must be located at vehicle access points to the facility and must be positioned at least ten (10) metres from any infrastructure (solar panels, wind turbines, battery energy storage systems, etc.).

f) The hard-suction point must be provided, with a 150mm full bore isolation valve **(Figure 3)** equipped with a Storz connection, sized to comply with the required suction hydraulic performance.

Adapters that may be required to match the connection are: 125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters **(Figure 4)** *with a matching blank end cap to be provided.*

(Continued overleaf.)

4.2 Facility Design (Continued)

Model Requirements (Continued)

g) The hard-suction point must be positioned within four (4) metres to a hardstand area and provide a clear access for emergency services personnel.

h) An all-weather road access and hardstand must be provided to the hard-suction point. The hardstand must be maintained to a minimum of 15 tonne GVM, eight (8) metres long and six (6) metres wide or to the satisfaction of the CFA.

i) The road access and hardstand must be kept clear at all times.

j) The hard-suction point must be protected from mechanical damage (eg., bollards) where necessary.

k) Where the access road has one entrance, an eight (8) metre radius turning circle must be provided at the tank.

l) An external water level indicator must be provided to the tank and be visible from the hardstand area.

m) Signage **(Figure 5)** indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.

n) Signage **(Figure 6)** must be provided at each vehicle entrance to the facility, indicating the direction to the nearest static water tank(s).

Modifications to Model Requirements must be in consultation with CFA.

Figure 3: *150mm full-bore isolation valve.*

Figure 4: *125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters.*

Figure 5: *Fire water signage to comply with AS 2419.1-2021, Clause 11.3.6: Water storage tanks and equipment.*

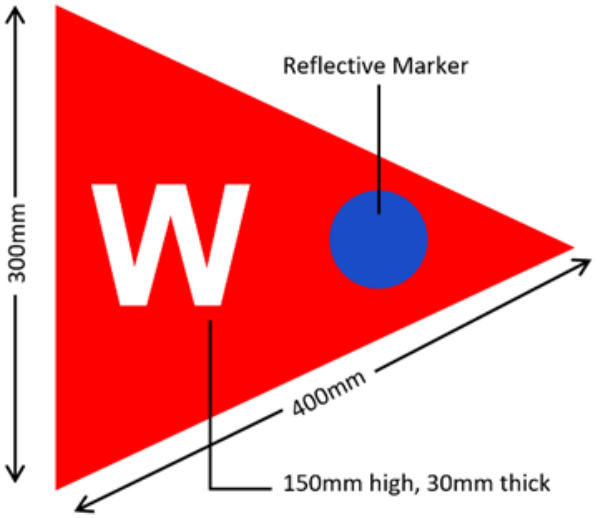


Figure 6: *Directional signage: fade resistant, fixed to a rigid post in contrasting lettering, white sign writing on red background, with a circle reflective marker. 'W' in 150mm upper case lettering.*

Wind Energy Facilities

A fire protection system must be provided for wind energy facilities. The fire protection system must be designed to allow adequate response to the risks and hazards at the facility, in consultation with CFA.

Model Requirements

a) The fire protection system for wind energy facilities must incorporate at least one static fire water storage tank of at least 45,000L effective capacity at each site entrance.

b) Additional static fire water storage tanks of at least 45,000L effective capacity must also be incorporated in facility design. The number and location of tanks is to be determined through a comprehensive risk management process (Risk Management Plan), in consultation with CFA.

c) Nacelles must be equipped with automatic fire detection, alarm and fire suppression systems.

Modifications to Model Requirements must be in consultation with CFA.

Where wind energy facilities include battery energy storage systems, additional fire water supply must be provided in accordance with the below.

4.2 Facility Design (Continued)

Solar Energy Facilities

A fire protection system must be provided for solar energy facilities. The fire protection system must be designed in consultation with CFA to allow a safe, adequate response to the risks and hazards at the facility.

Model Requirements

a) The fire protection system for solar energy facilities must incorporate at least one (1) x 45,000L static water tank at the primary vehicle entrance to each the part of the facility.

b) Additional static fire water tanks of at least 45,000L effective capacity must also be incorporated for every 100ha.

Modifications to Model Requirements must be in consultation with CFA.

For example, for solar energy facilities without battery energy storage systems:

- A **500ha area** requires a minimum of five (5) x 45,000L static water tanks. (Eg. 45,000L at the main entrance and four (4) additional 45,000L.)
- A **350ha area** requires a minimum of three (3) x 45,000L static water tanks. (Eg., 45,000L at the main entrance and two (2) additional 45,000L).

Where solar facilities include battery energy storage systems, additional fire water supply must be provided in accordance with the below.

Solar Energy Facilities (Micro)

For micro solar facilities up to and including 5MW without battery storage that are not located within high-risk landscapes, fire water of not less than 22,500 litres effective capacity, in lieu of 45,000 litres, may be provided. Fire water tank(s) must be located at the primary vehicle access point to the facility.

Where micro solar facilities include battery energy storage systems, additional fire water supply must be provided in accordance with the below.

Battery Energy Storage Systems

A fire protection system suitable for the risks and hazards at the facility must be provided. For battery energy storage systems, the water supply quantity must:

- Enable effective cooling of surrounding infrastructure.
- Account for reasonable duration of fire events based on the proposed battery chemistry.
- Account for local weather conditions and potential fire weather conditions.
- Provide for the safety of firefighters.

The fire protection system must be designed in line with the requirements of *AS 2419.1-2021: Fire hydrant installations*, Clause 3.9: Open Yard Protection, in consultation with CFA.

For the purposes of determining system requirements, the 'yard area' referenced within *AS 2419.1*, Table 2.2.5(D) may be considered that of the battery installation, including the minimum 10m fire break around the battery infrastructure, rather than the entire area of the yard or site.

Emergency response experience from battery energy storage system incidents indicates that larger quantities of water may be required.

Battery Energy Storage Systems (Centralised or Stand-Alone Facilities)

Where battery energy storage systems are ancillary to solar or wind energy facilities and proposed within a single centralised location, fire protection in accordance with the model requirements in this section must be provided.

Model Requirements

1) For facilities with centralised battery energy storage systems, the fire protection system must include at a minimum:

a) Where reticulated water is available, a fire hydrant system that meets the requirements of *AS 2419.1-2021: Fire hydrant installations*, Section 3.9: Open Yard Protection, and Table 2.2.5(D): Number of Fire Hydrant Outlets Required to Flow Simultaneously - Open Yards.

Except, that fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet.

OR

b) Where no reticulated water is available, a fire hydrant system that complies with *AS 2419.1-2021* must be provided:

i. The fire water supply must be of a quantity no less than 288,000L or as per the provisions of *AS 2419.1-2021: Fire hydrant installations*, Table 2.2.5(D) for open yards flowing for a period of no less than four hours at 20L/s, whichever is the greater.

(Continued overleaf.)

4.2 Facility Design (Continued)

Model Requirements (Continued)

ii. The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from *AS 2419.1-2021: Fire hydrant installations*, Table 2.2.5(D).

(E.g., For battery installations with an aggregate area of over 27,000m^2, 4 (four) hydrant outlets are required to operate at 10L/s for four hours, which equates to a minimum static fire water supply of 576kL.)

iii. Fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet.

iv. The fire water supply must be located at vehicle entrances to the facility, at least 10m from any infrastructure (electrical substations, inverters, battery energy storage systems, buildings).

v. The fire water supply must be reasonably adjacent to the battery energy storage system and shall be accessible without undue danger in an emergency. (Eg., Fire water tanks are to be located closer to the site entrance than the battery energy storage system).

vi. The fire water supply must comply with *AS 2419.1-2021: Fire hydrant installations, Section 5: Water storage tanks*.

Modifications to Model Requirements must be in consultation with CFA.

Figure 7: *Best-practice arrangement of fire service infrastructure for facilities with centralised battery energy storage systems with reticulated water supply meeting the performance requirements of AS 2419.1-2021: Fire hydrant installations.*

4.2 Facility Design (Continued)

Battery Energy Storage Systems (Decentralised)

Where battery energy storage systems are decentralised, that is, proposed in multiple locations such as amongst solar panel arrays, fire water must be available for each container/enclosure/cabinet.

All model requirements for battery energy storage systems contained within this guideline apply to decentralised battery energy storage systems unless otherwise specified.

Model Requirements

1) For facilities with decentralised battery energy storage systems, the fire protection system must include at a minimum:

a) Where reticulated water is available, a fire protection system as per Model Requirement (1a) under 'Centralised Battery Energy Storage Systems'.

OR

b) Where no reticulated water is available, a fire water supply in static storage tanks, where a minimum 45,000L static water tank is provided within 120m of each battery container. The aggregate quantity of fire water supply at the facility must be no less than 288,000L to the satisfaction of CFA.

Modifications to Model Requirements must be in consultation with CFA.

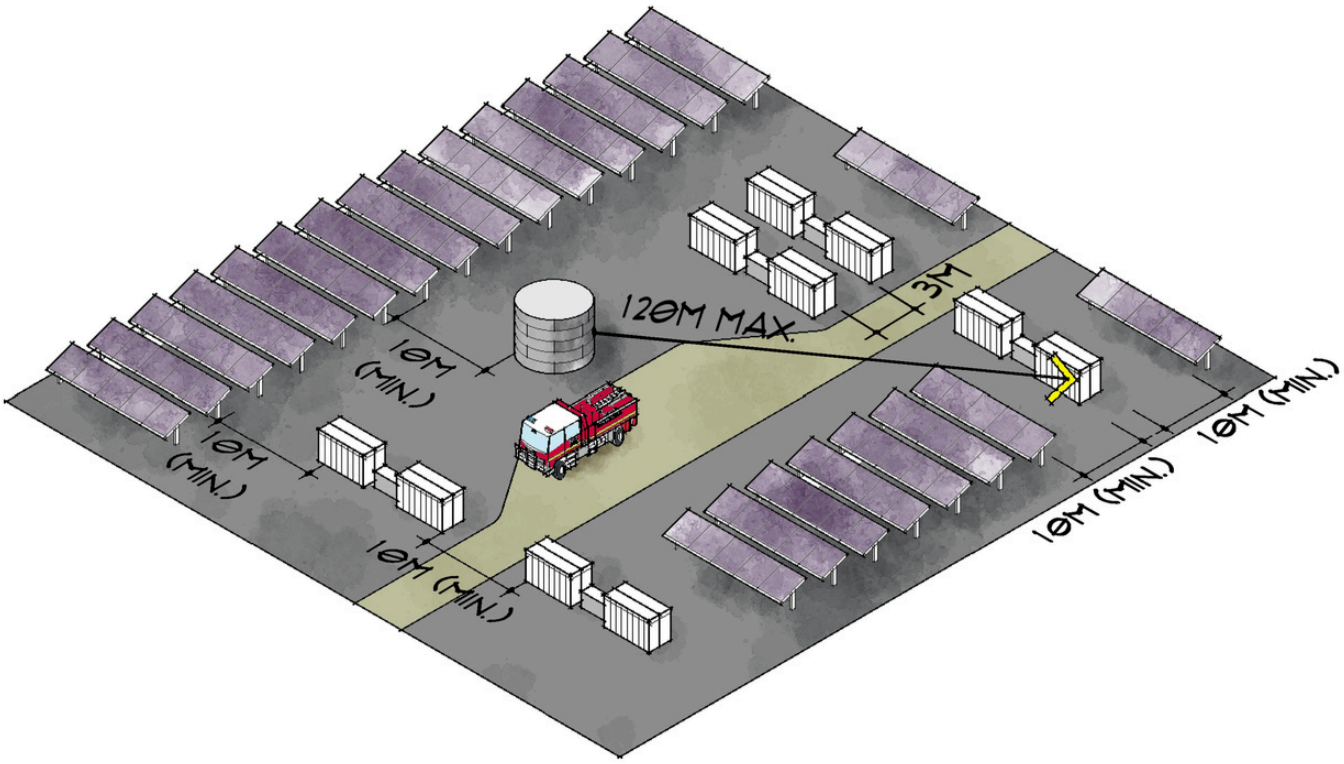


Figure 8: *Potential arrangement for fire water supply tank(s) for facilities with decentralised battery energy storage systems with no reticulated water supply to the site.*

4.2 Facility Design (Continued)

Figure 9: *Best-practice arrangement of fire service infrastructure at facilities with centralised battery energy storage systems without reticulated water supply, or a reticulated water supply that does not meet the performance requirements of AS 2419.1-2021: Fire hydrant installations.*

4.2.3 Fire Detection and Suppression Equipment

All Facilities

In addition to fire water supplies, suitable fire detection and suppression equipment must be provided at the facility. This includes first-aid fire protection equipment such as fire extinguishers and fire hose reels.

Model Requirements

Suitable fire detection and suppression equipment must be provided:

a) For on-site buildings and structures, according to the requirements of the National Construction Code.

b) For storages of dangerous goods, according to the requirements of any Australian Standards for storing and handling of dangerous goods.

c) For electrical installations, a minimum of two (2) suitable fire extinguishers must be provided within 3m-20m of each PCU.

d) In all vehicles and heavy equipment, each vehicle must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or other firefighting equipment as a minimum when on-site during the Fire Danger Period.

Modifications to Model Requirements must be in consultation with CFA.

4.2 Facility Design (Continued)

4.2.4 Landscape Screening and On-Site Vegetation

All Facilities

Any proposed or existing vegetation must be considered in the Risk Management Plan for its potential to intensify and propagate fire within and away from the site.

Where landscape screening is required, for example, to screen visual impacts or to prevent visual glare from a solar energy facility, the design must consider any potential increase in fire risk due to the type (species), density, height, location and overall width of the screening.

Facilities must be designed so that the radiant heat flux (output) from vegetation does not create the potential for ignition of on-site infrastructure or other vegetation.

Radiant heat impact leading to ignition may be mitigated through:

- Vegetation removal (where permitted).
- Separation from nearby infrastructure (e.g., fire breaks; refer below).
- The provision of thermal barriers at nearby infrastructure.
- Other means in consultation with CFA.

Consultation with CFA is required regarding landscape screening in high-risk environments.

Wind Energy Facilities

Where wind turbines are sited in high-risk environments, additional vegetation management must be considered in the Risk Management Plan.

CFA recommends considering the implementation of an additional reduced-fuel zone around the base of wind turbines, abutting the fire break. The reduced fuel zone may be:

- No less than 20m, or
- To the envelope of the wind turbine blades.

This zone is to be cleared of trees and scrub (where permitted by the responsible authority) and grass must be no more than 100mm during the Fire Danger Period.

Solar Energy Facilities

Where practicable, low-flammability vegetation (such as root vegetables) may be planted under solar panels, provided foliage does not extend beyond the panel footprint.

Substations and Electric Lines

Substations should be surfaced to eliminate all vegetation including grasses.

The *Electricity Safety (Electric Line Clearance) Regulations 2020* prescribe the vegetation clearance requirements for electric lines based on the assigned fire hazard rating for land established under Section 80 of the *Electricity Safety Act 1998*. Fire hazard ratings are available from CFA by request.

4.2.5 Fire Breaks

All Facilities

A fire break is a gap in fuel (vegetation) that reduces the potential for fire to enter or leave an area. Fire breaks may also be used for emergency vehicle access.

Model Requirements

A fire break must be established and maintained around:

a) The perimeter of the facility, commencing from the boundary of the facility or from the vegetation screening inside the property boundary.

b) The perimeter of control rooms, electricity compounds, substations and all other buildings on-site.

The width of fire breaks must be a minimum of 10m, and at least the distance where radiant heat flux (output) from the vegetation does not create the potential for ignition of on-site infrastructure.

Modifications to Model Requirements must be in consultation with CFA.

Where screening or other vegetation is a width of 20m or less (open density as per *AS 3959-2018: Construction of buildings in bushfire-prone areas*), or 15m or less (closed density as per *AS 3959-2018*), a fire break of 10m may be appropriate to prevent radiant heat from vegetation fully involved in fire becoming an ignition source for on-site infrastructure.

Outside these parameters, separation must be at least the distance where radiant heat flux (output) from the vegetation does not create the potential for ignition of on-site infrastructure.

4.2 Facility Design (Continued)

The width of the vegetation includes any existing vegetation from neighbouring properties or road reserves abutting the proposed or existing vegetation for the renewable energy facility.

Vegetation may be classified as per *AS 3959-2018* for the purposes of determining radiant heat flux (output).

Fire breaks must be:

- Non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock.
- Free of vegetation and obstructions at all times. No plant or equipment of any kind is to be stored in fire breaks.

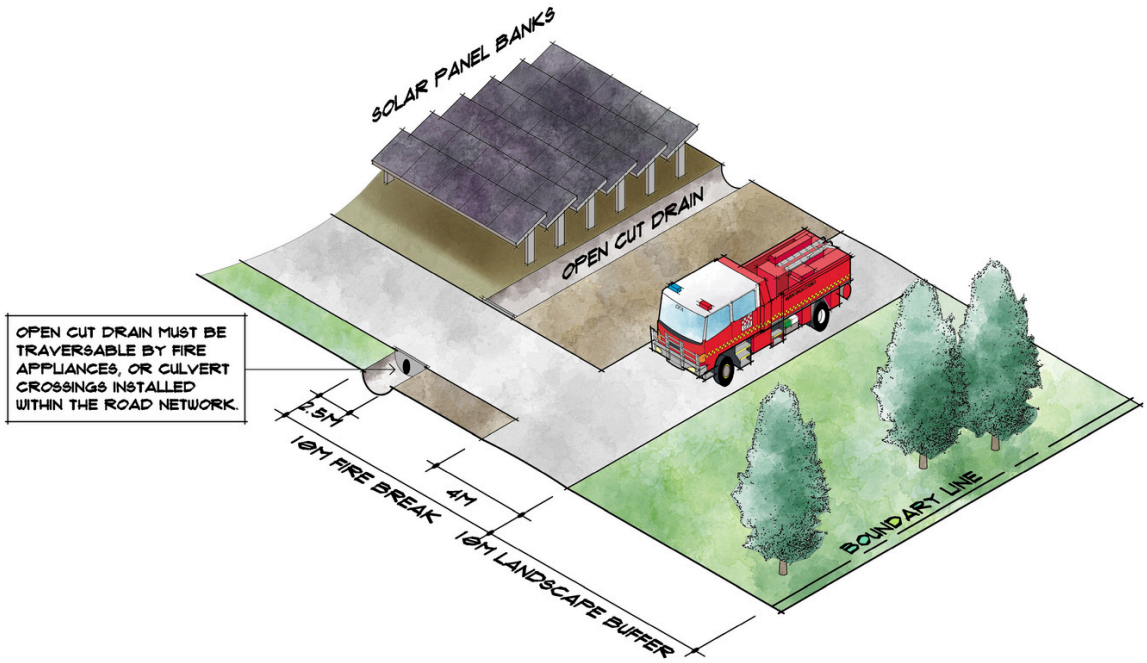


Figure 10: *Typical cross-section indicating fire break requirements at a solar energy facility.*

Wind Energy Facilities

Fire breaks are not required around the perimeter(s) of wind energy facilities.

Model Requirement

A fire break must be established and maintained around the base of wind turbines.

Modifications to Model Requirements must be in consultation with CFA.

Battery Energy Storage Systems

Model Requirement

A fire break must be established and maintained around battery energy storage systems and related infrastructure.

Modifications to Model Requirements must be in consultation with CFA.

In addition to radiant heat flux (output) from vegetation, the width of fire breaks between vegetation and battery energy storage systems must be at least the distance where the radiant heat flux (output) from the battery energy storage system fully involved in fire does not create the potential for ignition of vegetation.

Further Guidance Material

AS 3959-2018: Construction of buildings in bushfire-prone areas (Standards Australia)
Contains information on classifying vegetation that may be useful for bushfire hazard assessments, see Table 2.3 and Figures 2.4(a)-(h).

CFA Plant Selection Key
The Plant Selection Key helps you choose plants for a garden in a high bushfire risk.

CFA Landscaping for Bushfire
While aimed at residential garden design, this publication contains information that may be useful for design of renewable energy facilities.

4.2 Facility Design (Continued)

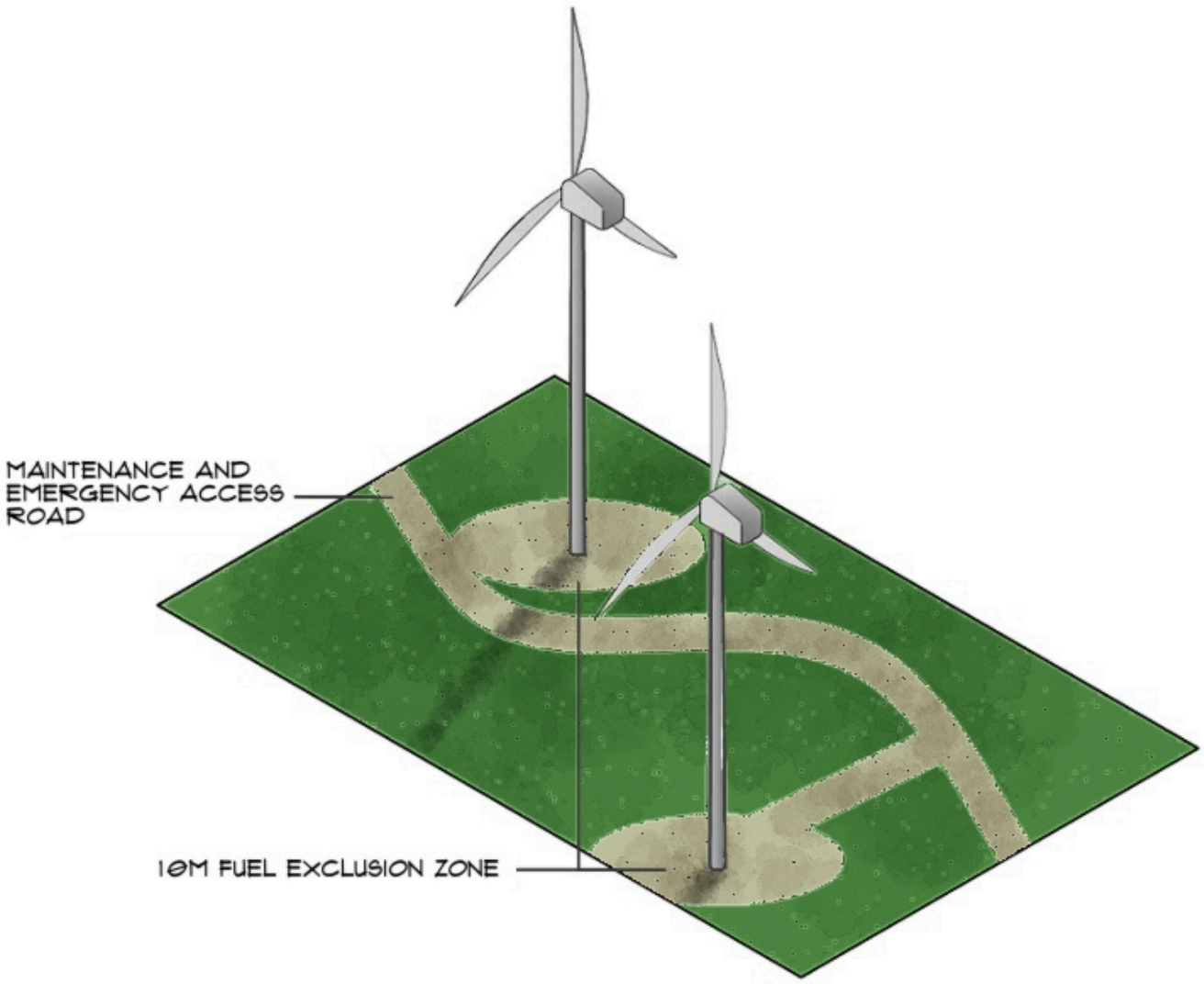


Figure 11: *Typical wind turbine arrangement with fuel exclusion zone and access roads.*

4.2.6 Design Specific to Facility Type

Wind Energy Facilities

4.2.6.1 Aerial Firefighting

Wind energy facilities pose hazards for aerial firefighting operations in certain weather and terrain conditions.

Fire suppression aircraft operate under Visual Flight Rules. Most fire suppression aircraft operate during the day, but only specialised aircraft have the ability for fire suppression at night, under strict protocols.

The following model requirements support safe and effective firefighting operations. The installation must be notified to CFA and Air Services Australia for inclusion in the Vertical Obstruction Database.

Model Requirements

a) Wind turbines must be located no less than 300 metres apart.

b) Wind turbines must be provided with automatic shut-down, and the ability to be completely disconnected from the power supply in the event of fire.

c) Installed weather monitoring stations must be notified to the Civil Aviation Safety Authority (CASA) as per CASA Advisory Circular AC 139.E-05 v1.1, October 2022 (as for all structures 110m or more above the ground).

d) All guy wires and monitoring towers must be clearly marked, even where marking is not required by CASA.

Modifications to Model Requirements must be in consultation with CFA.

4.2 Facility Design (Continued)

CFA air response to a grass fire in a wind energy facility, February 2022.

Solar Energy Facilities

4.2.6.2 Separation Between Banks

Adequate separation of solar panel banks facilitates safe and effective firefighting operations and can limit fire spread.

Model Requirement

Solar energy facilities are to have a minimum six (6) metre separation between solar panel banks.

Modifications to Model Requirements must be in consultation with CFA.

The separation between solar panel banks must be considered in the Risk Management Plan.

Long runs of solar panel arrays without breaks due to natural site features or access roads can pose hazards to firefighters, prolong incidents and increase the potential for asset damage.

CFA recommends that separation wherever possible:

- Is between each 'bank' of solar panels, where a 'bank' is that connected to a single power conversion unit/inverter, or
- Is provided so that no unbroken area of solar panels is greater than 25ha, or
- Is designed in consultation with CFA.

This zone is to be cleared of trees and scrub (where permitted by the responsible authority) and grass must be no more than 100mm during the Fire Danger Period.

For the purposes of this guideline, a 'bank' of solar panels may be that which is connected to a single power conversion unit/inverter.

Solar Energy Facilities (Micro)

Separating solar panel banks by six (6) metres is not required for micro solar facilities.

4.2 Facility Design (Continued)

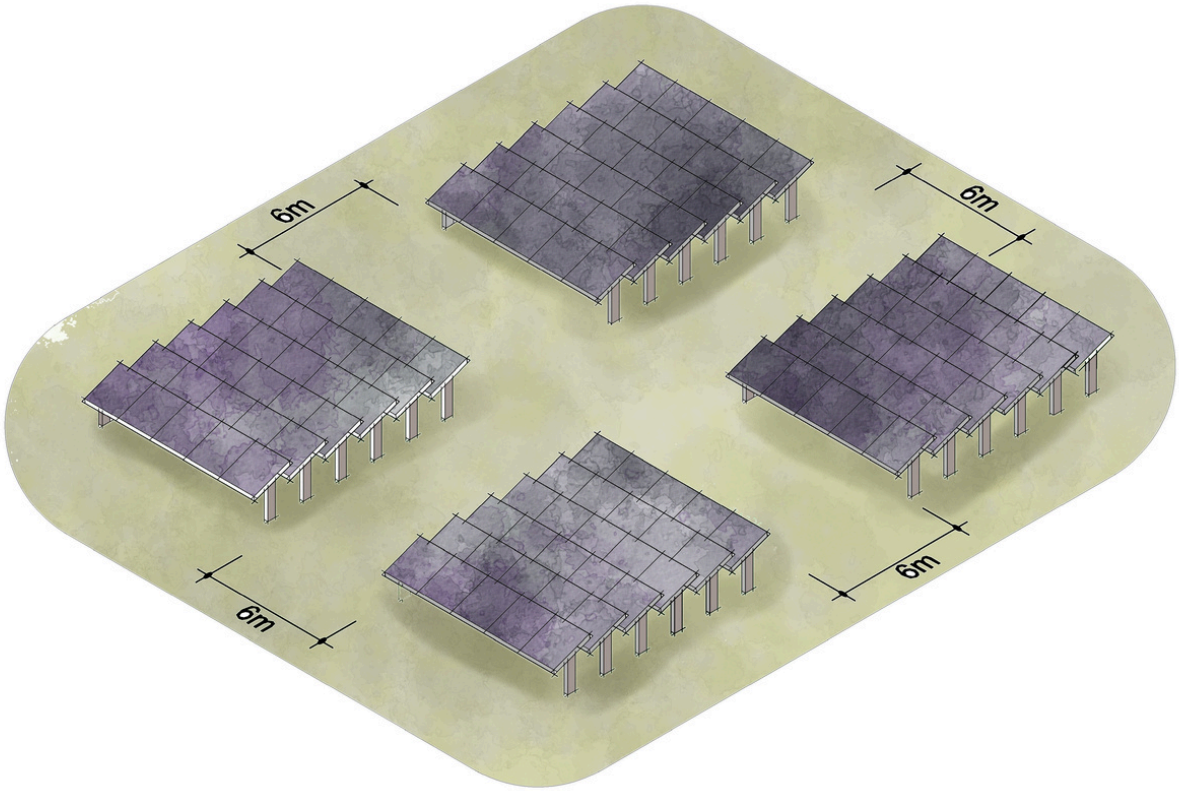


Figure 12: *Six metre separation between solar panel banks (indicative only).*

CFA air response to a grass fire in a solar facility, December 2022.

4.2 Facility Design (Continued)

Battery Energy Storage Systems

CFA acknowledges that battery technologies are continually evolving, and that not all battery energy storage systems have the same level of fire risk. CFA's guidelines are based on lithium-ion battery chemistries which all have the potential for thermal runaway, including lithium iron phosphate batteries. The principles of risk-based facility design can be adopted across the spectrum of large-scale battery technologies and configurations.

Facility design can reduce the potential for ignition and the consequences of fire should it occur. Facilities with battery energy storage systems must be designed with an ultimate goal of fire prevention.

Where a lithium-ion battery goes into thermal runaway, cooling surrounding infrastructure to prevent further spread may be the only safe response option available to CFA.

The battery management and safety systems within the chosen battery technology will largely dictate whether thermal runaway will occur and its initial management.

CFA recommends considering the provision of non-combustible, floor-to-ceiling partition 'walls' (thermal barriers) between battery racks (stacked modules) within battery containers/enclosures. For details, refer to *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems*.

In the absence of a specific Australian Standard for large-scale battery energy storage system facilities, the current versions of the following should be used in the design and operation of battery energy storage systems, except where varied by this guideline.

- *NFPA 855: Standard for the Installation of Stationary Energy Storage Systems*
- *UL 9540: Energy Storage System Requirements*
- *UL 9540A: Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems*
- *FM Global Property Loss Prevention Data Sheet 5-33 Electrical Energy Storage Systems*

If applying NFPA 855, CFA considers an 'exposure' as anything in the immediate range of a fire that is not burning but could start burning if the fire is not contained, including adjacent battery energy storage system containers/enclosures.

Model Requirements

1) The design of the facility must incorporate:
a) A separation distance that prevents fire spread between battery containers/enclosures and:

- Other battery containers/enclosures.
- On-site buildings.
- Substations.
- The site boundary.
- Any other site buildings.
- Vegetation.

Separation must be at least the distance where the radiant heat flux (output) from a battery energy storage system container/enclosure fully involved in fire does not create the potential for ignition of these site elements.

b) A fire break around the battery energy storage system and related infrastructure, of a width of no less than 10m, or greater where determined in the Risk Management Plan.

Fire breaks must be non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock.

The width must be calculated based on the ignition source being radiant heat of surrounding vegetation, including landscaping.

c) A layout of site infrastructure that:
i. Considers the safety of emergency responders.
ii. Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system.
iii. Minimises the potential for fires in battery containers/enclosures to impact on-site and off-site infrastructure.

2) Battery energy storage systems must be:
a) Located to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).

b) Located so that the site entrance and any fire water tanks are not aligned to the prevailing wind direction (therefore least likely to be impacted by smoke in the event of fire at the battery energy storage system.)

c) Provided with in-built fire and gas detection systems. Where these systems are not provided, measures to effectively detect fires within containers must be detailed within the Risk Management Plan.

(Continued overleaf.)

4.2 Facility Design (Continued)

Model Requirements (Continued)

d) Provided with explosion prevention via sensing and venting, or explosion mitigation through deflagration panels.

e) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.

f) Provided with suitable access roads for emergency services vehicles, to and within the site, including to battery energy storage system(s) and fire service infrastructure.

g) Installed on a non-combustible surface such as concrete.

h) Provided with suitable ventilation.

i) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical damage to battery containers/ enclosures.

j) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.

k) Provided with spill containment that includes provision for management of fire water runoff.

Modifications to Model Requirements must be in consultation with CFA.

Battery Energy Storage Systems (Decentralised)

Where battery energy storage systems are decentralised (eg., in multiple, separate locations on-site) they must be separated from adjacent infrastructure, such as solar panel banks.

Separation must be to at least the distance where the radiant heat flux (output) from the battery energy storage system enclosure/container/cabinet fully involved in fire does not create the potential for ignition of the adjacent infrastructure.

4.2.6.4 Management of Fire Water Runoff

CFA recommends that infrastructure is provided for the containment and management of contaminated fire water runoff from battery energy storage systems.

Infrastructure may include bunding, sumps and/or purpose-built, impervious retention facilities. A fire water management plan may consist of the containment and disposal of contaminated fire water.

CFA recommends a containment and management capacity equivalent to the on-site fire protection system. Containment is to be provided as per *AS 4681-2000: The storage and handling of class 9 dangerous goods*, Section 7.3.9: Control of run-off.

4.3 Battery Energy Storage System Safety and Protective Systems

Safety and protective systems will vary in battery energy storage systems based on battery technologies, chemistries and the preferences of manufacturers. These systems may add a layer of protection during high-consequence emergency scenarios.

CFA recommends that battery energy storage systems are equipped with the following elements:

Battery management/monitoring systems for monitoring the state of battery systems to ensure safe operation.

Systems for detecting smoke, heat (thermal), fire and toxic off-gassing within battery containers. Detection systems for off-gassing must be single-trigger and provide for both lighter and heavier than air gases.

Systems to prevent heat/fire spread within battery containers (such as thermal barriers, shut-down separators, isolation systems, cooling systems).

Systems to prevent explosion within battery containers (such as ventilation, pressure relief and exhaust systems).

Systems to prevent water ingress to battery containers and appropriate ingress protection (IP) ratings for containers/cabinets and/or battery modules.

Warning and alarm systems within the battery containers, and/or the facility, to enable early warning for faults, operation of the battery energy storage system above 'normal'/safe parameters, smoke, off-gassing, and fire.

5 Facility Construction and Commissioning

Fire risks must be identified and effectively managed during the construction and commissioning of renewable energy facilities.

The construction of facilities comes with additional risks, including fire risks. During the construction phase, CFA expects that a risk management process is undertaken to effectively identify risks and develop and implement appropriate and effective controls.

5.1 Recommended Risk Controls

All Facilities

CFA recommends the following risk controls for the construction of facilities. This is not an exhaustive list and must be supplementary to the site-specific risk management process outcomes and any relevant requirements under legislation.

5.1.1 Fire Detection and Suppression Systems

a) Install and commission fire detection and suppression systems for the facility at the earliest possible stage of construction.

b) Provide first-aid firefighting equipment, such as fire extinguishers (and where possible, portable fire hose reels), appropriate to the identified emergency scenarios, at all construction portables/buildings on-site, in the vicinity of all construction activities, and in site-based vehicles.

c) Provide the required fire protection equipment for any storages of dangerous goods as per the relevant Australian Standards.

5.1.2 Fire Risk Management

a) Obtain appropriate permits for work during the Fire Danger Period, and ensure that any conditions on permits are adhered to.

b) Adhere to restrictions on Total Fire Ban or days of elevated fire danger according to CFA's website.

c) During the Fire Danger Period, ensure vehicle operators are instructed to remain on tracks and are not permitted to drive through paddocks.

d) Restrict smoking to prescribed areas and provide suitable ash and butt disposal facilities.

e) Provide remotely-accessible site/system security monitoring at the facility.

5.1.3 Personnel Training

a) Provide training for personnel in the use of on-site first-aid firefighting equipment, and responsibilities during emergencies.

b) Ensure all on-site personnel complete CFA's online training module 'Bushfire Safety for Workers'.

5.1.4 Emergency Management

Model Requirement

An Emergency Plan must be developed for the construction and commissioning phase, before development starts.

Modifications to Model Requirements must be in consultation with CFA.

a) The Emergency Plan must address the requirements of Section 7 of this guideline.

b) An emergency communication system must be provided that is reliable and will operate in the event of power failure.

c) CFA must be notified at least seven (7) days prior to the commissioning of any high-risk infrastructure at the facility (eg., battery energy storage systems).

5.1.5 Occupational Health and Safety

CFA recommends the development of safe work procedures for the facility, encompassing but not limited to:

a) Electricity and chemical management.

b) Vegetation management.

c) Site security.

d) Ignition source control, including hot works.

e) Infrastructure, equipment and vehicle maintenance.

f) Emergency management.

Further Guidance

WorkSafe Victoria: Effective Emergency Response Plans on Construction Sites

6 Facility Operation

Fire risks must be effectively managed for the duration of the operational life of renewable energy facilities.

6.1 Fire Management Plan

All Facilities

Model Requirement

A Fire Management Plan must be developed for the facility, in consultation with CFA, before development starts.

Modifications to Model Requirements must be in consultation with CFA.

A Fire Management Plan details the fire hazards and risks at and to your facility. It specifies the activities and accountabilities for developing and implementing appropriate and effective risk control measures.

An effective Fire Management Plan is based on a sound risk management process, which CFA recommends is documented in a Risk Management Plan (**Section 3.3**).

The Fire Management Plan informs operational and emergency management practices at your facility.

CFA expects that the Fire Management Plan follows the structure and incorporates the information detailed below.

The Fire Management Plan may be a stand-alone document or incorporated into the facility's Emergency Plan (**Section 7**).

Fire Management Plan Structure and Content

A summary of fire hazards and risks to and from the site, specific to its location, infrastructure, activities and occupancy.	Based on sound hazard identification and risk management processes. This must include risks to firefighter safety during emergencies.
Description of control measures to prevent fire occurring and limit the consequences of fire at the facility.	Fire permits, ignition source controls, hot work permits, job hazard analyses, infrastructure/vehicle/equipment/road/fence/access maintenance, waste management, compliant dangerous goods storage and handling, vegetation/fuel reduction and management, peat management, Emergency Plan.
Description of control measures to prevent and reduce the consequences of external fire impacting the facility.	Bushfire monitoring, bushfire preparedness, reduced personnel presence/ activities/travel on days of Severe and above Fire Danger Rating, creation and management of fire breaks at the site perimeter and around infrastructure, vegetation/fuel reduction and management, Emergency Plan.
Details of equipment and resources to manage fire at the facility.	Fire detection and suppression systems, fire water supplies, automatic shut-down and isolation systems, monitored alarms, communications equipment, occupant warning systems, designated evacuation assembly areas, Emergency Information Container(s), Emergency Plan.
Policies and procedures that ensure all control measures are appropriate and effective, and remain so.	Performance standards for risk controls, specific activities to verify controls (servicing/maintenance, housekeeping inspections, external audits), review processes for risk control effectiveness.
Procedures for review of the Fire Management Plan.	Review triggers and schedule, organisational accountability for the Plan, allocated responsibilities (to persons or roles) for the ongoing review and development of the Plan.

6.2 Fire Hazards and Risk Controls

The following matters must be addressed within the Fire Management Plan.

6.2.1 Bushfire and Grassfire

All Facilities

Bushfire risk is different for every location, and the potential impact of bushfire is unique to renewable energy facilities facility due to the infrastructure, electrical and chemical hazards.

Your facility may be at-risk of bushfire if it is:

- Located in an area close to or amongst dense or open bush, unmanaged grassland, near coastal scrub, or at an urban fringe.
- Identified as being in a Bushfire Prone Area, or within the Bushfire Management Overlay.

Model Requirement

If your facility is at-risk of bushfire, prevention and preparedness activities must be detailed in the Fire Management Plan.

Modifications to Model Requirements must be in consultation with CFA.

Bushfire preparedness activities must be supported by procedures that specify the personnel accountable for their completion, the specific actions required, and a schedule.

6.2.1.1 Bushfire Prevention and Preparedness during the Non-Fire Danger Period

Preparing for bushfire is a year-round activity. Activities and procedures must be in place to prepare for bushfire well before the commencement of the Fire Danger Period.

Understand Landscape and Site Fire Risk

Site occupiers must:

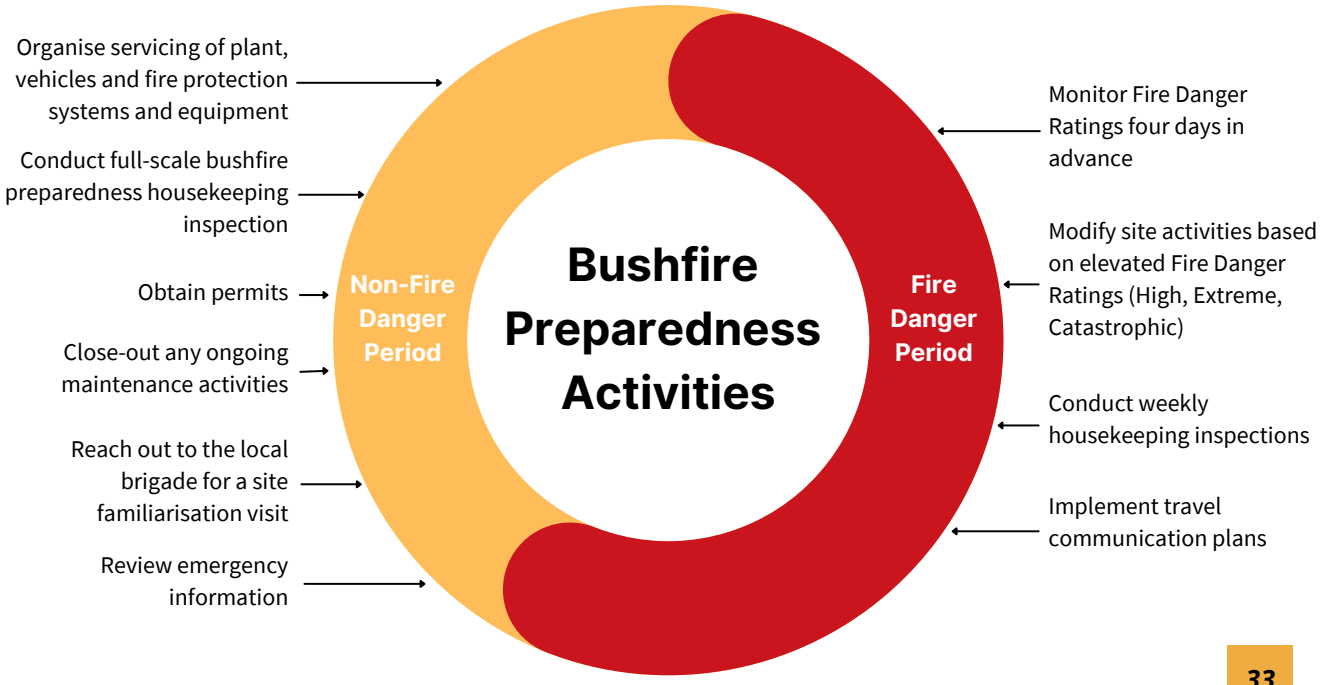
a) Take steps to understand how a bushfire may affect site occupants, facility infrastructure, and the surrounding community.
b) Ensure that fire risk controls commensurate to the fire risk are developed, implemented and reviewed.
c) Be proactive in modelling and maintaining both a culture of bushfire awareness and safety.
d) Establish and maintain a relationship with the local CFA brigade.

Develop and Implement Fire Risk Controls

Fire risk controls appropriate to the hazards and risks to and from the landscape, to and from your facility, must be developed and implemented.

a) Fire permits and restrictions - ensuring that fire permits are obtained and followed, and that restrictions based on Fire Danger Ratings or Total Fire Ban status are implemented.

Bushfire Preparedness Activities



6.2 Fire Hazards and Risk Controls (Continued)

b) Job/task fire risk management - ensuring job hazard analysis processes are developed and implemented that consider site infrastructure, operations and landscape hazards.
c) Vegetation management - ensuring that any accumulation of combustible materials are cleared and removed from site.
d) Facility and system monitoring - ensuring systems to monitor faults and abnormalities are effective.
e) Maintenance - ensuring fire protection and detection systems, plant, vehicles and equipment are regularly maintained.
f) Safe dangerous goods storage and handling - ensuring safe and compliant practices.
g) Site-wide bushfire preparedness housekeeping inspections - ensuring bushfire-focused inspections are conducted at least three months, and again one month, prior to the Fire Danger Period.

6.2.1.2 Bushfire Prevention and Preparedness During the Fire Danger Period

All activities during the Fire Danger Period must be planned and implemented prior to the commencement of the Fire Danger Period.

Implement Bushfire Monitoring Procedure

Developing a bushfire monitoring procedure for the Fire Danger Period assists site occupiers in understanding the potential for bushfire near the facility. Bushfire monitoring allows maximum implementation time for preparedness actions.

Bushfire monitoring involves:

- Nominating a person/role in your Emergency Control Organisation to be responsible for identifying, responding to and communicating Fire Danger Ratings at least four days ahead.
- Identifying bushfire activity within 50km of the facility, through the VicEmergency website, app, or ABC local radio.
- Communicating this information to everyone likely to be present on-site, and relevant off-site personnel.

Prepare to Modify Site Activities

A risk management process must be undertaken to determine the modification of site activities where there is risk of bushfire and grassfire.

Modifications to site activities:

- Must be in line with legislated restrictions for the Fire Danger Period and days of Total Fire Ban, any permits issued, and the Fire Danger Rating.
- Must be determined well before the Fire Danger Period, as part of risk management and emergency planning processes, and not left to be decided on the day.

Modified activities may include, but not limited to:

- Closing the site on days of (for example) ***Extreme*** and above Fire Danger Rating.
- Limiting non-essential activities on days of ***High*** and above Fire Danger Rating.
- Limiting travel on days of ***High*** and above Fire Danger Rating.
- Postponing planned maintenance shut-downs.
- Including bushfire ignition hazards in any Job Hazard Analysis or similar activity-based risk management process.
- Communicating modified activities and expectations to site personnel and visitors.

Fire Management Plans must:

a) List the modified activities for each Fire Danger Rating and during the Fire Danger Period.
b) Provide details of the modification based on the requirements of Fire Danger Period or Total Fire Ban permit/s, the Fire Danger Rating, and the risk management process.

Plan Travel

Where driving on days of ***High*** and above Fire Danger Rating is critical and unavoidable, procedures must be developed and implemented for planning and undertaking this travel. Never travel into any high-risk bushfire area where ***Catastrophic*** fire danger has been declared.

- Download the VicEmergency App and set 'watch zones' for areas of travel.
- Save the number for the VicEmergency Hotline in your phone: 1800 226 226.
- Safety equipment must be provided, and serviced, in all company vehicles that may be used during the Fire Danger Period.
- A communications plan must be in place to verify that personnel required to travel have arrived safely at each destination.

See CFA's advice on staying safe when you travel.

6.2 Fire Hazards and Risk Controls (Continued)

6.2.2 Vegetation Management

All Facilities

Effective vegetation management can reduce both the risk of fire entering your facility, and the consequences of fire if it does occur.

All renewable energy facilities within the Bushfire Management Overlay or a Bushfire Prone Area must maintain the vegetation to the prescriptions listed within planning permits.

Model Requirements

Facility operators must undertake the following measures during the Fire Danger Period:

a) Grass must be maintained at or below 100mm in height during the declared Fire Danger Period.

b) Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.

c) Restrictions and guidance must be adhered to during the Fire Danger Period, days of ***High*** (and above) fire danger and Total Fire Ban days (refer to www.cfa.vic.gov.au).

Modifications to Model Requirements must be in consultation with CFA.

Solar Energy Facilities

Solar energy facilities must have grass maintained to no more than 100mm under solar panels during the Fire Danger Period.

Operators of solar energy facilities on grazed paddocks must ensure that if additional measures to maintain grass to this level are required, they are implemented prior to, and for the duration of the Fire Danger Period.

Battery Energy Storage Systems

Containers/enclosures and infrastructure for battery energy storage systems must be maintained to be clear of vegetation, including grass, for at least ten (10) metres on all sides, or greater as informed by the Risk Management Plan.

Substations and Electric Lines

Vegetation management within any electric line easement must ensure that falling trees would not impact the transmission lines, towers and associated infrastructure.

Managing Vegetation On-Site

- Gutters, roof surfaces and valleys, kerbs, traps, sumps, bunds, drains, rooves or any other accumulation points for leaf litter, dry vegetation, or any other combustible materials must be cleared, and the debris removed from site.
- Vegetation management activities must be conducted across the entire facility (eg., grass slashing or mowing, removal of dead/fallen vegetation).
- Extraneous materials or vegetation in fire breaks at the site perimeter, at external building walls, and at other any site plant/assets must be cleared and removed from site.
- Extraneous or unnecessary materials (fuel loads) must be removed from site, eg., mulch piles; dilapidated/stored vehicles, plant or equipment; excess fuel/chemicals; any combustible waste materials. Vehicles must not be parked on unmanaged vegetation.

6.2.3 Arc Flash Hazard Management

All Facilities

Electrical equipment must be designed to reduce risks associated with arc flash hazards. Where an arc flash hazard exists it must be identified and managed.

There must be clear demarcation of arc boundaries to at least 10m from arc flash outlet flaps (blow-out panels) on PCUs, where there is a hazard to personnel.

Refer to Energy Safe Victoria's **Arc Flash Hazard Management Guideline** (2022) for information.

6.2.4 Facility and System Monitoring

All Facilities

Model Requirement

Appropriate monitoring for facility infrastructure must be provided, to ensure that any shorts, faults or equipment failures with the potential to ignite or propagate fire are rapidly identified and controlled. Any fire must be notified to 000 immediately.

Modifications to Model Requirements must be in consultation with CFA.

6.2 Fire Hazards and Risk Controls (Continued)

Battery Energy Storage Systems

For battery energy storage systems, appropriate monitoring and intervention measures must be provided to ensure that the following are rapidly identified and notified to 000 immediately:

- Any shorts, faults, temperature increases above normal parameters (eg., precursor to thermal events/runaway).
- Equipment failures with the potential to ignite or propagate fire.
- Off-gassing, smoke or fire.

The provision for direct alarm monitoring to the fire brigade for battery energy storage system automatic detection systems must be considered.

6.2.5 Maintenance

All Facilities

Model Requirement
Inspection, maintenance and any required repair activities must be conducted for all infrastructure, equipment and vehicles at the facility. Maintenance must be in line with any relevant Australian Standards and the manufacturer's requirements.
Modifications to Model Requirements must be in consultation with CFA.

Ensuring facility infrastructure, equipment and vehicles are maintained in safe, effective working order contributes to efficiency, reliability and importantly, fire safety.

A procedure, including a schedule and relevant personnel accountabilities, must be developed to inspect and maintain all infrastructure, equipment and vehicles.

- Any activities that involve flame cutting, grinding, welding or soldering (hot works) must be performed under a 'hot work permit' system or equivalent job hazard safety or risk management process.
- Any defects, faults or matters affecting the performance of fire protection systems and any equipment for emergency use must be identified through routine testing and servicing. Maintenance activities must be closed-out before the Fire Danger Period.

Fire detection and protection (suppression) systems, alarms, warning systems, communications and any other emergency equipment must always be in effective working order.

Battery Energy Storage Systems

Battery energy storage systems, including the battery management system and any associated safety systems, must be regularly serviced to the manufacturer's specifications.

A procedure, including a schedule and relevant personnel accountabilities, must be developed in relation to the inspection of battery energy storage systems.

Battery energy storage systems are to be regularly inspected for the following:

- Any signs of mechanical damage to the external containers/enclosures.
- Any accumulation of combustible materials (including leaf litter) in or within ten (10) metres of any battery energy storage systems and related infrastructure.

Any identified issues must be immediately rectified.

6.2.6 Safe Dangerous Goods Storage and Handling

All Facilities

Signage and labelling compliant with the *Dangerous Goods (Storage and Handling) Regulations 2022* and the relevant Australian Standards must be provided at the site entrance, dangerous goods storage locations, and storage tanks where applicable.

Appropriate material for cleaning up dangerous goods spills and leaks (including absorbent, neutralisers, tools, disposal containers and personal protective equipment) must be provided and available on-site.

Training must be provided for site personnel on the hazards, safe use and emergency response for spills, leaks and fire involving dangerous goods.

All dangerous goods stored on-site must have a current Safety Data Sheet (SDS). Safety Data Sheets must be provided within the facility's Emergency Information Book(s), in the Emergency Information Container(s).

The requirements of the dangerous goods legislative framework, and all relevant Australian Standards must be complied with for all facilities, including facilities with battery energy storage systems.

6.2 Fire Hazards and Risk Controls (Continued)

6.2.7 Housekeeping

All Facilities

Site-wide housekeeping inspections must be conducted regularly at facility. If your facility is at-risk of bushfire, site-wide bushfire preparedness housekeeping inspections must be conducted at least three months, and again one month, prior to the Fire Danger Period.

Housekeeping inspections must incorporate:

a) Hazard identification - ensuring that infrastructure, plant, equipment, vehicles and safety/warning signs show no signs of damage or dilapidation.

b) Facility access - ensuring all vehicle site access points, including emergency access points, are clear and accessible.

c) Fire protection systems and equipment - ensuring that all equipment is unobstructed, clearly identifiable, in-service and performing optimally.

d) Vegetation management - ensuring that any accumulation of combustible materials is cleared from infrastructure, buildings and fire breaks, and removed from the site.

e) Security measures - ensuring that fences, gates, and security cameras are inspected for damage, and that any damage is immediately actioned (eg., repaired or replaced).

CFA Renewable Energy Fire Safety Resources

https://www.cfa.vic.gov.au/plan-prepare/building-planning-regulations/renewable-energy-fire-safety

Unmanaged vegetation at string commander box.

6.2.8 Additional Requirements Specific to Facility Type

Battery Energy Storage Systems

A Fire Management Plan for a facility that incorporates a battery energy storage system must also include:

a) A schedule, list of activities and accountabilities for the inspecting, testing, monitoring and servicing of the battery and its monitoring, safety and protective systems.

b) Monthly inspections of battery enclosures/ containers and related infrastructure for physical damage. Any damage must be immediately assessed and rectified by a suitably qualified person.

c) Seismic activity as a trigger for inspecting, testing and servicing of the battery energy storage system and its related infrastructure. Any damages or changes in operating parameters must be immediately assessed and rectified by a suitably qualified person.

d) Regular inspection and removal of all combustible materials near the battery enclosures/containers and related infrastructure.

6.3 Fire Risk Review

All Facilities

Fire risk must be effectively managed at operating facilities to meet obligations for providing a safe workplace under the OHS Act.

CFA recommends that facility operators consider the design guidelines and model requirements contained in this document and develop procedures to ensure that:

a) The **Fire Management Plan** is reviewed and updated regularly, in line with any reviews and changes to hazards and risk management as per the **Risk Management Plan**, and where there is a near-miss or incident at the facility.

b) The **Emergency Plan** is reviewed and updated to reflect any changes in the **Fire Management Plan**, including where fire risks emerge or change, risk controls are added or modified, or where there is a near-miss or incident at the facility.

Where substantive changes are made to these documents, CFA recommends considering peer-review by a suitably qualified, independent third party.

CFA's Specialist Risk and Fire Safety Unit can also visit your site by invitation to provide specific advice on fire risk management and emergency planning in line with this guideline.

7 Emergency Planning

Emergencies at renewable energy facilities must be planned for and effectively managed.

All Facilities

Model Requirement

An Emergency Plan must be developed, specific to the facility, in consultation with CFA, before development starts.

Modifications to Model Requirements must be in consultation with CFA.

Effective emergency planning ensures that your facility is prepared in the event of an emergency, providing for the safety of site personnel, emergency responders and the community.

An emergency planning process, informed by *AS 3745-2010: Planning for emergencies in facilities*, provides a framework for developing an Emergency Plan through the formation and activities of an Emergency Planning Committee.

The Emergency Planning Committee is responsible for developing, implementing and maintaining the Emergency Plan.

7.1 Emergency Plans

7.1.1 Why Develop an Emergency Plan?

An Emergency Plan (EP) details the arrangements for managing emergencies, including the facility details, structures, procedures, resources and training. EPs must be specific to the infrastructure, operations and location of facilities, and informed by a sound risk management process.

An Emergency Plan may also assist employers in meeting their obligations under the OHS Act in providing a workplace that is safe and without risks to health.

7.1.2 Structure and Content of Emergency Plans

CFA recommends that facility operators develop an Emergency Plan consistent with *AS 3745-2010: Planning for emergencies in facilities*.

The structure and content of Emergency Plans must be adapted to the facility's specific infrastructure, hazards and arrangements.

Emergency Plans must be developed to cover the construction and commissioning, and operational phases and must cover:

a) Emergency prevention, preparedness and mitigation activities.

b) Activities for preparing for emergencies.

c) Control and coordination arrangements for emergency response (eg., evacuation procedures, shelter-in-place arrangements, emergency assembly areas and emergency response procedures).

d) The agreed roles and responsibilities of on-site personnel (eg., equipment isolation, fire brigade liaison, evacuation management, shelter-in-place management, if applicable).

To facilitate fire brigade response Emergency Plans must include:

a) A facility description, including infrastructure details, operations, number of personnel, and operating hours.

b) A site plan depicting infrastructure (solar panels, wind turbines, inverters, battery energy storage systems, generators, substations, grid connection points, transmission lines, dangerous goods storages, buildings, bunds), site access points and internal roads; fire services (water tanks, pumps, booster systems, fire hydrants, fire hose reels); drainage; and neighbouring properties.

c) An emergency response procedure for each credible emergency event and scenario, based on a comprehensive risk management process. CFA recommends including building, infrastructure and vehicle fires, and grassfire and bushfire.

d) Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency.

e) Evacuation procedures and where appropriate, shelter-in-place procedures for facilities at-risk of bushfire or grassfire, if it is too late to evacuate.

f) Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eye-wash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; and first aid.

g) A manifest of dangerous goods (if required under the *Dangerous Goods (Storage and Handling) Regulations 2022*).

7.2 Emergency Response Procedures

Emergency response procedures, as part of the Emergency Plan, contain the assigned responsibilities and actions to respond to and manage emergencies.

CFA recommends that emergency response procedures are developed in accordance with Section 4 of *AS 3745-2010: Planning for emergencies in facilities*.

Emergency response procedures must:

a) Include a specific action to notify (or verify notification) the emergency services, at the earliest possible stage of the emergency.

b) Specify the person or role responsible for making or verifying the notification.

c) Include '000' number in the procedure.

7.2.1 Emergency Response Procedures for Bushfire

Any emergency response actions for bushfire must be determined before the Fire Danger Period, and must consider the modified site activities in the Fire Management Plan.

Emergency procedures for bushfire must include:

a) Communicating with site personnel and supporting their physical relocation.

b) Ensuring all buildings and plant are adequately secured.

c) Initiating any bushfire protection measures such as sprinkler or deluge systems.

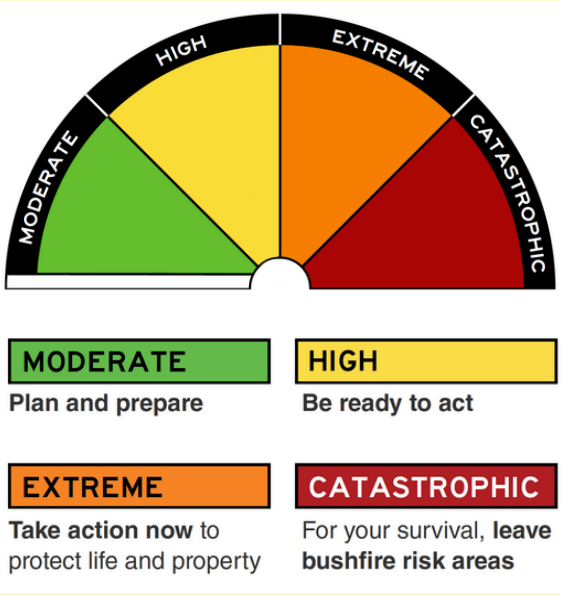
d) Liaising with the emergency services where possible.

e) Ensuring that evacuation/shelter in place areas are equipped with suitable resources.

7.2.2 Emergency Response Procedures for Facility Plant and Equipment

Procedure(s) must be developed and implemented for the isolation, shut-down, fail safe or management of critical/high-risk plant, equipment, and utilities (eg., electricity/gas) at the facility, should evacuation be required.

Australian Fire Danger Rating System



The Fire Danger Rating tells you how dangerous a fire would be if one started.

The four (4)-day Fire Danger Rating forecast is available on the CFA website during the Fire Danger Period.

https://www.cfa.vic.gov.au/warnings-restrictions/total-fire-bans-and-ratings

Find out what you can and can't do during the declared Fire Danger Period, and on days of Total Fire Ban at:

https://www.cfa.vic.gov.au/warnings-restrictions/total-fire-bans-and-ratings/can-i-or-cant-i

Emergency Warnings

You should never wait to receive an official warning before you leave. Fires can start quickly and threaten homes and lives within minutes.

Warnings are issued when a fire has started and you need to take action.

Make sure you understand the three levels of warnings and what they mean. The three levels of warnings are:

- Advice
- Watch and Act
- Emergency Warning

Warnings can be issued in any order. The first warning you could get could be an Emergency Warning.

https://www.cfa.vic.gov.au/warnings-restrictions/about-warnings

7.3 Evacuation and Shelter-in-Place

Being absent from the site, or leaving early, on days of ***Extreme*** and above Fire Danger Rating is the safest option to protect site personnel and those for whom employers have a duty of care under the *Occupational Health and Safety Act 2004*. Leaving early means leaving the area before a fire starts, not when flames or smoke are visible.

Evacuating or sheltering-in-place at your workplace during a bushfire potentially puts you, your site personnel and firefighters at extreme risk. This risk is amplified where your business involves:

- Large numbers of people.
- High fire-risk operations or processes.
- Production of combustible materials or their storage/use in production.
- Electrical infrastructure (substations, solar panels, battery energy storage systems).
- Unrestrained products, plant or equipment.
- The storage and handling of dangerous goods.

Commercial and industrial buildings have not routinely been constructed with any additional bushfire protections and may only provide very limited protection.

Leaving once a fire has started may be an option in some circumstances. This is an inherently risky option and safety will be affected by many factors, including the proximity of the fire, access to safe evacuation routes and timely access to incident information.

AS 3745-2010: Planning for emergencies in facilities advises that sheltering in place should only be considered where an evacuation might reasonably expose people to a greater level of danger.

Sheltering-in-place at your facility should only be considered when the following are thoroughly analysed through a risk management process:

- The type of facility.
- Where the facility is located relative to the threat.
- Whether the buildings have been constructed against bushfire impact.
- Whether the grounds and buildings are being maintained to suitable standards.
- The area of defendable space around buildings and infrastructure.
- How the buildings, grounds and plant may be affected by a bushfire.
- The number of occupants.
- Occupants requiring personal emergency evacuation plans (PEEP).
- Accessibility of the site (number and quality of roads in and out of the facility).

Where the Emergency Planning Committee considers sheltering in place an option at your facility, CFA recommends that last-resort procedures are developed to provide direction to site personnel if it is too late to safely evacuate due to bushfire threat, and sheltering-in-place is the only remaining option.

Emergency Management Victoria advises that informal places of shelter should only be considered when all other survival options have failed. Informal shelter options (such as a workplace) may provide some protection from radiant heat, the biggest killer in a bushfire.

Emergency procedures for sheltering-in-place are to consider:

- Who makes the decision for personnel to shelter on-site.
- When the decision is made.
- Where personnel are to shelter on-site.
- How to communicate the need to shelter, and the sheltering location, to personnel on-site.
- The on-site emergency resources and equipment to be provided to this location.
- The provision of appropriate signage to identify the shelter location. Signage may also provide additional information such as procedures relating to the use of the place during a fire event.
- Access to incident information.
- Company position and actions if someone insists on leaving the site.
- All vehicle site access points, including emergency access points, must be clear and accessible.

7.4 Personnel Training

All Facilities

Employers must provide information, instruction and training in accordance with the *Occupational Health and Safety Act 2004*.

CFA recommends that at least the following information and training be provided to any personnel working at the facility, and visitors as appropriate.

- Facility and operational risks and hazards.
- Facility emergency management roles, responsibilities and arrangements (as per the Emergency Plan).
- The on-site emergency warning systems and location of evacuation assembly areas.
- The safe and effective use of any fire-fighting equipment where there is an expectation for staff to undertake first aid firefighting.
- The storage, handling and emergency procedures for dangerous goods at the facility.
- The location of first aid facilities and application of first aid equipment.

For facilities with bushfire or grassfire risk, CFA recommends that all site personnel:

- Download the VicEmergency App and set 'watch zones' for the facility location and any related areas of travel.
- Information and training on the warning levels and messages issued by CFA and Emergency Management Victoria.
- Complete CFA's free 'Bushfire Safety for Workers' e-learning module before the Fire Danger Period. CFA recommends that this module is considered mandatory professional development for all personnel at the facility.

Further Guidance

CFA recommends the Australian Institute for Disaster Resilience Handbooks, particularly:

- **Managing Exercises** (2017) for further guidance on the designing, conducting and evaluating of practical exercises.
- **Lessons Management** (2019) for further guidance on applying learning experiences from events and exercises.

7.5 Emergency Exercises

All Facilities

Emergency exercises provide valuable opportunities to test the effectiveness of Emergency Plans. Emergency exercises should be planned well in advance, and be focused on strengthening emergency management structures, responsibilities and activities.

Where personnel are present on-site, an annual emergency exercise should be conducted at the facility, with an invitation extended to the local CFA brigade to participate.

CFA recommends that an ongoing program of site-specific emergency response exercises is developed as per *AS 3745-2010: Planning for emergencies in facilities* – Section 7: Emergency response exercises.

Emergency exercises should:

- Test emergency structures, prescribed activities, personnel knowledge, and any assumptions built into the Emergency Plan.
- Be consistent with the emergency procedures (based on identified hazards) in the Emergency Plan.
- Be conducted in various formats, from internal desktop to multi-agency practical field exercises.
- Be appropriately designed, conducted and evaluated.
- Incorporate 'failure', that is, things 'going wrong' or 'not to plan', such as communication system failures, the absence of the Chief Warden, delays in the arrival of the fire brigade, escalation scenarios. How well does the Emergency Plan work in those instances? How can it be modified to be adaptable?
- Be prefixed with an announcement indicating it as an exercise only, and include provision for alerting participants of an actual emergency during the exercises (i.e., 'NO DUFF').
- Incorporate a 'no blame' feedback/evaluation process that includes debriefing and at least one additional feedback method that enables anonymous feedback to be provided.
- On completion, be summarised in written format as a consolidated record of 'lessons identified', with measures and accountabilities to ensure those lessons are incorporated into the Emergency Plan (or elsewhere) as required.
- Be a trigger for reviewing the Emergency Plan.

7.6 Reviewing Emergency Plans

All Facilities

An Emergency Plan is a 'living document' that must be regularly reviewed to ensure its currency and effectiveness.

CFA recommends that Emergency Plans are reviewed:

- Following any changes to the risk on-site pertaining to site infrastructure and operations (Risk Management Plan).
- Following any review of the Fire Management Plan.
- After any activation of the EP or incident involving notification to the emergency services.
- After emergency exercises.
- At least annually.

Reviews of Emergency Plans for renewable energy facilities should be conducted in conjunction with reviews of the Risk Management Plan and the Fire Management Plan.

CFA can provide support and advice on emergency planning for renewable energy facilities, and provide advice on Emergency Plans. Requests can be made via CFA's Fire Safety Referrals team at firesafetyreferrals@cfa.vic.gov.au.

Notifications

Early notification to CFA during emergencies via 000 allows CFA the best opportunity to provide safe and timely response in the event of rapid escalation.

Outside of emergencies, the local CFA district must also be notified by phone or email at least seven days prior to:

- The commissioning of battery energy storage systems.
- Annual servicing of battery energy storage systems.

CFA recommends that annual servicing of battery energy storage systems should not take place on days of ***High*** *or above Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour.*

Contact with the local CFA brigade can be made through the local CFA district office. Refer to: https://www.cfa.vic.gov.au/contact/#district.

Fire protection system outages (eg., water-off due to faults or maintenance activities) must be notified as far in advance as possible to ESTA at burnoffs@esta.vic.gov.au or 1800 668 511.

7.7 Emergency Planning Specific to Facility Type

Wind Energy Facilities

A wind energy facility Emergency Plan must additionally include:

a) Emergency procedures for fires within, and near, wind turbines.

b) Details of any triggers or circumstances for ceasing the operation of wind turbines or shutting down the facility, such as on ***Extreme*** or above days or approach of bushfire/grassfire to the facility.

c) Maximum (safe) operational wind speed and temperature conditions and operating procedures to limit fire risk.

This information must also be provided within the facility's Emergency Information Book.

Wherever possible, rotors must be stopped into a 'Y' pattern during emergencies.

Solar Energy Facilities

A solar energy facility Emergency Plan must additionally include:

a) Emergency procedures for isolation and shut-down where solar panels and/or related infrastructure are involved in fire.

b) Emergency procedures for fires within the vicinity of solar energy facilities.

c) Specifications for safe operating conditions for temperature, and the hazards related to electricity generation at the facility.

This information must also be provided within the facility's Emergency Information Book.

Battery Energy Storage Systems

Emergency Plans for facilities with battery energy storage systems must additionally include:

a) Contact information for 24/7/365 specialist technical support for the battery energy storage system.

b) Emergency response procedures based on identified risks and hazards of the battery energy storage system and related infrastructure, including but not limited to:

i. Electrical infrastructure faults and fire.

ii. Battery energy storage system damage or faults, including battery monitoring faults, temperature increases above normal operating parameters, electrical faults, chemical spills or reactions, off-gassing, thermal events/runaway, smoke and fire.

iii. Bushfire and grassfire.

iv. The management of fire water runoff.

c) Details of the elements monitored/controlled by the Battery Management System (BMS), including internal temperature, state of charge, voltage, etc. and the locations this information is available (eg., at the BESS containers, in an on-site control room, off-site monitoring facilities).

d) A plan for partial and full decommissioning of the battery energy storage system in the event of an emergency incident that renders the facility inoperable or unsafe, before its anticipated end-of-life.

e) Any information that supports the considerations in **Appendix B: Emergency Response Considerations for Large-Scale Battery Energy Storage Systems**.

This information must also be provided within the facility's Emergency Information Book.

8 Provision of Emergency Information

8.1 Developing an Emergency Information Book

All Facilities

Model Requirement

An Emergency Information Book must be developed and available to emergency responders. Emergency Information Books must be located in Emergency Information Containers, provided at each vehicle entrance the facility.

Modifications to Model Requirements must be in consultation with CFA.

Renewable energy facilities pose special hazards for firefighters during emergency response. Providing accurate, current information about potential risks and hazards to emergency responders during emergencies facilitates effective intervention, reduces delays during response, and contributes to providing a safe workplace for emergency responders.

Providing emergency information to responding emergency services is also a requirement of numerous Victorian regulations and Australian Standards.

CFA's preferred format for providing emergency information is an Emergency Information Book, within an Emergency Information Container. CFA's Guideline for the Provision of Emergency Information contains CFA's expectations for developing an Emergency Information Book.

The Emergency Information Book must include:

a) A description of the premises, its infrastructure and operations.

b) Site plans that include the layout of the entire site, including buildings, internal roads, infrastructure, fire protection systems and equipment, dangerous goods storage areas, gas detectors, battery energy storage systems, substations/terminals, grid connections, drains and isolation valves, neighbours and the direction of north.

c) A manifest of dangerous goods (if required) as per Schedule 3 of the *Dangerous Goods (Storage and Handling) Regulations 2022*.

d) Procedures for the management of emergencies, including evacuation, shelter-in-place (for facilities at-risk of bushfire/grassfire), containment of spills and leaks, and fire procedures (including infrastructure/plant fires, vehicle fires, grassfire/bushfire).

e) Details of emergency equipment, including the type and location of gas detectors.

f) Up-to-date contact details for site personnel, regulatory authorities and site neighbours.

g) Safety Data Sheets (SDS) for dangerous goods stored on-site.

Emergency Information Containers must be:

a) Painted red and marked 'EMERGENCY INFORMATION' in white contrasting lettering not less than 25mm high.

b) Located at all vehicle access points to the facility, installed at a height of 1.2 metres – 1.5 metres.

c) Accessible with a fire brigade standard '003' key.

d) Kept clear of obstructions, including products, rubbish, vehicles, vegetation and any hazards (eg., pest infestation).

Battery Energy Storage Systems

Operators of facilities with battery energy storage systems must inform emergency responders of hazards. This information must be provided within the site's Emergency Information Book, and must include:

a) Specifications for safe operating conditions for temperature.

b) Schematics and technical data for battery energy storage system containers/enclosures, the number of containers/enclosures on-site, and the number of battery racks or modules within each container/enclosure.

c) Details of the hazards for the battery energy storage system, including thermal events/runaway, electrical safety hazards, explosion hazards, dangerous goods hazards (including off-gassing and associated vapour clouds), and the effects of fire on the battery energy storage system (eg., explosion, release of toxic gases).

d) Details of the elements monitored/controlled by the Battery Management System (BMS), including internal temperature, state of charge, voltage, etc. and the locations this information is available (eg., at the BESS containers, in an on-site control room, off-site monitoring facilities).

e) Details of all provided battery safety and protective systems, including a description, the activation process/automatic trigger, and associated hazards.

8.1 Developing an Emergency Information Book (Continued)

f) The shut down and/or isolation procedures if the batteries are involved in fire, and appropriate personnel contact details for verifying that the battery enclosure/container system has been isolated/shut-down and de-energised during emergencies.

8.2 Fire Brigade Site Familiarisation

All Facilities

Before commissioning of the facility, operators are to offer a familiarisation visit and explanation of emergency procedures to CFA brigades and other emergency services.

Site familiarisation visits allows brigades to obtain information and develop pre-plans based on the facility's:

- Operations and personnel complement.
- Site access points, layout and infrastructure.
- Specific hazards.
- Installed fire detection and suppression systems.

Providing brigades with an opportunity to understand site infrastructure, operations and hazards is critical to safe and effective response, as there are additional hazards for firefighters at renewable energy facilities.

Contact information for at least two persons who may be able to provide information or support during emergencies (24 hours a day) must be provided for unoccupied facilities.

A schedule for ongoing site familiarisation to account for changing personnel, facility infrastructure and hazards, and emergency exercises should be developed in conjunction with the local CFA brigade.

Contact with the local CFA brigade can be made through the local CFA district office. Refer to: https://www.cfa.vic.gov.au/contact/#district.

8.3 Review of Emergency Information

All Facilities

A review of the information contained within the facility's Emergency Information Container and Book must be undertaken before the Fire Danger Period. Any corrections, removal or addition of information must be completed as a matter of urgency.

9 Battery Energy Storage Systems at Commercial and Industrial Facilities

9.1 Risk Management Considerations

Increasingly, small-scale battery energy storage systems (<1MW) are being installed at commercial and industrial buildings to supplement power requirements for business operations.

CFA recommends that any proposed small-scale battery energy storage system installation is subject to a comprehensive risk management process.

9.1.1 Siting

Battery containers/enclosures/cabinets must not be sited in restricted or hazardous areas as per *AS/NZS 5139-2019: Electrical installations - Safety of battery systems for use with power conversion equipment*.

CFA recommends that battery containers/enclosures/cabinets are sited externally to buildings wherever possible. Externally-located batteries should be:

- Sited in an area reasonably adjacent to a site vehicle entrance suitable for emergency vehicles.
- Sited within 60m of a serviceable, accessible, compliant, clearly marked on-site or street fire hydrant capable of achieving 20L/s for a period of not less than four hours.
- Sited in an area with minimal potential for vehicle impact, eg., away from traffic flows and vehicle parking areas. Car parking should be prohibited within 10m of the battery container, unless a radiant heat shield is provided that extends no less than 2m either side, and no less than 1m above the battery container/enclosure/cabinet.
- Separated from buildings by at least 10m, or a distance that prevents radiant heat exposure from the battery container fully involved in fire from igniting the building and vice versa.
- Sited as far as possible from neighbouring residential premises.
- Located within a secure compound to prevent unauthorised access to the cabinet and related equipment. The enclosure must be secured at all times. Protocols must be developed to control and track authorised access to the enclosure.
- Provided with impact protection equivalent to at least a W barrier.
- Provided with appropriate spill containment (bunding or otherwise) that includes provision for managing fire water runoff.

Where batteries are installed in buildings, CFA recommends that they are:

- Located in a fire-separated compartment under the National Construction Code (eg., with adequate separation and fire-rated construction to prevent impact from radiant heat, vapour clouds and smoke in the event of thermal runaway or external fire impact).
- Located away from switchboards and other electrical installations and appliances.
- Located in sprinkler-protected areas (where a sprinkler system is provided in the building).
- Located in a room with a detector linked to the Fire Indicator Panel/FDCIE (where a FDCIE is provided in the building). For all other buildings a smoke alarm and gas detector should be installed within the same room, as per *AS/NZS 5139-2019*.
- Provided with ventilation that exhausts to outside of the building only as per *AS/NZS 5139-2019*.
- Kept clear of extraneous or stored materials. Only items related to the battery are to be stored in rooms with battery energy storage systems.

9.1.2 Design and Operation Risk Controls

CFA recommends:

- Batteries are provided with gas, fire, explosion detection and protection systems appropriate to the battery chemistry, electrical and other hazards. The detection and protection systems within the battery container must have direct alarm monitoring to the fire brigade whenever possible.
- Batteries are provided with adequate ventilation as per the manufacturer's requirements/the Safety Data Sheet(s) for the BESS and/or any relevant national or international standards.
- Batteries are equipped with appropriate monitoring systems to ensure that any shorts, faults, off-gassing, equipment failures and increases in temperature outside of the defined operating parameters of the manufacturer are immediately intercepted, and any off-gassing, smoke, fire or explosion is immediately notified to the emergency services.
- Batteries are regularly inspected, tested and serviced according to manufacturer's requirements.

BESS at Commerical and Industrial Facilities (Continued.)

9.2 Emergency Planning

Before commissioning of supplemental battery energy storage systems, CFA recommends that the facility's Emergency Plan is comprehensively reviewed and updated to:

- Consider risks and hazards from and to the battery energy storage system and the impact of fires involving the battery energy storage system, such as facility egress and paths of travel to evacuation assembly areas during emergencies.
- Incorporate emergency procedures based on hazards associated with the battery energy storage system. Emergency procedures must include battery monitoring faults, temperature increases above normal operating parameters, electrical faults, chemical spills or reactions, off-gassing, and thermal runaway (smoke, fire and explosion).
- Incorporate a plan for partial and full decommissioning of the battery energy storage system in the event of an emergency that renders the battery inoperable or unsafe, before its anticipated end-of-life.

9.3 Fire Brigade Site Familiarisation

CFA recommends that arrangements are made for site familiarisation with the local brigade before the commissioning of the battery energy storage system to confirm access arrangements, fire detection, suppression and protection systems, and contact information for at least two persons who can provide information or support during emergencies (24 hours a day).

9.4 Provision of Emergency Information

CFA recommends that the facility's existing emergency information is updated to include information relevant to the battery energy storage system.

9.4.1 Site Drawings

The location of solar panels, power conversion units, battery energy storage systems, and system shut-down controls must be marked on:

- Site plans for the use of emergency services (eg., within the Emergency Information Book and at the Fire Indicator Panel/FDCIE).
- Block plans for the facility (as per *AS 2419.1-2021: Fire hydrant installations*, Clause 11.5: Block plan).
- Essential Services drawings for the facility.

9.4.2 Emergency Information Book

CFA recommends that the following information is included within the Emergency Information Book:

- A summary of the installation, including:
  - The capacity, chemistry and safety systems.
  - The location of all system infrastructure on-site.
- Specifications for safe operating conditions for temperature (including ambient and internal temperatures) for battery energy storage systems.
- Schematics and technical data for battery energy storage system containers.
- Details of the hazards for the battery energy storage system, including thermal runaway, electrical safety hazards, explosion hazards, dangerous goods hazards (including off-gassing), and the effects of fire on the battery energy storage system.
- Details of battery monitoring systems and safety systems, including battery smoke and fire detection systems, fire suppression systems, thermal detection, gas detection and pressure relief systems, cooling systems, and warning and alarm systems at the facility.
- The shut down and/or isolation procedures if the batteries are involved in fire. These instructions must also be provided at the PCE/inverters and battery energy storage system.

10 Neighbourhood Battery Energy Storage Systems

Across Victoria, battery energy storage systems (BESS) are being proposed in local communities to enable the power network to support more rooftop solar.

Community or neighbourhood-scale battery energy storage systems range from approximately 100kW to 5MW. Where they are connected to a section of the electricity distribution network operating with a nominal voltage not exceeding 66,000 volts, they may be exempt from planning permit requirements in most planning zones.

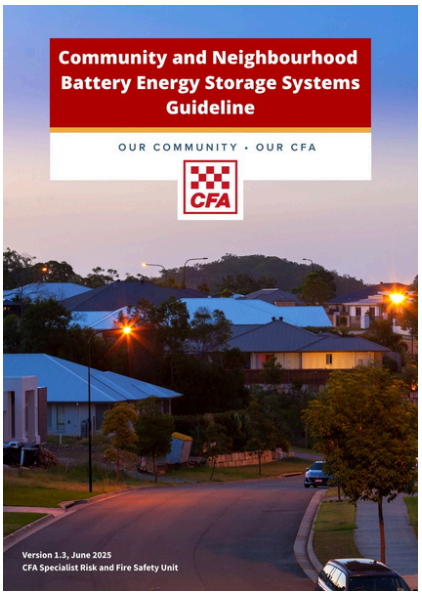
CFA's Specialist Risk and Fire Safety Unit can provide expertise to support fire risk management for your specific community BESS proposal, including:

- Fire risk considerations in site selection and design.
- Fire brigade access and response requirements.
- Considerations for firefighter and community safety during emergency response.

To ensure fire risk is effectively considered within community BESS proposals, engaging with CFA's Specialist Risk and Fire Safety Unit as early as possible is essential.

CFA's Specialist Risk and Fire Safety Unit

risk-info@cfa.vic.gov.au



Refer to *CFA's Community and Neighbourhood Battery Energy Storage Systems Guideline* (v1.3, June 2025) for guidance for siting, fire risk controls, markings, maintenance, and notification to CFA.

Appendix A: Guideline Checklist

Section 2: Consultation

Consulting with CFA Early consultation with CFA's Specialist Risk and Fire Safety Unit, before developing a planning permit application.	***How do I demonstrate this?*** ☐ Provide consultation details, including dates, personnel involved and summary of discussions.

Section 3: Fire Risk Management

Risk Management Plan A Risk Management Plan must be developed for the facility, in consultation with CFA, before development starts.	***How do I demonstrate this?*** ☐ Provide a copy of the **Risk Management Plan**. **OR** Confirm that a Risk Management Plan will be developed in consultation with CFA, before development starts.

Section 4: Facility Location

Landscape Risk to Facility An assessment against policy at *VPP Clause 13.02-1S (Bushfire Planning)* that considers: **a)** The impact of any ignitions arising from the infrastructure on nearby communities, infrastructure and assets. **b)** The impact of bushfire on the infrastructure (eg., ember attack, radiant heat impact, flame contact).	***How do I demonstrate this?*** In the **Risk Management Plan**: ☐ Demonstrate application of the best available science to identify vegetation, topographic and climatic conditions that create a bushfire hazard to: • Provide an assessment of bushfire hazard based on landscape conditions, local conditions, neighbourhood conditions, and the site for development. • Provide appropriate bushfire protection measures.
Facility Risk to Landscape As assessment of the fire risk from the proposed facility to the landscape.	☐ Provide an evidence-based assessment of the fire risk from the proposed technologies to: • Identify whether the proposal will lead to an increase in risk to adjacent land. • Identify how the proposal will reduce risks at the site to an acceptable level.

Section 4: Facility Design

Emergency Vehicle Access **a)** Construction of a minimum four (4) metre perimeter road within the perimeter fire break. **b)** Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes (eg., no compacted earth). **c)** Constructed roads should be a minimum of four (4) metres in trafficable width with a four (4) metre vertical clearance for the width of the formed road surface. Ensure any fencing along access routes allows for width of fire trucks.	***How do I demonstrate this?*** In the **Risk Management Plan**: ☐ Confirm provision of minimum four (4) metre perimeter road within the perimeter fire break. ☐ Confirm that roads will be designed to meet or exceed these requirements (B-E).

Appendix A: Guideline Checklist (Continued.)

Emergency Vehicle Access (Continued)	***How do I demonstrate this?***
d) The average grade should be no more than 1 in 7 (14.4% or 8.1°) with a maximum of no more than 1 in 5 (20% or 11.3°) for no more than fifty (50) metres. **e)** Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle. **f)** Roads must incorporate passing bays at least every 600 metres, which must be at least twenty (20) metres long and have a minimum trafficable width of six (6) metres. Where roads are less than 600 metres long, at least one passing bay must be incorporated.	In the **Risk Management Plan**: ☐ Confirm that road networks will incorporate passing bays.
g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, and battery energy storage systems and related infrastructure. **h)** The provision of at least two (2) but preferably more access points to each part of the facility.	☐ Confirm that road networks will be designed to enable emergency vehicle access to all areas of the facility. ☐ Confirm that at least two access points will be provided into each part of the facility.
Additional Requirements for Wind Facilities The provision of access roads to, and around, each wind turbine.	☐ Confirm the provision of access roads to, and around, each wind turbine.
Additional Requirements for Solar Facilities (>5MW) The provision of at least two access points into each non-adjoining area of the facility over 5MW (eg., a main access point and an emergency access point in each fenced area), or to the satisfaction of CFA.	☐ Confirm that at least two access points will be provided into each non-adjoining area of facility.
Additional Requirements for Battery Energy Storage Systems The provision of at least two access points into each section where battery energy storage systems are located.	☐ Confirm that at least two access points will be provided into each BESS section.
Firefighting Water Supply **a)** Water access points must be clearly identifiable and unobstructed to ensure efficient access. **b)** Static water storage tank installations must comply with *AS 2419.1-2021: Fire hydrant installations – System design, installation and commissioning*. **c)** The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel. **d)** The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours. **e)** The static water storage tanks must be located at vehicle access points to the facility and must be positioned at least ten (10) metres from any infrastructure.	☐ Confirm that fire water supplies will be designed to meet or exceed these requirements (A-N).

Appendix A: Guideline Checklist (Continued.)

Firefighting Water Supply (Continued) **f)** The hard-suction point must be provided with a 150mm full bore isolation valve equipped with a Storz connection, sized to comply with the required suction hydraulic performance. **g)** The hard-suction point must be positioned within four (4) metres to a hardstand area and provide a clear access for emergency services personnel. **h)** An all-weather road access and hardstand must be provided to the hard-suction point. The hardstand must be maintained to a minimum of 15 tonne GVM, eight (8) metres long and six (6) metres wide or to the satisfaction of the CFA. **i)** The road access and hardstand must be kept clear at all times. **j)** The hard-suction point must be protected from mechanical damage where necessary. **k)** Where the access road has one entrance, an eight (8) metre radius turning circle must be provided at the tank. **l)** An external water level indicator must be provided to the tank and be visible from the hardstand area. **m)** Signage indicating 'FIRE WATER' and the tank capacity must be fixed to each tank. **n)** Signage must be provided at each vehicle entrance to the facility, indicating the direction to the nearest static water tank(s).	***How do I demonstrate this?*** In the **Risk Management Plan**: ☐ Confirm that fire water supplies will be designed to meet or exceed these requirements (A-N).
Additional Requirements for Wind Facilities **a)** Fire water storage tanks of at least 45,000L are provided at each site entrance. **b)** Additional fire water storage tanks of at least 45,000L are incorporated in facility design, in consultation with CFA. **c)** Nacelles are equipped with automatic fire detection, alarm, and fire suppression systems.	☐ Confirm the provision of fire water tanks of a capacity in line with this requirement.
Additional Requirements for Solar Facilities >5MW **a)** The provision of fire water tanks of at least 45,000L at the primary vehicle entrance to each part of the facility. **b)** The provision of additional fire water tanks of at least 45,000L effective capacity for every additional 100ha (after the initial 100ha).	☐ Confirm the provision of fire water tanks of a capacity in line with this requirement.
Additional Requirements for Solar Facilities <5MW The provision of fire water tanks of at least 22,500L at the primary vehicle entrance to the facility.	☐ Confirm the provision of fire water tanks of a capacity in line with this requirement.

Appendix A: Guideline Checklist (Continued.)

Additional Requirements for Battery Energy Storage Systems - Centralised BESS **a)** Where reticulated water is available, the provision of a fire hydrant system that meets the requirements of *AS 2419.1-2021: Fire hydrant installations*, Clause 3.9: Open Yard Protection, and Table 2.2.5(D): Number of Fire Hydrants Required to Flow Simultaneously - Open Yards.	***How do I demonstrate this?*** In the **Risk Management Plan**: ☐ Confirm the provision of fire hydrants to provide coverage to the battery energy storage system.
OR	***OR***
b) Where no reticulated water is available, provision of a fire water supply in static storage tanks, where: **i.** The fire water supply must be of a quantity no less than 288,000L or as per the provisions for Open Yard Protection of *AS 2419.1-2021: Fire hydrant installations*, flowing for a period of no less than four hours at 20L/s, whichever is the greater. **ii.** The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from *AS 2419.1-2021: Fire hydrant installations*, Table 2.2.5(D). **iii.** Fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet. **iv.** The fire water supply must be located at vehicle entrances to the facility, at least 10m from any infrastructure (electrical substations, inverters, battery energy storage systems, buildings). **v.** The fire water supply must be reasonably adjacent to the battery energy storage system and shall be accessible without undue danger in an emergency. (Eg., Fire water tanks are to be located closer to the site entrance that the battery energy storage system). **vi.** The fire water supply must comply with *AS 2419.1-2021: Fire hydrant installations*, Section 5: Water storage tanks.	☐ Confirm the provision of fire water tanks for the battery energy storage system of a capacity in line with this requirement.
Additional Requirements for Battery Energy Storage Systems - Decentralised BESS **a)** Where reticulated water is available, a fire protection system as per Model Requirement (1a) under 'Centralised Battery Energy Storage Systems'.	☐ Confirm the provision of reticulated fire water.
OR	***OR***
b) Where no reticulated water is available, a firewater supply in static storage tanks, where a minimum 45,000L static water tank is provided within 120m of each battery container, to the satisfaction of CFA.	☐ Confirm the provision of fire water tanks of a capacity in line with this requirement.

Appendix A: Guideline Checklist (Continued.)

Fire Detection and Suppression Equipment **a)** For on-site buildings and structures, according to the requirements of the National Construction Code. **b)** For storages of dangerous goods, according to the requirements of any Australian Standards for the storage and handling of dangerous goods. **c)** For electrical installations, a minimum of two suitable fire extinguishers must be provided within 3m-20m of each PCU. **d)** In all vehicles and heavy equipment, each vehicle must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or other firefighting equipment as a minimum when on-site during the Fire Danger Period.	***How do I demonstrate this?*** In the **Risk Management Plan**: ☐ Confirm the provision of required fire detection and suppression equipment for buildings, storages of dangerous goods and electrical installations. ☐ Confirm the provision of a fire extinguisher in line with this requirement in on-site vehicles and heavy equipment.
Fire Breaks The provision of fire breaks: **a)** Around the perimeter of the facility, commencing from the boundary of the facility or from the vegetation screening inside the property boundary. *(N/A for wind energy facilities.)* **b)** Around the perimeter of control rooms, electricity compounds, substations and all other buildings onsite. **c)** Of a width of at least 10m.	☐ Confirm that fire breaks will be provided around the perimeter of the facility, infrastructure and buildings on-site. ☐ Confirm that fire breaks will be a width of at least 10m.
Additional Requirements for Wind Facilities **a)** The provision of fire breaks around the base of each wind turbine.	☐ Confirm the provision of fire breaks around the base of each wind turbine.
Additional Requirements for Battery Energy Storage Systems **a)** The provision of a fire break around battery energy storage systems and related infrastructure.	☐ Confirm the provision of fire breaks around the battery energy storage system and related infrastructure.
Design Specific to Facility Type ***Requirements for Wind Facilities*** **a)** Wind turbines are located no less than 300 metres apart. **b)** Provision of automatic shut-down, and the ability for wind turbines to be completely disconnected from the power supply in the event of fire. **c)** Notification of installed weather monitoring stations to the Civil Aviation Safety Authority (CASA). **d)** Marking of all guy wires and monitoring towers.	☐ Confirm wind turbines are no less than 300 metres apart. ☐ Confirm provision of automatic shut-down and ability for disconnection of wind turbines. ☐ Confirm intention to notify CASA. ☐ Confirm provision of markers for all guy wires and monitoring towers.
Requirements for Solar Facilities >5MW **a)** Provision of a minimum six (6) metre separation between solar panel banks.	☐ Confirm the provision of minimum six (6) metre separation between solar panel banks.

Appendix A: Guideline Checklist (Continued.)

Design Specific to Facility Type (Contined)	***How do I demonstrate this?***
Requirements for Battery Energy Storage Systems	In the **Risk Management Plan**:
1. Facility design that incorporates:	
a) A separation distance that prevents fire spread between battery containers/enclosures and other site elements.	☐ Specify and justify the separation distance between battery containers and other infrastructure is sufficient to prevent fire spread.
b) A fire break around the battery energy storage system and related infrastructure, of a width of no less than 10m.	☐ Confirm the provision, and specify the width, of a fire break around the battery energy storage system and related infrastructure.
c) A layout of site infrastructure that: **i.** Considers the safety of emergency responders. **ii.** Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system. **iii.** Minimises the potential for fires in battery containers/enclosures to impact on-site and offsite infrastructure.	☐ Specify how the site layout has been designed to meet or exceed these requirements.
2. Battery energy storage systems must be:	
a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).	☐ Confirm the location of the battery energy storage system is adjacent to a site vehicle entrance.
b) Located so that the site entrance and any fire water tanks are not aligned to the prevailing wind direction (therefore least likely to be impacted by smoke in the event of fire at the battery energy storage system.)	☐ Confirm that any smoke/vapour cloud from the battery energy storage system is unlikely to impact the site entrance and access to the fire water supply.
c) Provided with in-built fire and gas detection systems.	☐ Specify the in-built fire detection and suppression systems to be provided.
d) Provided with explosion prevention via sensing and venting, or explosion mitigation through deflagration panels.	☐ Confirm provision of explosion prevention via sensing and venting, or explosion mitigation through deflagration panels.
e) Provided with suitable ember protection.	☐ Confirm provision of suitable ember protection.
f) Provided with suitable access roads for emergency services vehicles.	☐ Confirm provision of suitable access roads to battery energy storage systems.
g) Installed on a non-combustible surfaces.	☐ Confirm installation of battery energy storage systems on non-combustible surfaces.
h) Provided with suitable ventilation.	☐ Confirm provision of suitable ventilation.
i) Provided with suitable impact protection.	☐ Confirm provision of suitable impact protection.
j) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.	☐ Confirm provision of enclosed wiring and buried cabling.
k) Provided with spill containment that includes provision for management of fire water runoff.	☐ Confirm provision of suitable spill containment that includes provision for management of fire water runoff.

Appendix A: Guideline Checklist (Continued.)

Section 5: Facility Construction and Commissioning

Emergency Plan An Emergency Plan must be developed for the construction and commissioning phase of the facility.	***How do I demonstrate this?*** ☐ Provide a copy of the construction and commissioning **Emergency Plan**. **OR** Confirm the development of a construction and commissioning Emergency Plan in consultation with CFA.

Section 6: Facility Operation

Fire Management Plan A Fire Management Plan must be developed for the facility, in consultation with CFA, before development starts.	***How do I demonstrate this?*** ☐ Provide a copy of the **Fire Management Plan**. **OR** Confirm that a Fire Management Plan will be developed in consultation with CFA, before development starts.
Bushfire and Grassfire If your facility is at-risk of bushfire, prevention and preparedness activities must be detailed in the Fire Management Plan.	☐ In the Fire Management Plan, specify bushfire prevention and preparedness.
Vegetation Management Facility operators must undertake the following measures during the Fire Danger Period: **a)** Grass must be maintained at or below 100mm in height during the declared Fire Danger Period. **b)** Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation. **c)** Restrictions and guidance must be adhered to during the Fire Danger Period, days of High (and above) fire danger and Total Fire Ban days (refer to www.cfa.vic.gov.au).	☐ In the Fire Management Plan, specify that vegetation will be managed in line with these provisions.
Arc Flash Hazard Management Where required, appropriate demarcation of arc boundaries to at least 10m from PCU arc flash outlet flaps (blow-out panels) must be provided.	☐ In the Fire Management Plan, confirm the management of arc flash hazards.
Facility and System Monitoring Appropriate monitoring for facility infrastructure must be provided, to ensure that any shorts, faults or equipment failures with the potential to ignite or propagate fire are rapidly identified and controlled, and any fire is notified to 000 immediately.	☐ In the Fire Management Plan, confirm the provision of appropriate monitoring for facility infrastructure.
Maintenance Inspection, maintenance and any required repair activities must be conducted for all infrastructure, equipment and vehicles at the facility. Maintenance must be in line with any relevant Australian Standards and the manufacturer's requirements.	☐ In the Fire Management Plan, confirm the provision of appropriate monitoring for facility infrastructure.

Appendix A: Guideline Checklist (Continued.)

Section 7: Emergency Planning

Emergency Plan (Operational)
An Emergency Plan must be developed for the operational phase, specific to the facility, in consultation with CFA, before development starts.

How do I demonstrate this?

- ☐ Provide a copy of the **Emergency Plan** for the operational phase of the facility.

OR

Confirm the development of an operational Emergency Plan in consultation with CFA.

Section 8. Provision of Emergency Information

Developing an Emergency Information Book
An Emergency Information Book must be developed and available to emergency responders. Emergency Information Books must be located in Emergency Information Containers, provided at each vehicle entrance the facility.

How do I demonstrate this?

- ☐ Confirm the development of an **Emergency Information Book**.
- ☐ Confirm the provision of Emergency Information Containers at each vehicle entrance to facilities.

Appendix B: Emergency Response Considerations for Large-Scale Battery Energy Storage Systems

Emergency Plans must contain information on the behaviour of battery energy storage systems during emergencies to enable safe and effective response by site personnel and emergency services.

CFA recommends addressing the following questions within Emergency Plans and Emergency Information Books.

System information and emergency response procedures should be discussed with local CFA brigades during site familiarisation visits.

B1 Status of the Equipment

- **What are the warning systems** at or associated with the BESS (lights, alarms, codes)? What are the triggers for the activation of each warning system?
- **What is the severity of each alarm**? How quickly must action be taken? (Eg., Immediately, within a day, within a week, etc.)

Any detection of critical faults must trigger the immediate shut-down of the battery until a suitably qualified person has checked it.

- **What happens at each alarm level**? What systems are automatically activated or deactivated within the BESS, and at what time intervals?
- **What systems are connected to the BESS**? How must these systems be considered during emergency response? (Eg., PV installations.)
- **How does power outage** affect these systems?

B2 Notifications

- **What are the contact details** for off-site personnel who can provide technical support during emergencies? Who can emergency services seek advice from about safe actions to take?
- **Who is notified** at each alarm stage?
- **What actions can be taken** by those notified to prevent escalation? Remotely and on-site? What are the success and failure criteria for these actions?
- **When are emergency services notified?** What triggers this notification? Are notifications automatic? Who is responsible for making/verifying notifications?

B3 Activation of Fire Safety Systems

- **Where are the E-Stops?** If present, only activate if safe to do so.
- **What are the triggers for the activation** of the fire safety systems? Are they automatic, manual or both? Can manual systems be remotely activated?
- **How can emergency responders understand** what is happening with the BESS and fire safety systems?

B4 Arrival of Emergency Services

- **How are actions taken remotely communicated to responders?** How do responders know which systems have been shut down or activated remotely?
- **Where is the affected BESS enclosure/container/cabinet**? How will this be communicated to emergency responders?
- **What are the hazards to emergency responders** from any activated fire safety systems? What measures are in place to ensure their safety?
- **Where are the system shut-downs**/isolation points/switchboards on-site? Use labelled site plans, diagrams and aerial imagery to show all relevant locations. What are the hazards after shut-down?
- **What is the shut-down/isolation procedure**? Use labelled diagrams and photos of the actual BESS containers, components, display panels and boards.

Isolation procedures must clearly state that the product is not de-energised after isolation.

B5 Supporting Response Activities

Where safe to do so:

- **Provide information** on the incident, site layout, infrastructure and its hazards.
- **Ensure clear access** into the site and to fire protection equipment for fire trucks and personnel.
- **Account for persons on-site** and evacuate non-required personnel from the site.
- **Provide on-site monitoring equipment** (TICs, gas detectors, etc.) that may assist with emergency response.

B6 Site Handover, Ongoing Monitoring and Equipment Disposal

- **How will affected BESS containers be monitored** for delayed thermal runaway and fire?
- **How will affected equipment be removed** and disposed of? Where will it be removed to?

Appendix C: Document Relationship Map

Appendix D: References and Resources

CFA Resources

This guideline is on CFA's website at:
Renewable Energy Fire Safety

CFA will periodically place clarifying or complementary information on this page between revisions of this guideline. Please refer to this page when applying this guideline.

Other relevant information from the CFA website (current at the time of publishing):

- About Warnings
- Am I at Risk?
- Bushfire Safety for Workers
- Can I or Can't I?
- Electric Line Fire Hazard Ratings
- Fire Danger Period Restrictions
- Fire Permits
- Landscaping for Bushfire
- Planning and the Bushfire Management Overlay
- Plant Selection Key
- Staying Safe When You Travel
- Total Fire Bans and Ratings

Country Fire Authority 2019, Guideline for the Provision of Emergency Information - 2019 Update, Burwood, Victoria.

Victorian Government Resources

Agriculture Victoria, Emergency Management - Bushfires (*Accessed June 2023)*.

Emergency Management Victoria, Bushfire Shelter Options (Accessed June 2023).

Energy Safe Victoria 2023, Arc Flash Hazard Management, ESV, Melbourne.

Energy Safe Victoria 2023, Safety Standards for High Voltage and Complex electrical installations, ESV, Melbourne.

Environment Protection Authority (Victoria) 2018, 1698: Liquid storage and handling guidelines, EPA, Melbourne.

Victorian Department of Energy, Environment and Climate Action (DEECA), Neighbourhood batteries *(Accessed July 2023)*.

Victorian Department of Transport and Planning, Bushfire (Accessed June 2023).

Victorian Department of Transport and Planning, Building in bushfire prone areas *(Accessed July 2023)*.

Victorian Department of Transport and Planning, Building in the bushfire management overlay *(Accessed July 2023)*.

Victorian Department of Transport and Planning 2021, Community Engagement and Benefit Sharing in Renewable Energy Developments, Victorian Government, Melbourne.

Victorian Department of Transport and Planning 2021, Development of Wind Energy Facilities in Victoria - Policy and Planning Guidelines, Victorian Government, Melbourne.

Victorian Department of Transport and Planning 2022, Solar Energy Facilities – Design and Development Guidelines, Victorian Government, Melbourne.

Victorian Department of Transport and Planning 2023, Victoria Planning Provisions.

Victorian Department of Transport and Planning, Victoria Planning Provisions Clause 13.02-1S: Bushfire Planning (*Accessed June 2023*).

Victorian Department of Transport and Planning, Victoria Planning Provisions Clause 53.02: Bushfire Planning (*Accessed June 2023*).

Relevant Legislation

Designers and operators of renewable energy facilities are subject to various legislative frameworks and instruments. *For acts and statutory rules currently in force for the below, refer to Victorian Legislation.*

Building Act 1993
Building Regulations 2018
Dangerous Goods Act 1985
Dangerous Goods (Storage and Handling) Regulations 2022
Electricity Safety Act 1998
Electricity Safety (Bushfire Mitigation) Regulations 2023
Electricity Safety (Electric Line Clearance) Regulations 2020
Electricity Safety (Equipment Safety Scheme) Regulations 2019
Electricity Safety (General) Regulations 2019
Occupational Health and Safety Act 2004
Occupational Health and Safety Regulations 2017
Planning and Environment Act 1987
Planning and Environment Regulations 2015

Australian Resources

Australasian Fire and Emergency Service Authorities Council 2022, Operational Response and Lithium Ion Batteries (Video), Presentation by Prof. Paul Christensen (*Accessed July 2023*).

Australasian Fire and Emergency Service Authorities Council 2018, Wind Farms and Bushfire Operations Guideline (AFAC Publication No. 2053), AFAC, Melbourne.

Civil Aviation Safety Authority 2022, Advisory Circular AC 139.E-05 v1.1, Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome.

CSIRO, Assessing Bushfire Hazards (*Accessed July 2023*).

NSW Government and Fire and Rescue NSW 2023, Technical Information - Large-scale external lithium-ion battery energy storage systems - Fire safety study considerations, FRNSW.

NSW Planning 2011, NSW Planning's Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011).

Safe Work Australia 2012, Fact Sheet - Emergency Plans and Procedures.

International Guidance and Standards

CFPA Europe, Wind Turbines Fire Protection Guideline (CFPA-E No. 22:2022 F), March 2022.

FM Global 2020, Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems, FM Global.

Prof. Paul Christensen, Lithium Ion Safety (*Accessed July 2023)*.

National Fire Protection Association (NFPA) 2023, NFPA 855: Standard for the Installation of Stationary Energy Storage Systems, NFPA.

UK National Fire Chiefs Council 2022, Grid Scale Battery Energy Storage System planning – Guidance for Fire and Rescue Services, Version 1, UK NFCC.

UL, Energy Storage Systems and Equipment (2023), UL 9540.

UL, Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (2019), UL 9540A.

Australian Standards

Standards Australia 2023, AS/IEC 62619-2023: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications, Sydney NSW, Standards Australia.

Standards Australia 2023, AS 3780-2023: The storage and handling of corrosive substances, Sydney NSW, Standards Australia.

Standards Australia 2021, AS 2419.1-2021: Fire hydrant installations – System design, installation and commissioning, Sydney NSW, Standards Australia.

Standards Australia 2019, AS/NZS 5139-2019: Electrical installations – Safety of battery systems for use with power conversion equipment, Sydney NSW, Standards Australia. *(For systems 200kW or less.)*

Standards Australia 2018, AS 3959-2018: Construction of buildings in bushfire prone areas, Sydney NSW, Standards Australia.

Standards Australia 2018, AS ISO 31000-2018: Risk Management – Guidelines, Sydney NSW, Standards Australia.

Standards Australia 2017, AS 1940-2017: The storage and handling of flammable and combustible liquids, Sydney NSW, Standards Australia.

Standards Australia 2013, SA/SNZ HB 89: Risk management - Guidelines on risk assessment techniques, Sydney NSW, Standards Australia.

Standards Australia 2010, AS 3745-2010: Planning for emergencies in facilities, Sydney NSW, Standards Australia.

Standards Australia 2000, AS 4681-2000: The storage and handling of class 9 dangerous goods, Sydney NSW, Standards Australia.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