



bushfire&natural  
**HAZARDS**CRC

# **A summary of workshop outputs supporting the statement on national research priorities for natural hazards emergency management**

**ISSUES, PRIORITIES, DIRECTIONS**

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**Australian Government**  
**Department of Industry,  
Innovation and Science**

**Business**  
Cooperative Research  
Centres Programme



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# Purpose

This publication on the major research issues in natural hazards emergency management:

1. Communicates research priorities for Australia identified by the emergency management sector for the decade 2017 to 2027.
2. Promotes greater collaboration between researchers, practitioners, policy developers and funders.
3. Contributes to building a strong and interconnected evidence base in natural hazards science, based on the highest needs of the sector.

These research priorities represent the consensus view of industry experts and are based on extensive consultation and discussion. This is the first time an exercise of this scale focussed on natural disasters has been conducted in Australia. It is the first time the collective knowledge of the industry has been drawn together and recorded in such a manner.

By synthesising this information, it will be easier for researchers, policy makers and practitioners at all levels to plan and prioritise their work, to enable a nationally coordinated research capacity to address the major issues of our day and to support the uptake of that research into practice.

**This publication is the beginning of a process, not an end. A national discussion within the emergency management sector has identified themes for research priorities, but this is not intended as either a final or comprehensive list. As new themes and research priorities are identified in coming years, they will be included in this document, and published on the Bushfire and Natural Hazards CRC website.**

## A suite of publications on national research priorities

Statement	Workshop summary	Theme specific publications
National research priorities for natural hazards emergency management - issues, priorities, directions	A summary of workshop outputs supporting the statement on national research priorities for natural hazards emergency management	A series of online publications to guide future research activities, individually themed around the workshop: <a href="http://www.bnhcrc.com.au/nationalpriorities">www.bnhcrc.com.au/nationalpriorities</a>

# Our approach

## What are the most significant natural hazard emergency management issues Australia faces over the next 10 years?

This was the question posed to the Australian emergency management sector in a series of workshops hosted by the Bushfire and Natural Hazards Cooperative Research Centre from 2015 to 2017. Each workshop was facilitated by a peak agency body (see Appendix 1) to give it the imprimatur needed to be an authoritative statement of end user priorities. Participants in the workshops included those with specific expertise or operational experience across a range of aspects of emergency management.

The outcomes presented here represent a consensus of industry experts and are based on extensive consultation - this is the first time an exercise of this scale focussed on natural disasters has been conducted in Australia. It is the first time the collective knowledge of the industry has been drawn together and recorded in such a manner.

This publication collects the top level outcomes of these workshops and, in doing so, presents a broader set of national research priorities in natural hazards emergency management by identifying end user motivated national priorities across major themes.

The workshops provided an exploration of major issues that would benefit from the support of research at a national level. There was no attempt to solve any of the issues or problems raised nor was there any discussion on the details of specific research.

The workshop themes are broadly linked under the four pillars of **Natural, Social, Economic and Infrastructure**.

**Natural Pillar** – a focus on the natural environment and the understanding of the physical processes, impacts and mitigation of sudden onset hazards such as bushfire, floods, cyclones, storms, heatwave, earthquake, landslide, and tsunami, and long term hazards such as droughts and climate change.

**Social Pillar** – a focus on people and the need to ensure that individuals, communities, business and government have the information and capabilities needed to enhance their resilience to disasters. The breadth of themes within this pillar is broad, and encompass aspect of cultural resilience, community engagement, organisational capabilities, and psychosocial impacts of disasters and recovery.

**Economic Pillar** – a focus on the economic impacts, both tangible and intangible, of disasters on individuals, businesses and government and means for mitigating those impacts.

**Infrastructure Pillar** – a focus on physical assets, ranging from residential homes and structures and where they are built through to critical infrastructure such as roads, telecommunications, banking, energy and water supply.

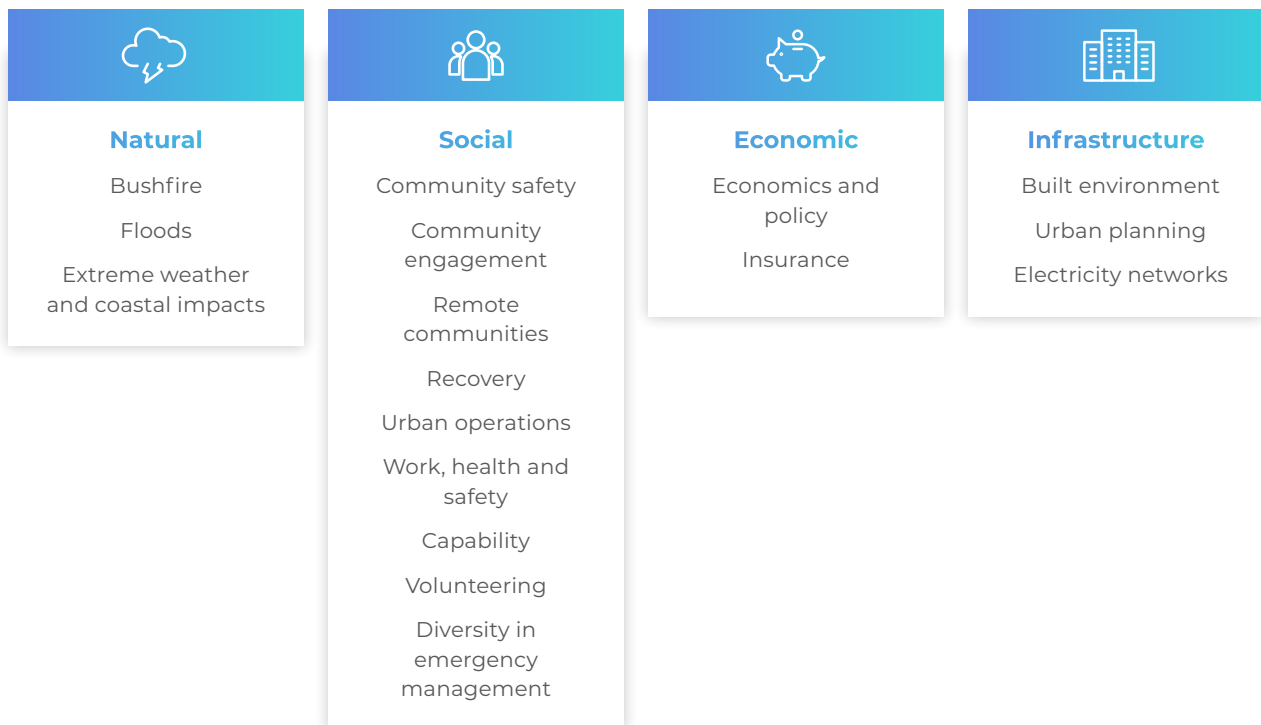
## The workshop themes conducted to date are shown below with each pillar.

The workshop participants discussed issues they believed were relevant to the specific theme under discussion, the relative importance of these issues and the reasons underpinning their relative importance.

The issues facing the emergency management sector were then matched with questions, which formed the basis of the national research opportunities.

This publication draws together the high priority recurring themes uncovered during the workshop process.

A series of theme specific publications that summarise the outcomes of each workshop and provide a more thorough guide for research activities in Australia over the next decade and beyond can be found here: [www.bnhcrc.com.au](http://www.bnhcrc.com.au).



# Natural

## BUSHFIRE

Reducing the occurrence, severity and impact of unplanned bushfires, and enhancing the resilience of our natural ecosystems by managing fire in our forests and rangelands through planned burns, are core objectives of bushfire management. Local and regional actions contribute to the broader outcomes across the entire landscape. These outcomes need to reflect community values and expectations.

Developments in science and technology supporting fire behaviour modelling, fuel monitoring and weather prediction have led to significant improvements in the ability to provide predictive services support to communities, emergency services, land management agencies and business. Ensuring the availability of accurate input data, such as weather observations and fuel loads, is essential to the utility of any predictive modelling approach. Affordable and timely technologies are required to gather this information if modelling approaches are to be effective.

### Communicating risk and managing expectations

Land management operates in a highly urbanised and politicised environment. The community has a wide range of understanding and beliefs concerning land management activities, such as the use of prescribed fire by land management agencies. Community engagement is essential to ensuring that the broader community and land management agencies develop a common understanding of values, risk and risk reduction activities and that access is provided to information supporting community decision-making and planning.

#### Questions for research

What does the community expect of land management agencies, and how should those expectations be addressed?

How can information that inherently contains uncertainty be best provided to the community, and how can the community make best use of that information?

### Understanding the economics

A better understanding of the economic costs of disasters and their risks, and the risk-reducing benefits of treatments, can build a more convincing case that improves the likelihood of risk treatments being resourced and implemented.

#### Questions for research

How can we quantify the long-term benefit of mitigation investments across different hazards?

How can the need to respond and recover from emergency events and climate change be used to support building mitigation activity directly into recovery processes?

### Meeting demands and expectations

There is a growing demand from community and government for an advanced, reliable and accurate predictive services capability. These services are valuable over a range of timescales and a variety of purposes. As demand for information grows, expectations will also grow in terms of accuracy, availability, and ensuring that it is clearly and appropriately communicated to all potential users.

### Questions for research

What are the appropriate measures of accuracy for predictive services?

What are the expectations of community from predictive services?

How can we validate fire behaviour models when there is limited data collected during the most dangerous and extreme conditions?

How do we improve our fire behaviour models?

### Explaining uncertainty

Predictive services must inherently deal with uncertainty and an important approach to dealing with this uncertainty is the use of ensemble forecasting. Ensemble forecasting relies on performing repeated model runs using slightly different conditions for each run, within the expected range of variation that the input data might be expected to exhibit. The output of the approach can, for instance, be a map highlighting the probability that a fire front reaches a particular point within a given length of time, or the likelihood that a severe fire will start tomorrow and destroy a certain number of homes.

### Questions for research

How can information that inherently contains uncertainty be best provided to the community and emergency managers?

Are there ramifications for the providers of the information if the information is misinterpreted by the community and individuals are injured or killed, or houses destroyed, as a result?

How do we provide confidence to decision-makers and community in a world of uncertainty?

### Keeping pace with technology

Technologies supporting predictive services are advancing rapidly, and predictive services must evolve rapidly to absorb and exploit those advances. At the same time, the body of research available for enhancing predictive services capabilities continues to grow.

### Questions for research

How can technology contribute to community and emergency management?

How do we assimilate rapidly evolving technology and a growing body of research and translate this knowledge into operational practices?

## FLOODS

Floods cause significant life, agricultural and economic losses and are the most financially costly natural hazard in Australia. Floods have caused significant losses of life and are currently our second deadliest natural hazard, behind heatwave. The topological and geographic nature of the Australian landscape means Australians experience a wide variety of flood and inundation including flash flooding, sudden and long-onset riverine floods, coastal inundation and seasonal flooding in northern Australia.

### Community engagement and response to warnings

Providing an understanding of flood risk ownership to communities is the critical component to kick start community activity for preparedness for flood, and to help communities to understand and respond appropriately to warnings. There are certain community behaviours, simple and sophisticated, that can be adopted that will significantly reduce the risks and consequences of a flood, including preparing individual homes, responding appropriately to flood warnings and not driving through flood waters.



### Questions for research

How can the emergency management sector improve community capacity to prepare for, respond to and recover to from flood?

How can the emergency management sector reduce risk-taking behaviour during floods?

### Better land use planning

Land use planning has been identified by government, community and industry as crucial to community resilience and preparedness for natural disasters, and in particular floods. Land use planning that actively uses flood management plans to manage flood risk will reduce that risk significantly.

### Questions for research

How can political processes account for flood risk in land use planning?

What technologies, including flood modelling, exist that will help the process of land use planning in communities?

### Building a total flood warning system

Building an effective flood warning system is complex and requires the seamless integration of a range of components and processes including flood data collection, prediction, interpretation, message/warning construction, communication and review. All these components require input from a range of hydrologists, hydrogeologists, meteorologists, IT specialists, field technicians, spatial modellers, evaluators and social scientists. A total flood warning system requires intensive financial, time and skill investment from government and the emergency management sector.

### Questions for research

What scientific components are integral for an end-to-end flood warning system?

How should the physical aspects of floods be translated into effective warnings and communication to the public?

### Climate change and flood risk

There are a range of impacts potentially associated with flood stemming from climate change, most notably variation in intensity, frequency and duration of rainfall causing significant run off where it might not have previously, or at levels not previously seen.

### Questions for research

What effects will climate change have on floods in Australia?

### EXTREME WEATHER AND COASTAL HAZARDS

More than 85 percent of Australia's population lives within 50 kilometres of the coastline. Coastal proximity increases exposure to extreme weather events such as tropical cyclones, storm surges, extreme waves, dangerous marine weather and coastal erosion. The impacts of these events can be further compounded by riverine flooding and infrastructure development pressure.

### Predicting impacts

The potential impact of many severe weather and ocean events is increasing due to climate change (including sea level rise) increasing the severity and geographic range of these events, along with demographic changes. Proper preparation for an event relies not just on the current best estimate of the event's magnitude, but also that plausible alternative scenarios and their relative likelihood are considered.

### Questions for research

What advances are needed to improve forecasts of the rapid intensification of an event to a catastrophic level, or for short-onset events such as severe thunderstorms or flash flooding?

How can we improve early warning of the possibility of a severe event, or even multiple events close together in time?

### Questions for research

How can we better manage rapid onset events and the rapid intensification of events close to impact time?

How can we enhance the accurate prediction of events to enable mitigation planning?

## Translating science

The research and science behind a hazard is often not fully applied in an operational context. This applies to key areas of emergency management, from planning right through to recovery.

### Questions for research

How can we ensure that the right science is targeted for operations to be of value to emergency managers and the community?

How can the wide and deep understanding of climate science be incorporated into operations and influence decision makers and the public?

## Exploiting data

Data is becoming richer but its collection is becoming more complex with greater detail and accuracy in measuring, and with more sources, ranging from satellites to social media.

These ever-expanding data sources must be harnessed and exploited to the maximum extent possible by scientists and emergency managers to provide the most effective outcomes for the community. The availability of the information itself can support community resilience through its accessibility and transparency.

## Seamless forecasting and risk assessment

Successful mitigation of the threat of severe weather and coastal hazards requires operation over a wide range of time scales. When warnings of a specific event are being issued the information flow should be continuous, even though the precision of the forecast will change as the event nears. As an event nears and additional information becomes available, the expected magnitude or location of the event will change. Consistency in messaging is important as sudden major changes reduce user confidence and hamper preparation. The technologies underpinning forecasts should aim to minimise abrupt changes as far as is consistent, while also providing accurate information.

### Questions for research

What data sources are the highest priority for providing the most effective contributions to extreme weather and coastal impact science and operations?

How should this exploitation and integration of data sources be made readily accessible to the emergency services, political decision makers and the community, targeted for planning and response?

# Social

## COMMUNITY RESILIENCE

In recent years, there has been a shifting paradigm impacting on emergency management organisations. No longer are they expected to be solely 'response' focused, they are now carrying responsibility for community engagement and information management, as well as recovery after an event.

There needs to be a shared understanding of what emergency services are able to do so that expectations are realistic and attitudes consistent with sharing responsibility, and communities have the information and resources to share that responsibility.

Recognising that many Australians do not prepare adequately for natural disasters, the National Strategy for Disaster Resilience advocates for the community to be active participants in their own resilience. This strategy represents a major policy shift in emergency management, moving from the traditional emergency services function of serving the community, to where the community is empowered to act as its own agent in emergency management.

### The costs and benefits of risk mitigation

A better understanding of the economic costs of disasters, their risks profiles, and the risk-reducing benefits of mitigation treatments can build a more compelling case that improves the likelihood of risk treatments being resourced and implemented.

A better understanding of the economic and policy environment within which decisions are made, and improved understanding of how risk information is perceived and understood by decisionmaking bodies, can allow risk-reduction proposals to be presented in a more compelling manner that increases the likelihood of resourcing and implementation.

### Questions for research

How can we quantify the long-term benefit of mitigation investments, both physical and social, across different hazards, and use these as drivers for proactive mitigation activity?

How does investment in changing behaviour at different levels, including political, government agencies, business, community and individual support, improve disaster resilience?

### A community-centred approach to managing risk

Traditional notions of risk management focus on government and emergency management agencies taking responsibility for identifying, quantifying and mitigating risks. However, those directly threatened by natural hazards have the most to lose, and hence, also the most to gain in managing risks.

### Questions for research

What can government and emergency management agencies do to enable communities to manage their own risks?

### Understanding resilience

There is no shared definition of resilience, it is often used differently by groups depending on their perspective, and in some cases not defined at all. However, in general, all agree that resilience should include something about the ability to prepare, respond, and bounce back from a disaster or emergency. The difference in definition is really how about how this is practically applied.

### Questions for research

What does resilience look like and how can it be measured?

What levels of resilience already exist in communities and how can they be nurtured?

### Questions for research

What does good community engagement look like?

How does the vast body of community engagement research fit together and how can it be made accessible to community and government?

## Building partnerships and collaboration

The emergency services have assumed the role of the interventionist taking responsibility for natural hazards such as flood, fire and earthquake for many years. In recent years the emergency services have recognised this paradigm needs to change, because as it takes power away from communities to be their own agents of resilience and change. This new approach encourages individuals and communities as a group to take charge of themselves, and manage their own risk and establish their own priorities. Shared responsibility is a relatively new policy platform and as it matures it will rely on collaboration and partnerships between government and community.

### Questions for research

How can government collaborate with community to break down silos to build trust and effective partnerships?

## Practice informed by research

There is a wide body of academic and sector research into the social elements of risks, including community engagement, warnings and resilience. However, the amount of research is so broad and deep that governments and communities have a difficult time making sense of all the results, recommendations and information. Further, government and agencies bombarded by research do not have the time to fully realise the research and implications for their business. Understanding social research in emergency management, what it is saying, how it can be applied, why it matters and how it fits with other research, will enable government and emergency management agencies to make better decisions to develop programs and policies and allocate resources.

## REMOTE INDIGENOUS COMMUNITIES

Remote Indigenous communities are often defined by their vulnerabilities due to extreme economic, environmental and social disadvantage, including poverty, poor employment, health services and governance. These factors affect their resilience. However, people in remote areas of Australia often feel a cultural responsibility to understand and protect country and this connection to country contributes to building a different kind of internal resilience to natural hazards.

In the event of a natural hazard, these communities will not necessarily expect a tailored emergency services response, including warnings. In many cases communities and individuals have developed a series of adaptive response cues and behaviours that will enable them to withstand an emergency without external intervention.

## Building capacity

Those directly threatened by natural hazards have the most to lose, and hence, the most to gain in managing risks. Community engagement activities that aim to promote communities and build community preparedness in the longer term are integral to the longevity of remote communities in Australia. These activities centre on the concepts of shared responsibility and community resilience and encourages active participation of individuals, businesses and communities in preparing for emergencies.

### Questions for research

What does preparedness look like in remote communities?

What levels of preparedness already exist in remote communities and how can it be nurtured and developed further?

### Questions for research

How can we use common environmental challenges such as grassy weeds management and climate change as an opportunity for remote communities?

What strengths and vulnerabilities exist in the physical and social environment that can be repurposed to effect change?

## Community education

There are many natural hazard response training packages and materials currently in Australia, but only a small proportion have been developed for remote communities. It is important to note that in one remote region alone, there may be many languages or dialects spoken. A cross-cultural natural hazard response program would be of significant help to remote communities.

### Questions for research

What does an effective culturally sensitive education program look like?

## The physical environment or remote communities

The net effect of invasive grassy weeds and climate change upon remote communities is the potential to change and shape both physical and social environments, making the lives of people in living on and managing the land difficult. This could potentially drive them to leave for regional or urban centres. This has significant social and environmental consequences for remote Australia, as land becomes untenable and left to manage itself, further increasing land management issues, such as invasive flora and fauna.

Research that explores the physical environment, natural hazards and their relationship with land management, will provide a greater understanding of how to support better outcomes for remote communities.

## RECOVERY

Recent experiences in the aftermath of a number of large-scale disasters has encouraged Australian governments to significantly evolve and elevate recovery to a core function that involves all agencies in the emergency management sector, and as a consequence invest more in research and other areas.

The Australian Business Roundtable for Disaster Resilience and Safer Communities found in 2016 that the economic costs of disasters in Australia are at least 50 percent greater than previously estimated and are expected to increase from \$9 billion to \$33 billion per year by 2050, and that approximately half the costs relate to intangibles such as the psychosocial impacts of disasters. It is therefore important that recovery policy and practice continues to invest in research to ensure it is developed based on robust evidence.

### Long term impacts

Research has demonstrated that the impacts of recovery are often intangible. A lack of evidence on the long-term impacts of disaster for individuals and communities and the different stages of recovery makes it difficult for agencies and governments to develop robust recovery policy and programs.

### Questions for research

What are the long term impacts of disasters for individuals and communities?

What are the different stages of recovery over the long term?

### Questions for research

What are the knowledge, skills, education and training needed for an effective recovery workforce?

How can we best capture and transfer knowledge about recovery experience and lessons learned from previous events?

## Community

Research is highlighting that social capital plays a major role in how people and communities recover after a disaster and social networks are the most critical indicator of how well communities respond and recover. However, to date there is limited research specifically into community-led recovery activities and the effectiveness of community-led recovery, including barriers, strengths and limitations.

### Questions for research

What are the community level impacts of disasters?

What are the enablers, barriers, strengths and limitations of community led recovery?

## Resilience and vulnerability

It is expected that with climate change Australia will see an increased number of cumulative or multiple emergency events, such as days of heatwave followed by a bushfire. However, the experience in Australia so far has been limited in this capacity and more could be done to understand the impact of cumulative events to enable government and agencies to build policy and resilience that will prepare them to respond to these types of events.

Research has found that recovery is not about returning a post-event community into the pre-event community; it is the rehabilitation of a community to accept and transition to a new state. Disasters can impact upon all aspects of wellbeing, degrade quality of life and undermine the social quality of the community.

## Recovery workforce

The recovery workforce consists mainly of itinerant workers from government and agencies temporarily employed to fill specific roles in recovery in response to a localised disaster. Little is known or understood about good practice in this area and what works best for agencies, governments and communities. Even less is understood about the knowledge and skills that is required for an effective recovery process.

### Questions for research

What are the impacts at different levels (individual, community, economy) of multiple and cumulative disaster events?

What are the conditions that enhance or detract from resilience?

How can we better understand resilience and vulnerability in the context of disaster recovery?

## CAPABILITY

Numerous challenges face the emergency management sector in coming years, including more frequent and extreme natural disasters, increasing urbanisation, greater community expectations and increasingly politicised

emergency events. Each is difficult to respond to in its own right; together they pose a complex problem for community and government.

In the last decade, each jurisdiction has evolved its own capability in accordance with the specific risks it faces. Capability discussions between the jurisdictions have predominantly focused on cross-border learning rather than developing a national capability framework for interoperability and sharing resources.

Concepts around capability can now include a number of activities under the broad themes of risk and resilience, readiness, response, relief and recovery service delivery. Specialist fields include warnings and communication, workforce planning and coordination, interoperability, predictive services and modelling, relief coordination, community partnerships, and education and research.

### Capability building for catastrophic events

Changes in demographics, climate change, ageing infrastructure and an increased fiscal austerity are increasing the likelihood and consequence of catastrophic events, particularly events yet to be experienced.

#### Questions for research

What are the likely policy, resourcing and operational impacts of catastrophic events?

How can the nation work collaboratively to understand the consequences of catastrophic events?

### Harnessing the community

The emergency management sector understands that there is a wealth of emergency management skills and resources in Australian communities and is seeking to better understand, harness and build on that capability.

Embracing community will involve a range of activities that will help build community capability for those inevitable emergency events. It is more than just community engagement; it is about community's active participation in a range of emergency management activities before, during and after emergencies.

#### Questions for research

How should government balance building community resilience and extending emergency management sector capability?

How can the emergency management sector better involve communities in capability discussions?

### National agenda for interoperability and sharing resources

There is currently no national agenda for interoperability and sharing resources in an emergency. Each state has their own reciprocal arrangements with other states, but there is no overarching strategy around interoperability. However, climate change foreseeably brings significant change in the frequency and intensity of emergencies and catastrophic events, and it is likely that all jurisdictions will need a wider pool of resources to draw from.

#### Questions for research

How should capability be defined and how does this shape the discussion on interoperability within and between agencies and jurisdictions?

What are the financial benefits that come with national interoperability and the ability to provide both surge and specialist capabilities between jurisdictions?

## OPERATIONS

The capacity and capability of emergency management organisations to respond to disasters will be significantly tested as social demographics change, the frequency and intensity of disasters become more variable, and expectations of the emergency services increase. Recent natural disasters and security threats have revealed emerging issues at the regional, state, national and international levels.

Emergency services are under increasing pressure to develop adaptive emergency management policy and procedures that can respond to current and future challenges. Responding to these challenges requires strong leadership, workforce strategies, understanding of research and innovation in science, technology and operational capability and investment from the entire emergency management sector, including government and community.

### **Workforce management**

The emergency services workforce is facing a range of internal and external issues and barriers, most significantly, evolving cultures, climate change and changing demographics. Future resilience in the workforce will include the emergency management agencies developing leadership and a workforce strategy that is considerate of diversity, staff training and health and development, and career and succession planning.

#### **Questions for research**

What are the critical steps to workforce management for current and future sustainability in the emergency services?

What lessons can we learn from other industries about adaptive and diverse workforces?

### **Workforce leadership**

Changing expectations in the workforce have challenged the traditional command and control model of leadership that has been so prevalent in the emergency services. The new leader is inclusive, and motivated to build resilience in the team. Encouraging this type of leadership requires significant investment in a leadership strategy that will aim to nurture and develop adaptive leadership across the board, regardless of their level or status.

#### **Questions for research**

How can we develop strong leadership in emergency service units that is blind to status and level?

How do we help emergency service leaders adapt from a command and control style leadership to a more contemporary inclusive leadership model?

### **Improving communication and engagement**

There are a series of community engagement approaches that the emergency services can use to warn communities and build community resilience in order for the community to be able to respond to hazards. Embracing new technologies and enhancing communications through social media can allow the emergency services to access large segments of the community in a short amount of time.

Social media is a growing field in emergency management. It has significantly changed from an add on, to a key tool that is able to provide advice in a timely and efficient manner. Social media also enables key messages to be tailored and is therefore more relevant for communities across the spectrum of emergency management. However, there are further opportunities that can be exploited where people continue to use traditional media for emergency warnings and communications.

#### **Questions for research**

What are the most effective community engagement tools for communicating warning?

How can the emergency services harness the power of social media to issue warnings to the community?

How do the emergency services build community preparedness to enable a response to an emergency warning?

How can the emergency services engage the community to discuss preparedness, uncertainty and risk?



## Firefighting capability

The role of firefighters has expanded from traditional firefighting as they respond to diverse situations such as hazards, counter-terrorism, and pandemic health crises. These changes have significant legal, training, procedural and technical implications for the emergency services.

Rapidly evolving technologies offer great promise for intelligence gathering and response. Given the current challenging environment, emergency agencies are keen to exploit this technology to help refine and improve emergency response. It is imperative that agencies understand and measure the effects they seek to achieve, and learn how to adapt their organisations to embed capability and technology into their normal business.

### Questions for research

What are the implications of the changing role of the firefighter on emergency agencies?

How can capability be quickly attained in the face of new hazards?

What tools and new firefighting techniques can be utilised to achieve greater affect while at the same time protecting the health, safety and wellbeing of personnel?

## VOLUNTEERING

Volunteers play a fundamental role in emergency management preparedness, response and recovery in Australia. As disasters and emergencies continue to become more frequent, more intense and of longer duration, the interoperability, capacity and capability of emergency management organisations to respond is being significantly tested and the reliance on volunteers and the roles they play will continue to grow.

The emergency management sector is under increasing pressure to develop adaptive emergency management policy and procedures that can respond to current and future challenges. Recent changes to the physical and social landscape in Australia, for example, a shifting urban/rural fringe and a changing political climate, have revealed emerging and veiled volunteer issues.

## Calculating the value of volunteers

Volunteers are integral to their community and their community's resilience, providing knowledge and leadership, reducing reliance on the emergency management sector and increasing the community resilience of Australian communities. A volunteer in a rural setting will play a major role in their local community as they will not only turn out to an emergency event, they are likely to be involved in a range of formal and informal community activities in planning, preparation, response and recovery, including community planning, engagement and support.

Despite this, there is still an over-emphasis on the functional role of volunteers. This in part is due to the experience the emergency management sector has at demonstrating the tangible value of volunteerism. For instance, lives and properties saved, reduced response times, and the functional role are all known and used indicators and data sets. However, showing the intangible value to the community is more difficult as there is not always a definitive or immediate answer and government and agencies are less well versed in demonstrating intangible factors like resilience. Yet it is these intangible qualities that may well have the greatest value for the sector and benefit to the community.

### Questions for research

How do emergency service volunteers contribute to the social fabric of their communities?

What indicators can be used to demonstrate the tangible and intangible value of volunteers?

How can we calculate and demonstrate the true value of volunteers to government and community?

What are the core skills that volunteers draw on to fulfil their roles in communities?

## Investment and business models for volunteers

Volunteers require investment from the emergency management and other sectors. This investment should include financial resources as well as time and people who can consider new methods and processes to support a wider application of volunteer capacity and capability. The emergency services generally retain a command and control structure and are continuing to use traditional models to try to attract, retain, train and support volunteers. These models are inherently rigid and, moreover, they resist those activities that are able to capitalise on recent trends.

There is ample research on volunteering and volunteering trends that highlight that there is an untapped pool of people that want to volunteer for their community, but they have other priorities such as families, work and other activities that take their time. The current structures of most agencies in the emergency management sector are prohibitive for these potential volunteers.

### Questions for research

How do we harness volunteer resources in a changing volunteer environment?

What business models from other industries can be applied to volunteering to enable better investment from government?

## Transformation: future role of volunteers

A shift towards a greater emphasis on community resilience is changing traditional paradigms and transforming the emergency management sector. This transformation requires the sector to reimagine policy and procedures, in particular those related to volunteering such as training, recognition, support, safety and interoperability from a community perspective.

Understanding a community perspective means recognising a broader engagement and recruitment of volunteers, including exploring alternative approaches to volunteerism, such as non-traditional volunteering, spontaneous volunteering and digital volunteers. It is also important that the sector works to ensure

the workforce becomes more inclusive and representative of the community in order to break down potential barriers, broaden the pool of volunteers and maximise capacity and capability.

### Questions for research

How can transformation of volunteerism in the emergency management sector be encouraged and supported?

What new opportunities do spontaneous and non-traditional volunteering bring?

What are the barriers to diversifying the volunteer base?

## WORKPLACE HEALTH AND SAFETY

Work, health and safety in the emergency services ensures resilience in the workforce is supported to conduct activities, before, during and after emergencies. This includes identifying challenges and using legislation and regulations to create safe workplaces.

A changing climate has brought changes to the frequency, duration and intensity of many natural hazards. Traditional models of response may be unsustainable to protect the emergency service individual in this new environment.

## Health management and fitness for role

Individual agencies and jurisdictions have long-established health management policies and standard operational procedures. However, multifaceted work, health and safety challenges, such as an ageing workforce, mental health and wellbeing, and climate change are beginning to stretch current policies and procedures.

### Questions for research

What is the impact of a shift to an all hazards-all agencies model in terms of the knowledge requirements of emergency management practitioners?

How do we minimise the risks posed to emergency management responders?

### Questions for research

How can emergency management agencies capitalise on new technologies to meet these new challenges?

What adaptive measures can be used to help the sector transition to a modern workplace consistent with the environment around it?

## Safety leadership and behaviour

Society expects employers to provide a safe workplace. It is important that agencies and government provide leadership to the sector to ensure that organisations continue to protect and support their workforce.

### Questions for research

How are we preparing to respond to the increased range of exposures that emergency management personnel may face?

What is the relationship between diversity and a safer workforce? How can we identify and value add to safety through diversity?

## Research and change management

The current state of work, health and safety in the emergency management sector questions how organisations adopt flexible workplace practices to support a resilient workforce in a more complex and intense environment. How can emergency management agencies capitalise on new technologies to meet these new challenges and what opportunities do new technologies offer?

It is resource intensive for agencies and jurisdictions to independently navigate work, health and safety challenges. A national evidence-based approach presents a more compelling alternative, but requires input from the entire sector to be effective.

## DIVERSITY

Diversity in the emergency services sector encompasses gender, race, disability and cultural diversity. Currently, there are low rates of participation for women and people from diverse cultural backgrounds in many areas of the sector.

Emergency management personnel need to become culturally competent and aware of the different aspects of local communities to be able to support and respond to their needs and what barriers to resilience may exist amongst diverse communities. At the same time, diversity is also an untapped area of potential that can have benefits not only for the emergency management sector, but also for the broader community. It is important to understand how existing forms of community resilience, knowledge and resourcefulness can be harnessed and strengthened, and how the benefits derived from diversity add value, and what that value is.

## Diversity and strong leadership

The emergency management sector has been tackling the issue of diversity for a considerable amount of time with relatively little progress. More recently leaders in the sector are beginning to recognise the value of diversity and their role in achieving a more diverse workforce. This is an important step for the sector as strong leadership will drive transformational change in the culture to uncover and consistently address the systemic and attitudinal barriers to diversity and inclusion in the sector. A key aspect of this is to have diverse leadership at all levels, to mentor staff and

exemplify the benefits of a diverse culture. Although the sector has worked to improve in this area, more work could be done to attract more diversity onto boards and in leadership teams to ensure they are more representative of the community they serve.

#### Questions for research

How can leaders entrenched in traditional processes be encouraged to embrace change?

How can the sector design agile processes to enable inclusiveness and innovation?

What strategic doctrine encourages systemic change in industries and organisations?

### Culture change

A part of the resistance to diversity is an unconscious refusal to think differently about emergency management. Sector transformation is about making the necessary changes for diversity.

Ultimately it is the culture that permeates across the sector that needs to be addressed so that a broader awareness of diversity is promoted across all levels of emergency management sector organisations. The sector cannot continue to rely on a few motivated and committed individuals to champion change in diversity. It needs to build awareness and understanding in the culture about the benefits, barriers and implications of not having a diverse and inclusive organisation.

#### Questions for research

What are the benefits, barriers and implications of a diverse workforce?

What business models exist for diversity in other industries that can be applied to the emergency management sector?

How can the emergency management sector capitalise on the economic factors of diversity?

### Refocusing the role of the emergency service professional

The emergency management sector needs to work across the community to reframe what an emergency services professional looks like. There is the widespread belief that only men work as responders, and women and other diverse groups are more comfortable in other roles.

As values and demographics evolve so should the culture. With the evolution of support technology, the future emergency service professional could change from being extremely physically capable to being having greater capability.

The sector has the opportunity to change the traditional paradigm and genuinely collaborate with diverse communities to build resilience and prevent and prepare for emergencies. This will not only require a different skill set from the emergency service professional, but it could also significantly reduce cost to government as the community becomes more resilient.

#### Questions for research

What are the implications on diversity from the changing role of the emergency service professional? How are other countries dealing with these issues?

What does the community expect of the emergency service professional, now and in the future?

# Economic

## ECONOMICS AND POLICY

Government funding for natural disasters favours disaster response and recovery. There is broad agreement that the existing approach is no longer adequate or sustainable given the frequency, intensity and consequences of significant events. Furthermore, the frequency and intensity of such events is likely to change, potentially resulting in greater impacts and higher demands on the emergency management sector.

Rebalancing government investment across disaster mitigation and recovery supports increased mitigation activity, strengthens community resilience and helps to reduce the impact of disasters on Australian communities.

### Investing in long term behavioural change

A better understanding of the economic and policy environment within which decisions are made, and an improved understanding of how risk information is perceived and understood by decisionmaking bodies, will allow risk-reduction proposals to be presented in a more compelling manner. In turn, this will increase the likelihood of resourcing and implementation support.

#### Questions for research

How can we quantify the long-term costs and benefits of mitigation investments across hazards?

How can we encourage new partnerships and enhance existing partnerships between government, business and community to deliver change?

### Understanding of hazard landscapes and risk

Australian communities face multiple natural hazards such as bushfires, cyclones, floods, heatwaves and earthquakes. Under climate change

forecasts the hazard risk profiles of all areas are expected to change in both frequency and intensity. Understanding the hazard potential and risk is critical to the resilience of communities, businesses and government. A clear understanding of exposure to hazards and the likelihood and potential consequences informs all mitigation activities.

#### Questions for research

How can advanced data analytics be used to support targeted communication to promote personal and community risk mitigation activities?

How can we capitalise on the experience of emergency events to heighten interest in government, community and business to prepare for and mitigate natural hazards?

### Mainstreaming emergency management policies across whole of government

Applying a resilience-based approach should not be the sole domain of emergency management agencies. Many of the actions needed to improve Australia's disaster resilience sit well outside the emergency management sector. The ability to prepare for, respond to, and recover from disasters relies on capabilities and policies across a range of sectors and across all levels of community, business and government. To 'mainstream' emergency management, then, is to consider how all sectors interact to enhance disaster resilience.

### Questions for research

What should be the ultimate objectives of emergency management policy and how can they be measured?

How can emergency management sector priorities be moved into whole of government decision making for resource allocation, rather than focused on agency specific responsibilities?

### Questions for research

How does investment in changing behaviour at different levels, including political, government, agency, business, community and individual, support improving disaster resilience?

How can we quantify the long-term costs and benefits of mitigation investments across hazards?

## INSURANCE

Natural hazards have always been part of the Australian landscape. However, the rising costs of disasters have instigated much policy discussion that highlights the importance of mitigation and resilience activities and the need to share data. There is a need to develop effective approaches and questions regarding the sustainability of the insurance industry in its current form, the understanding and measurement of risk profiles in both the financial and government sectors, and the tools and innovations available to help manage fiscal risks.

### Investment in behavioural change

Behaviour change includes any activity that mitigates risk at the community or individual level. The ultimate goal of a behaviour change campaign in emergency management is to build resilience in individuals and communities.

Currently there is a lack of evidence that demonstrates the value of government and business investment in risk mitigation for communities and individuals. This is because there is no direct 'line of sight' between behaviour change, risk mitigation and the cost of disasters.

### Shared acknowledgement and standardised language to communicate risk

There are numerous sources of hazard and exposure data, including official warnings and information (via various media channels), social media, independent websites that compile publicly available information and community meetings. The diversity of sources can make it difficult to make sense of the information and how it applies to one's own situation. Investment in systems, such as standardised language and technology, will support universal use of data in a coherent format that can be used by a range of partners in a variety of preparedness, response and recovery events.

### Questions for research

How can hazard information be better communicated to inform mitigation activity at personal, community and government levels?

How can advanced data analytics be used to support targeted communication to promote personal and community risk mitigation activities?

### Collaboration across government, academia and landowners

Many of the actions needed to improve Australia's disaster resilience sit well outside the emergency management sector. The ability to prepare for, respond to, and recover from disasters relies on capabilities and policies across a range of sectors

and across all levels of community, business and government.

Data is a key issue for the emergency management sector, it is integral to understanding risk as it helps to build risk profile. Currently, Australia does not have the data capability to understand the size of the problem; there is neither transparency nor consistency of data across different sectors of society. Good data capability, drawing from all sectors, will help the insurance industry develop more accurate pricing and can help to demonstrate to householders the different risk profiles of living in different areas.

#### **Questions for research**

How can we better develop new partnerships and leverage existing partnerships between government, business and community to engage and to deliver change?

How can technology be used to present multiple, diverse sources of data together in a coherent fashion and be sensibly presented to stakeholders?

# Infrastructure

## BUILT ENVIRONMENT

As climate-related hazards grow in intensity and frequency and urban density increases, there is increasing pressure to strengthen infrastructure to reduce the risk to the community and to lower longer term recovery costs.

Decisions around infrastructure construction and the built environment would benefit from more consideration of the risks of natural hazards.

A better understanding of the built environment and how it interacts with other factors will enable action to increase disaster resilience and can also provide tangible benefits for the community, such as reduced insurance premiums. There are a range of activities that can help to reduce vulnerability that will aid in community and individual resilience before, during and after disasters and emergencies. These activities include setting of a risk profile and building standards, infill and retro-fitting existing development, and critical infrastructure.

### Urban critical mass

Population growth in the urban environment results in either urban sprawl or an increase in urban densification, each with significant challenges for emergency management and the built environment. Planned investment of resources will ensure that infrastructure is able to withstand pressure from multiple sources. However, this does not always occur, leaving our infrastructure and community vulnerable to different emergency events. In the urban environment, where communities' risk exposure to a number of natural hazards such as floods, heatwave and coastal inundation, the challenges are complex and difficult.

#### Questions for research

What does urban density look like in 10 years?

What will be the impact on government and emergency services?

## Resilient buildings and infrastructure

Building resilient buildings and infrastructure with all-hazard protection would be a major contribution to helping the emergency services to mitigate risk to communities.

A large proportion of the current building stock in Australia is brittle and susceptible to a number of different hazards, including bushfire, heatwave and earthquake. Given the current trends for greater urban density and greater exposure to risk, as the frequency and intensity of events are expected to change, it is important that buildings provide the community with appropriate protection from natural hazards.

#### Questions for research

How vulnerable is our building stock and critical infrastructure to natural disasters? How can we learn from good examples of resilient buildings and infrastructure?

How can we build critical infrastructure to be resilient to natural disasters?

How can we better leverage off standards and building codes?

## Sharing knowledge between community, industry and agencies

Collaboration has its challenges as it requires a broad alignment of priorities in the built environment. This means community, emergency services, and all levels of government - including regulation, legislation and planning - work together.



### Questions for research

How can community, emergency service agencies and government work together to plan strategically to build resilience to natural hazards?

How do we take the concept of community resilience which works well in a rural community to high density urban settings?

### Questions for research

How can political processes be influenced to ensure that risk is taken into account in land use planning decisions?

How is it possible to ensure that development is resisted in high risk, yet highly valued, areas?

How do we integrate emergency management input across all hazards into land use planning?

## LAND USE PLANNING

Land use planning decisions for residential and infrastructure construction must balance consideration of the growing risks from increased frequency and intensity of natural disasters and the growing pressure to increase the availability of land.

Disaster resilience of communities and landscapes can be improved through better linkages between the emergency management sector and planning of land use and the built environment but this potential is not yet fully realised. Barriers include the inability to determine and articulate the cost of the transfer of risk for the protection of life and property on an all-hazards basis.

There is a need to explore how to include risk into land use planning decisions and the most effective mechanisms to enable this to occur.

### Strategic planning and the regulatory environment

Strategic planning has been identified by government, community and industry as crucial to community resilience and preparedness for natural disasters. However, disaster management and mitigation is just one element in a number of political, socio-economic and historical factors that drive land use planning in local government areas.

### Building standardised and accessible data sharing between government, business and community

Data is a key asset for the government, the community and the emergency management sector as it is integral to understanding risk and helping to build risk profile. Currently there is no centralised, open repository for hazard related data that is available to government, business and community. Consequently, we do not have good data to understand the size of the risk problem generally, and this is exacerbated

Good quality openly available data will enable land use planners, the emergency management sector, the insurance and finance industries and other major stakeholders to be able to work together more effectively to develop policy and build more disaster resilient communities.

### Questions for research

How can various stakeholders be brought together to develop and fund an open data sharing infrastructure supporting risk modelling?

What level of detail and consistency is required from data to meet the needs of government, business and community?

## **Demonstrating the value of risk mitigation**

The two main policy drivers in emergency management, the National Strategy for Disaster Resilience and the Productivity Commission's report into Natural Disaster Funding Arrangements, advocate to build disaster resilience through a number of mechanisms, and chiefly through risk mitigation. Despite this policy position, there is a lack of evidence to demonstrate to governments, emergency agencies and businesses the value of mitigation activities.

### **Questions for research**

How can we quantify the long-term costs and benefits of mitigation investments across hazards?

How do we assess the appropriateness of current standards and building codes?

# Electricity networks

**Australia's electricity networks are one part of the electricity system, providing the infrastructure that connects generators to customers who purchase their electricity from a retailer. All these players operate in a highly regulated framework to ensure a reliable and cost-effective supply of electricity.**

The nature of Australia's electricity system is transforming and moving away from large generators that operate over long distances to dispersed customers, to a system where customers are at the heart of the electricity system because they can now generate and store their own electricity and will provide services to support the electricity market. In this decentralised future, customers will still need to be connected to each other and to larger generators, via networks, to access the market.

By 2050 it is estimated that customers or their agents - not utilities - will determine how over \$200 billion in system expenditure is spent and millions of customer-owned generators will supply 30-45% of Australia's electricity needs.

In addition to the transformation in the way our electricity networks operate, the environment in which network infrastructure functions is also changing, with more extreme weather, such as cyclones, bushfires and heatwaves. Australia's networks need to respond to all of these significant changes and prepare their infrastructure, systems and supporting capabilities.

This statement explores and identifies the priority areas that will allow networks to be resilient to natural hazards. Increasingly, the complex linkages and dependencies between the electricity system and critical infrastructure and services have become better understood and acknowledged – with September 2016 in South Australia providing a good case study, with significant power outages following extreme weather.

As agreed by network service providers, the top four priorities for research related to natural hazard resilience for electricity networks are:

## **1. Understanding the fundamental vulnerabilities of Australia's electricity networks and strategies to minimise the risks posed by those vulnerabilities**

Some of the specific challenges associated with minimising risks to electricity networks include achieving consistency across the sector for understanding vulnerability and defining risk. This encompasses:

- Understanding the fundamental vulnerabilities of the network overall, and in specific operating environments
- Clarifying who owns the risk for network failure
- Agreeing what is included in risk assessments
- Obtaining agreement on how to assess and value options to address those risks.

With clarity around these issues, networks will be able to focus on increasing the maturity of their approach to identifying and understanding:

- the vulnerabilities of their networks
- the risk management and minimization strategies and practices across the sector to address those vulnerabilities.

With the greater capability that will come from this understanding, the vulnerabilities of businesses, communities and individuals who are reliant on the supply of electricity will also be included in the risk management and minimisation strategies.

## **2. New approaches to stakeholder engagement to support better planning and implementation of resilient networks and distributed generation capability**

Multiple stakeholders are responsible for ensuring resilience to the effects of natural hazards – individuals, communities, businesses and

government. Effective disaster resilience is created when all stakeholders understand their role(s) and responsibility(s) in planning for and responding to an event, regardless of severity.

### **3. New concepts in operation and regulation of electricity networks (including frameworks)**

Electricity networks operate under significant regulatory structures that must be adhered to.

Regulatory determination periods mean that networks have restricted flexibility in terms of their ability to put initiatives in place to strengthen the network and mitigate against natural hazards. All investments and spending need to be fully justified in submissions to the Australian Energy Regulator.

A tension exists between the perceived constraints of regulation and opportunities to deliver new approaches with some activities possible and some individual network businesses having a greater appetite for these approaches than others.

### **4. Harnessing current and new data to enhance forecasting and modelling of electricity networks to better manage the risk and impacts associated with natural hazards.**

Electricity networks recognise the value of data, both from their own operations and customer activities. They also recognise the need to maximise the use of that data for better decision making about future risks. Better forecasting and modelling tools are needed to support the day-to-day network operations, but also to understand the longer term potential impact of climate change and severe weather on networks assets and operations.

Forecasting and modelling of imminent natural hazards will also facilitate an efficient and effective response as well as inform broader network resilience initiatives.

much broader electricity and energy sector, which is governed by regulation, there are still significant opportunities for network service providers to trial and lead innovative business practices and ways of thinking. Research can help networks consider risk differently (going beyond reliability), help improve two-way engagement with stakeholders and communities about risks, and maximise the capability of current data to significantly improve the resilience of communities and businesses against the expected natural events and those beyond our experience and imagination.

## **SUMMARY**

The world is increasingly interconnected, and the changing climate is increasing the frequency and intensity of natural hazards. It is in this context that the ability of electricity networks to better understand and address current and emerging risks is vital. Whilst electricity networks are a subset of a

# Appendix 1

## Workshop dates and sponsors

Theme	Date	Workshop Lead
Recovery	Oct-15	ANZEMC Recovery Sub-committee
Capability	Mar-16	ANZEMC Capability Development Sub-committee
Economics and policy	Mar-16	ANZEMC Risk Assessment, Measurement and Mitigation Sub-committee
Hardening Infrastructure	Mar-16	AFAC Built Environment Technical Group
Urban operations	Apr-16 and Jun-16	AFAC SES and Urban Operations Groups
Community safety	Apr-16	AFAC Community Safety Group
Bushfire Predictive Services	Apr-16	AFAC Predictive Service Group
Community engagement	May-16	AFAC Predictive Service Group
Urban planning	May-16	Geoscience Australia and Planning Institute of Australia
Flood	May-16	National Flood Risk Advisory Group
Work, health and safety	May-16	AFAC Work, Health and Safety Group
Bushfire	May-16	Rural and Land Management Group
Insurance	Jun-16	Willis Re
Extreme weather and coastal hazards	Aug-16	Bureau of Meteorology
Remote communities	Aug-16	Ten Deserts Arid Land Environment Centre
Volunteering	Jan-17	Red Cross and AFAC Volunteering Management Technical Group
Diversity	Jan-17	AFAC Diversity Group
Warnings	N/A	Developed from the National Review of Warnings report – 2015
Electricity networks	Aug-18	Energy Networks Australia and S&C Electric Company



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