

# Promoting the Design of Buildings that Are Fire Safe and Sustainable

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A Review for Fire Protection Association Australia

An Interactive Qualifying Project Report  
submitted to the faculty of  
WORCESTER POLYTECHNIC INSTITUTE  
in partial fulfilment of the requirements for the  
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May 2, 2011

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This report represents the work of four WPI undergraduate students submitted to the faculty as evidence of completion of a degree requirement. WPI routinely publishes these reports on its web site without editorial or peer review.

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## **Abstract**

The sustainable building and fire protection industries have differing interests and ideals that present challenges in new building construction. We interviewed fire protection and sustainability experts to explore different incentives for fire safety and sustainability, and found most experts supported a more holistic approach to building design. We recommended that FPA Australia increase its communication with the sustainable building industry and promote awareness about sustainability to the fire protection industry by adopting a definition of sustainability suited to fire protection.

## Executive Summary

Over the past several decades a sustainable building industry has emerged and grown quickly. The main goals of the sustainable building industry include using non-renewable resources efficiently, protecting the health of building occupants, and reducing waste that negatively impacts the environment (EPA, 2010). In order to encourage sustainability, certification systems such as the Green Star Rating Tool have been used to assess the level of sustainability in buildings. The Green Star Rating Tool evaluates buildings based on several criteria including energy, water, and materials, but fails to mention fire protection.

However, there has been increasing discussion in the fire protection industry that some features of sustainable buildings create greater fire safety risks (Chow, 2005). For example, atria provide more natural light, but can pose fire hazards due to the spread of smoke in a short amount of time (Chow, 2005). The high ceilings of atria also result in ineffective sprinkler systems and smoke detectors (Chow, 2005). Certain types of insulation used to create more energy efficient buildings also provide structural support for thin steel walls. However, this insulation can melt in extreme heat caused by fires, degrading the structural integrity of the building. The building structure can sometimes be dangerous to fire fighters as these weakened walls can result in the collapse of burning buildings (Tidwell, 2010).

One major concern is that if a sustainable building burns down, many negative environmental impacts are caused. There is much loss and pollution associated with a building fire; building materials are lost and carbon emissions are released. After the fire, reconstruction of a building requires money, more building materials, and more carbon emissions.

While some sustainable building features can compromise fire safety, there are also fire protection measures which could be more sustainable. For example, according to Paul Verheijden from Integrated Fire Services, fire sprinklers in Victoria use approximately 500 million litres of water unnecessarily in testing every year. In addition, some fire extinguishing substances such as halon gases can be harmful to the ozone layer. Today, these halons are being phased out due to their hazardous effect on the ozone layer (Pitts, 2009). Overall, there has been little communication and interaction between the sustainable building industry and fire protection industry. Therefore, buildings have included design aspects that can sometimes lead to unintended consequences.

## Project Goal and Objectives

The ultimate goal of this project was to assist FPA Australia in developing an action plan to provide information to both the sustainable building industry and the fire protection industry of the benefits of creating buildings that are both fire safe and sustainable. Through discussions with regulators and designers of sustainable buildings along with fire protection experts, we aimed to identify mechanisms to promote more awareness about fire safe and sustainable buildings. In order to accomplish the project goal, we pursued the following objectives:

- Understanding the views of the fire protection industry
- Understanding the views of the sustainable building industry
- Identifying opportunities for collaboration between fire protection and sustainable design
- Developing an action plan to promote communication between the two industries

## Methods and Limitations

We interviewed 19 fire protection experts, 3 building code regulators, and 2 sustainability experts. Of the 19 fire protection experts, 5 had experience with sustainable building. These experts were mostly suggested by FPA Australia. Each interview lasted about one hour, and was conducted in a semi-structured way. We asked about challenges faced between the two industries, incentives for constructing fire safe buildings versus incentives for constructing sustainable buildings, opportunities for better integration, the role of the Green Star Rating Tool, the Building Code of Australia, and deliverables which could reach the most professionals in both industries. We had limited input from the sustainable building industry as most of our contacts were referred by FPA Australia. Since we interviewed a small number of experts from the sustainable building industry, it is possible the information we received does not reflect the community at large.

## Findings

**Several fire protection experts and sustainability experts believe that in order to construct a sustainable and fire safe building, all designers and engineers should be involved with the building design process from the beginning.**

Instead of simply adding regulations and requirements to enforce strict policies, several fire protection experts recommended addressing the issue by encouraging more collaboration between the two industries during the building design process. By using a holistic approach, several fire protection experts feel that it would be beneficial for the fire protection industry and the sustainable building industry to collaborate early in the building design process. By working together in these early stages, several fire protection experts felt that it would be easier to sort out disagreements that may arise between the two fields. It was also explained by several building experts that it is much easier to alter a building in its initial stages.

**Nearly all of the experts that we interviewed identified multiple drivers for sustainable buildings, including regulatory legislation, economic incentives, and social pressure.**

Experts from both the fire protection industry and the sustainable building industry reported that sustainable building is very appealing to a wide variety of people due to the incentives that it offers. Several fire protection experts pointed out that the Building Code of Australia (BCA) includes Section J, entitled “Energy Efficiency.” As a result of this recent addition to the BCA, buildings are required to meet these sustainability regulations. Many fire

protection experts see this as the government's way of promoting sustainability throughout Australia. A variety of experts also viewed the push towards sustainability resulting from economic and financial incentives. By achieving a higher Green Star rating, building owners have realised that they can charge higher rent from tenants. In addition, many building experts noted that a more sustainable building leads to energy savings, which reduces overall running costs over time. With certifications such as the Green Star Rating Tool, sustainability can be used as a marketing factor. Several fire protection experts expressed that people are moving towards more sustainable options simply to gain a positive public image. Some of the fire protection experts suggested that many of the large corporate companies are using sustainability as a marketing tool to promote themselves as a company that is doing the right thing. According to many fire protection experts, people feel a growing societal pressure to become more sustainable.

**Most fire protection experts believe that there are few incentives for constructing fire safe buildings that go beyond the minimum requirements of the Building Code of Australia.**

Several fire protection experts claimed that fire safety in buildings is often taken for granted in Australia. Most of the fire protection experts that we interviewed suggested that with the low chance of commercial fires, and the efficiency of the fire brigades, most people do not seriously consider the risks of fire. Numerous fire protection experts stated that it usually takes a catastrophe to cause people to be concerned about fire safety. As a result, fire protection experts sometimes have trouble convincing clients of the importance of fire protection. The BCA provides detailed regulations for fire protection. As long as the criteria outlined in the BCA are met, most fire protection experts explained that people do not usually try to exceed these requirements. Instead, fire protection experts see building designers working to meet the minimum standards at the lowest possible cost.

**From a fire protection standpoint, the Green Star Rating Tool considers the individual characteristics that make a building sustainable, but does not necessarily consider the lifelong sustainability of a building.**

The Green Star Rating Tool includes many categories that determine the sustainability of buildings. The idea behind the rating system is that those buildings that add more sustainable design aspects are rewarded with a higher number of green stars. Several fire protection experts whom we interviewed were concerned that during the design process the number of sustainable features sometimes becomes more of a priority than ensuring fire safety. Some experts even feel that the tendency is to go above and beyond in the area of sustainability, while little effort is dedicated to fire protection. Since fire protection ensures the lifelong sustainability of a building, several fire protection experts feel that the Green Star Rating Tool should consider fire protection as one of the criteria for rating buildings.

**Both fire protection experts and sustainable building experts receive information primarily from their own journals and conferences with little interchange of ideas between the two industries.**

Experts from both industries have expressed that they receive the majority of their information through journal articles and conferences. All of the experts agreed that the most effective way to educate both industries would be through these mediums. However, the industries currently draw on different journals and conferences and there are few common venues to encourage sharing of ideas and research. There was a general consensus among those interviewed that a conference including the sustainable building industry and the fire protection industry would be beneficial. This conference would establish more communication between the two industries and allow for debate and discussion.

### **Recommendations**

Below, we present recommendations regarding the next steps that the Fire Protection Association Australia might take to advance this conversation in Australia. These recommendations are aimed primarily at raising awareness about sustainability among FPA Australia members, and increasing communication between the fire protection and sustainable building industries.

**We recommend that FPA Australia develop and promote a definition of sustainability for the fire protection industry.**

Through our interviews and background research, we heard several different views about the definition of sustainability. Based on conversations with fire protection experts, we have attempted to define sustainability with regard to fire protection to provide a starting point. *Sustainability within the fire protection industry involves application of fire safety systems and design measures that support and promote building characteristics that are environmentally friendly during the buildings' daily use. These systems and designs must reduce the fire risk and impact that such characteristics and uses might contribute to throughout the full life expectancy of the building. Daily use characteristics include reducing harm to the environment by minimising energy consumption, water consumption, material consumption and fire risk.*

**We recommend that FPA Australia survey its members, to further explore the opportunities for integration and communication between the fire protection and sustainable building industries.**

The goal of a survey would be twofold. The first objective would be to prompt fire professionals to think about the role of sustainability in the context of their work. The second objective would be to generate statistical evidence that FPA Australia can use to further

awareness within the fire protection industry about sustainability and its impact on fire protection.

**We recommend that FPA Australia host a conference for its members focused on the topic of sustainability, as well as a joint conference with professionals from the sustainable building industry to build consensus about integrating fire protection and sustainable building.**

Many conferences are held each year by FPA Australia but none are dedicated solely to the topic of sustainability. We suggest that the first step for FPA Australia should be to organise a discussion through the format of a national conference in order to define what sustainability means for the fire protection industry. Once the fire protection industry obtains objectives for sustainability, fire protection experts will be in a better position to interact productively with the sustainable building industry. Following this conference, we suggest that a combined conference between FPA Australia and a sustainable building organisation will foster learning and understanding between experts in both fields. We propose that FPA Australia provide information at these conferences to both industries and provoke discussion and debate in a constructive manner.

**We recommend FPA Australia publish an article in *Fire Australia* to provide awareness about the relationship between fire protection and sustainable building design.**

The purpose of this article would be to raise awareness regarding the relationship between sustainable building design and fire protection and to direct people to the FPA Australia website where they can receive more information.

**We recommend that FPA Australia's website include more information about sustainability in the context of fire protection.**

We recommend adding a link to FPA Australia's website to inform the fire protection industry about the opportunities for the fire protection industry to become involved in sustainability and actions that the fire protection industry can take to be more sustainable. We recommend that FPA Australia provide information on its website including:

- A definition of sustainability that is applicable to the fire protection industry
- Examples of other attempts to integrate sustainable building design and fire protection from around the world
- A blog or interactive tool to allow experts to further discuss and debate
- Appendices A-D to allow experts in the field to compare specific technologies
- A link to this report



## Authorship

Michael Carter, Nathan Lee, Erik Oliver, and Molly Post all contributed to the research and writing of this report. The following is a breakdown of how the report was written for this project.

Michael Carter contributed to the executive summary, extensive tables in the appendices which are referred to in the background chapter, the drafting of the methodology, part of the findings chapter, and the recommendations chapter. Michael also participated in several of the interviews and contributed to the appendices containing interview summaries. Additionally Michael was largely responsible for the reformatting of the entire report for submission.

Nathan Lee contributed to the abstract, executive summary, introduction, significant technical sections in the background chapter, the drafting of the methodology, parts of the findings chapter, and the recommendations chapter. Nathan led a majority of the interviews and wrote a large amount of the interview summaries found in the appendices.

Erik Oliver contributed to the executive summary, introduction, large sections of the background including the section on solutions and partnerships, the methodology chapter, sections in the findings chapter, as well as a significant addition to the recommendations. Erik conducted a significant number of interviews and assisted in writing the summaries of interviews located in the appendices.

Molly Post contributed largely to the executive summary, introduction, large sections of the background including the section on efforts to create more sustainable buildings on a global scale, the methodology chapter, sections of the findings chapter, and final recommendations. Molly was responsible for contacting and setting up all of the interviews that were conducted. Molly conducted a majority of the interviews and wrote many of the interview summaries found in the appendices.

In addition to writing individual sections of this report, Michael Carter, Nathan Lee, Erik Oliver, and Molly Post all edited the paper for organisation, grammar, content, and flow as a group.

## Acknowledgements

We would like to thank our sponsor Fire Protection Association Australia. We appreciated being included in the office and the invitations for events outside of work. Thank you all for being so generous.

Matthew Wright, our liaison, took a tremendous amount of time out of his busy schedule to meet with us on almost a daily basis. His feedback was incredibly helpful in guiding our project and paper. Without his large number of contacts, we would have never been able to discuss our project with as many insightful experts.

We would like to thank everyone we interviewed. We are grateful for the time that you took out of your day to contribute to our project. The information that you gave us was extremely valuable. Also, we appreciated your patience in helping us to understand your perspectives on the various issues presented in both the fire protection and sustainable design industries.

Lastly, we would like to thank our advisors, Professor Chrysanthe Demetry, and Professor Richard Vaz, from Worcester Polytechnic Institute for all of the hours spent helping us with our report and presentation. Their guidance and direction helped shape the project.

## Glossary

ABCB	Australian Building Codes Bureau
BCA	Building Code of Australia
BREEAM	Building Research Establishment Environmental Assessment Method
CFA	Country Fire Authority
ESD	Ecologically Sustainable Development
FM Global	Factory Mutual Global
FPAA	Fire Protection Association Australia
FPA UK	Fire Protection Association United Kingdom
GBCA	Green Building Council of Australia
GSRT	Green Star Rating Tool
ICC	International Code Council
IGCC	International Green Construction Code
LEED	Leadership in Energy and Environmental Design
NASFM	National Association of State Fire Marshals
NFPA	National Fire Protection Association
NIST	National Institute of Science and Technology
PV	Photovoltaic

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## INTRODUCTION

Over the past several decades a sustainable building industry has emerged and grown quickly. The main goals of the sustainable building industry include using non-renewable resources efficiently, protecting the health of building occupants, and reducing waste that negatively impacts the environment (EPA, 2010). The sustainable building industry in Australia has been influenced by the Green Star Rating Tool, one of the many certification systems that serves to assess and encourage a high level of sustainability in buildings. The Green Star Rating Tool evaluates buildings based on several criteria including energy, water, materials, and emissions. There are currently 840 member companies that are certified to use the Green Star Rating Tool (Green Building Council of Australia, 2011). The growing concern for sustainability has resulted in over 3,000 downloaded copies of the Green Star Rating Tool each month (Green Building Council of Australia, 2011).

Unfortunately, the push for a more sustainable environment has caused some commercial and residential buildings to compromise fire safety for sustainability (Stevenson, 2010). For example, atria create more natural light, but can pose fire hazards due to the spread of smoke in a short amount of time (Chow, 2005). The high ceilings of atria also result in ineffective sprinkler systems and smoke detectors (Chow, 2005). Certain types of insulation used to create more energy efficient buildings also provide structural support for thin steel walls. However, this insulation can melt in extreme heat caused by fires, degrading the structural integrity of the building. The building structure can sometimes be dangerous to fire fighters as these weakened walls can result in the collapse of burning buildings (Tidwell, 2010). Matthew Wright, Chief Technical Officer from Fire Protection Association (FPA) Australia, has pointed out that if a building burns down, it will not be environmentally friendly regardless of its sustainable design. This is not only because of the toxic fumes and water runoff from putting out the fire, but also because the building must be rebuilt with new resources.

Despite the importance of fire safety in creating sustainable buildings, the Green Star Rating Tool contains no reference to fire protection concerns. The lack of fire protection considerations in the Green Star Rating Tool is just one example of how the fire protection industry and the sustainable building industry are not well integrated. Mr Wright recognises the importance of communication in the design process, and has observed that currently there is little collaboration between these two fields; as a result, conflicts often arise late in the design process. It is unlikely that new buildings will achieve a suitable balance between fire safety and sustainability, unless the fire protection industry and sustainable building industry collaborate and communicate.

A guide recently published by National Association of State Fire Marshals (NASFM) in the United States has worked to encourage more integration of fire protection and sustainable design. The NASFM has also proposed changes in legislation to the International Green Construction Code (IGCC) to include precautions regarding fire protection and occupational safety for fire fighters. Australia is working to meet these same goals by taking initiatives in the



fire protection industry. FPA Australia is a national organisation that is dedicated to educating its members as well as the broader community about fire safety practices. FPA Australia holds several conferences annually and publishes *Fire Australia Magazine*, both of which are commonly used by fire protection experts. As a result of its connections, FPA Australia is able to provide awareness through these forums to a large number of fire protection experts throughout Australia.

The goal of this project was to assist FPA Australia in developing an action plan to provide information to both the sustainable building industry and the fire protection industry regarding the benefits of creating buildings that are both fire safe and sustainable. We interviewed fire protection experts and sustainable building experts to discover their views on how fire protection and sustainability can be better integrated into building design and construction. Through the information acquired from experts in both fields, we were able to better understand the reasons why this lack of integration exists, and identify ways in which these two industries can collaborate more effectively. Based on the feedback that we received from a variety of experts, we made recommendations to FPA Australia for encouraging the design of buildings that are both fire safe and sustainable.

## **BACKGROUND**

In this chapter, we begin by addressing the need for the sustainable building industry and fire protection industry to better incorporate their designs into building construction. First, we will discuss several definitions for the term sustainability. Then, we will address the growing concern for constructing sustainable buildings on a global scale and the certification systems that implement sustainable practices. In addition, Australia's push for sustainability will be discussed, along with the Building Code of Australia. After that, the conflicts between sustainability and fire protection will be presented in a way that addresses specific materials, designs, and devices. Finally, possible solutions and techniques for improving integration will be discussed by identifying other global attempts to address this concern.

### **Efforts to Create More Sustainable Buildings on a Global Scale**

The worldwide push for sustainability has led to organisations being created to monitor the sustainability of buildings. These organisations set up rating schemes that score buildings on various categories to give them a sustainability rating. These schemes typically consider energy usage, material consumption, and carbon emissions. The categories are used to determine a score that ranks the sustainability of the building.

### **Definitions of Sustainability and Sustainable Buildings**

Sustainability is a broad term that is used to describe a combination of environmental, economic, and other social impacts. Since sustainability applies to a wide range of areas, it is challenging to present just one definition of the word. Different industries have their own definitions based on the applications of sustainability to their fields. This section includes several definitions of the term sustainability, chosen to include concepts that apply to fire protection and the values of life safety.

Sustainability Victoria, an agency of the Victorian Government, states that “[s]ustainability is about making sure the social, economic and environmental needs of our community are met and kept healthy for future generations.” This organisation works to integrate sustainability into every part of life for the entire Victorian population. The definition includes the common themes of social, economic, and environmental aspects. In addition, the definition addresses the impact of sustainability on future generations.

David O’Riley, the Development Manager for Project Fire, a fire sprinkler system company, defines sustainability as “primarily about reducing water usage, reducing energy consumption, and minimising the carbon footprint.” Mr O’Riley has created this definition to help improve the impact of fire sprinkler systems on the environment. He indicated that the main concern in terms of sustainability is that fire sprinkler systems are seen as wasting water. Through his work installing sprinkler systems, Mr O’Riley attempts to reduce water usage and provide more environmentally friendly water storage. Even though Mr O’Riley’s work specifically targets fire sprinkler systems, he also recognises the importance of decreasing energy consumption and diminishing the carbon footprint.

CJ Walsh, a firm of consultant architects, fire engineers and technical controllers defines that “[t]he aim of sustainable fire engineering shall be to design for Maximum Credible Fire and User Scenarios in order to maintain a proper and satisfactory level of fire safety and protection over the full life cycle of a building.” While this definition addresses the concern for the life cycle of a building, there is no mention of environmental impact. This definition seems narrow compared to other definitions, but it directly mentions fire safety and protection with regard to buildings.

The National Fire Protection Association (NFPA) defines sustainability as including “Commitment to the environment, energy efficiency, performance-based design options, and building rehabilitation.” This definition is being used by the NFPA for their 5000 Building Construction and Safety Code. These criteria cover a wide range of characteristics of sustainability. The performance-based design is especially important in that it allows for alternative environmentally friendly designs, but also requires a certain standard of life safety. In addition, the building rehabilitation is an essential aspect of sustainability in that it encourages the reuse of already existing buildings. By rehabilitating buildings, there is a decrease in the amount of waste and a reduction in the building materials needed, providing increased sustainability at a decreased cost.

Simon Dent from Arup states that, “A sustainable building is the physical end product of a design philosophy to improve the ‘performance’ of the built environment by increasing the efficiency of the resources used in building during its lifecycle: construction, operation and demolition. Such performance is typically measured through a range of international environmental performance-rating systems for buildings.” This definition addresses sustainable buildings specifically, and discusses the lifecycle and performance of the building. In addition, this definition mentions the rating systems that are used throughout the world to measure the sustainability of these buildings. By specifically addressing buildings, this definition is applicable in that it identifies the aspects of sustainability that directly affect building design.

## **Sustainable Building Initiatives Worldwide**

On a global scale, the International Green Construction Code (IGCC) has been pushing for sustainable buildings, both commercially and residentially, since the late 1970s (Stevenson, 2010). High levels of carbon emissions and energy usage have been found to be problematic to many countries around the world. As countries move toward being more conscious about sustainable building, several organisations have created measurement tools to assess these buildings based on their sustainable features.

A variety of rating systems are used to rate the level of sustainability in buildings. One of the most successful systems is the Leadership in Energy and Environmental Design (LEED) certification system. This system created by the U.S. Department of Energy uses the following criteria for building rating systems: relevance, measurability, applicability, and availability (Fowler, 2006). LEED is utilised by the United States Green Building Council to assess the environmental sustainability of buildings based on their energy usage, water efficiency, carbon

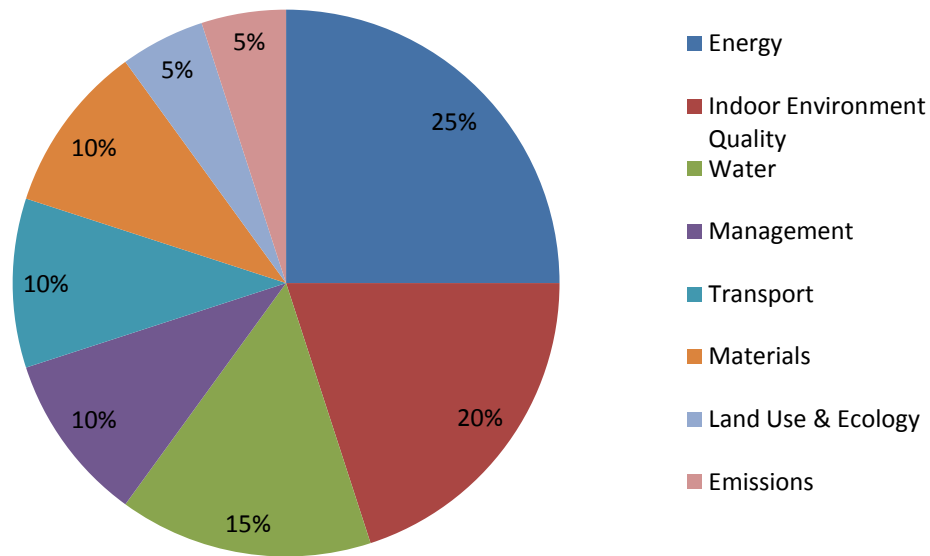
emissions, and use of resources (Fowler, 2006). Other similar certification systems include the Green Building Challenge used in Europe, the Building Research Establishment Environmental Assessment Method (BREEAM) system used in the United Kingdom, and the Green Star Rating Tool used in Australia.

While each rating scheme has its own criteria, there are many similar elements seen throughout. The rating schemes generally provide guidelines for commercial, industrial, retail, educational, and medical buildings. While most rating schemes are voluntary, they are looked highly upon by society. Many countries even provide economic incentives and rewards to buildings that get high sustainability ratings. The rating schemes include considerations from the design stage, operational stage, and management stage. All of these schemes are intended to make buildings more sustainable and less resource-intensive. However, despite the negative environmental consequences of building fires, none of these rating schemes mention fire protection practices.

### **Sustainable Building Initiatives in Australia**

Australia is the world's largest greenhouse gas emitter per capita, in part due to the contribution from buildings (Newell, 2008). New building construction is responsible for 40 per cent of energy consumption and 50 per cent of total carbon dioxide emissions (Australian Greenhouse Office, 1999). In addition, the building industry accounts for 40 per cent of raw material consumption (Subramanian, 2007). Due to the concern regarding the environmental impact of buildings throughout Australia, various organisations are working to implement better sustainable building certification systems (Wilson, 2006). Some of the beneficial components of creating sustainable commercial property include savings in water and energy costs, increasing marketability, as well as reducing liability and risk (Newell, 2008).

A system called the Green Star Rating Tool has been used to assess the level of environmental sustainability in commercial buildings throughout Australia. The Green Building Council of Australia (GBCA) developed the Green Star Rating Tool. This certification system uses a scale of six stars to indicate the level of sustainability of buildings. In this system, one star represents a building that is the least sustainable, and six stars represent global recognition in sustainability (Wilson, 2006). The Green Star Rating Tool is encouraging society to create buildings with higher Green Star Ratings, in an attempt to improve Australia's overall sustainability. As seen in Figure 1, the criteria for the Green Star Rating Tool are: energy, indoor environment quality, water, management, transport, materials, land use and ecology, and emissions (Wilson, 2006). Despite the extensive criteria used to rate these buildings, the Green Star Rating Tool does not address any fire safety concerns involved in building design and construction.



**Figure 1: Green Star Rating Tool Criteria**

### Building Code of Australia

While rating schemes such as the Green Star Rating Tool are voluntary, the Building Code of Australia (BCA) is the regulatory standard when designing a building in Australia. The BCA outlines what the government requires for every style of building. It includes sections describing the necessary fire safety and sustainable aspects of building design. Through these sections, the BCA strives to create comprehensive regulations that will generate the greatest benefits to society.

The authors of the BCA have recognised the growing sustainability movement by including a section entitled *Energy Efficiency, section J*. The objective of this section is to limit greenhouse gas emissions (BCA, J0). With the addition of this section, it is clear that the government sees the need to regulate sustainable building design. The BCA requires that buildings with atria include fast acting fire sprinklers alongside of the atria with a maximum temperature rating to protect the walls from catching fire (BCA, G3.8). An atrium also must include fire sprinklers that activate at a specific temperature at the top of the atrium to protect the roof (BCA, G3.8). The issue of smoke spreading during a fire is also addressed. When the fire detection systems are activated, all of the air ventilation systems in the atrium must stop supplying air to the fire. While the BCA has some regulations on sustainable features for fire safety such as atria, not all sustainable features are addressed in this section with regard to fire protection.

When meeting the requirements of the BCA, there are two options available. Building designers can create a building using the BCA guidelines which will be “Deemed to Satisfy,” or they can tailor the guidelines to their building which is called an “Alternative Solution.” The

“Deemed to Satisfy” guidelines are addressed by what is explicitly stated in the BCA. This option adheres to a rigid set of guidelines that states exactly what is needed for each aspect in every type of building. These guidelines have been carefully detailed and understood by both the fire protection industry and sustainable building industry.

However, the BCA also allows for alternative solutions in all buildings, thereby allowing designs to be tailored to particular buildings and encouraging the use of innovative materials. This is intended to give the designer flexibility while still maintaining the performance requirements. The requirements for the alternative solutions allow for fire protection and sustainability methods that are not always up to the BCA standards. To satisfy the BCA, an alternative solution does not necessarily require the design to be evaluated by a fire protection engineer or a sustainable building expert. The alternative solution can be designed by any professional engineer or other appropriately qualified personnel (BCA, A2). Alternative solutions are beneficial in that they promote creativity, but without the insight of a fire protection engineer, some buildings may have an increased risk of fire. Similarly, some buildings that are not approved by a sustainability expert may cause tremendous harm to the environment.

## **Conflicts between Sustainability and Fire Protection**

Constructing a building to be more sustainable can sometimes mean making the building less fire safe. Likewise, making a building more fire safe sometimes requires the building to be less sustainable. This section describes how sustainable materials, designs, power sources and extinguishing devices affect fire protection.

### **Sustainable Materials and Fire Protection**

The use of materials is one key aspect that must be considered when constructing sustainable buildings. There is a large debate about which materials will cause the least amount of damage to the environment in the long run. Appendix A lists specific examples of some of these materials and their impacts on fire safety.

The construction industry is using more timber because it is considered to be a renewable resource. In Lie’s report from 2010 entitled “A method for assessing the fire resistance of laminated timber beams and columns,” he discusses how timber is very flammable and allows for fire to spread more quickly than in buildings made of different materials. The increase in fire spread is due to the fact that the timber beams will ignite at a lower temperature than other building materials. According to FPA Australia’s Chief Technical Officer Matthew Wright, once the beam ignites it will spread quickly through the walls to other rooms in the building. Though timber may be renewable and sustainable, it may lead to unnecessary deaths from fires in years to come.

Another material being examined in sustainable design is the insulation of a building. A common type of foam insulation used in buildings is called sandwich panel insulation, which is insulation between two thin metal sheets. Often times foam insulation is manufactured from petroleum-based material which has a low melting point (Tidwell, 2010). This material has excellent insulation performance from a sustainable design perspective and also provides

structural reinforcement to the building. However, according to Mr Wright, a fire in a building using this sandwich panel design can cause the foam insulation to melt, leaving two thin metal sheets to support the weight of the roof. This can lead to the structural integrity of the building being sacrificed. It may not be apparent to fire fighters that the walls of a building with sandwich panel construction lack structural integrity and could collapse at any moment. Clearly this is dangerous for both fire fighters and the occupants of the building.

### **Sustainable Design and Fire Protection**

The sustainable construction industry has evolved over recent years to develop many innovative designs that reduce carbon emissions. Unfortunately several designs have caused unintended consequences from a fire safety perspective. The safety and well-being of fire fighters and the buildings' occupants may be at risk because of some of the sustainable alterations for new buildings. Several sustainable design features along with their sustainability benefits and fire protection concerns are described in Appendix B.

One method used to increase natural lighting in a large building is the use of skylights. These skylights can significantly decrease the amount of energy used to illuminate a building, but may cause structural problems in the ceilings (Mahlman, 2007). Skylights can cause structural weaknesses because they may not support the ceiling and add additional weight. In the case of a fire, these skylights are likely to come crashing down, causing harm to anyone who is below (Mahlman, 2007). Also, fire fighters may have difficulty navigating a roof with skylights, which sometimes lack structural strength.

Another common method of increasing light in large buildings is the use of an atrium. An atrium is an area situated somewhere in the middle of the building, with extremely high ceilings. The atrium often goes from the ground floor to the ceiling of the top floor. This high ceiling will have windows that allow light to penetrate to the bottom floor of the building. The use of this kind of design in a large building will decrease the amount of energy used to light a building, and thus decrease electricity costs. However, a room like this is also a concern for fire protection. In Chow's study from 2005, he asserts that the high ceilings may decrease the effectiveness of smoke detectors. The smoke can travel part way up the atrium then hover below the smoke detectors without actually setting them off. By the time smoke actually triggers the smoke detectors, the building may already be engulfed in flames (Chow, 2005). Also, an atrium can allow smoke to spread throughout the building instead of being obstructed by walls and doors.

The addition of vegetative roofs to sustainable buildings has caused several difficulties for responding fire fighters. Vegetative roofs are a concern because they must have the appropriate moisture level to prevent becoming a combustible accelerant in the event of a fire (Tidwell, 2010). Also, Tidwell explained that a walking perimeter on vegetative roofs for fire fighters is not always required. One example of a situation where a vegetative roof was called into question was in the design of the Victorian Desalination Plant. This vegetative roof was intended to help the facility blend in with its coastal surroundings. However, the fire brigade raised several concerns about this idea. Their main concern was the possibility that the vegetative roof might be predisposed to ignite in the event of a bush fire. After negotiations, fire



protection precautions were implemented to ensure that fire fighters would be able to extinguish a potential fire on the roof.

### **Sustainable Power and Fire Protection**

Alternative forms of energy are being widely implemented in an effort to reduce the need for non-renewable energy sources. This is an effective step forward for sustainable construction, but these new power production systems can pose challenges for fire fighters. Some of the more common power production systems are photovoltaic (PV) panels, wind turbines, and hydrogen fuel cells, which can sometimes conflict with fire protection. Different power production systems along with their sustainability benefits and fire protection concerns are described in Appendix C.

Photovoltaic (PV) cells are a source of alternative energy using solar power. PV cells are usually arranged in a panel array. These panels are often placed on commercial or residential rooftops. The NASFM published a report entitled “Bridging the Gap” in which Tidwell identified three primary concerns raised by the fire protection industry regarding PV panels.

First, there should be a power shut-off that is easily accessible to the responding fire department to ensure that the solar panels are disabled (Tidwell, 2010). Second, alternative energy systems should be clearly labelled because it is vital that the fire brigades know what kind of electrical system is used by the building (Tidwell, 2010). Finally, the roof panels should be tested for structural soundness so that they meet or exceed the fire safety standards of the roof on which they are installed (Tidwell, 2010). This includes leaving enough exposed roofing material for ventilation (Tidwell, 2010). Currently there are very few requirements in the Building Code of Australia regarding PV panels and automatic shut-offs.

Wind turbines are another alternative form of energy that can affect fire safety. In fact, the concerns for PV panels also apply to any mounted wind turbine on a structure. The power shut-off and labelling of essential schematics are required for the fire department to respond appropriately to a fire (Tidwell, 2010). On windy days the spinning blades themselves could detach and harm fire fighters as they attempt to put the flame out. Wind turbines can be an effective method for decreasing energy consumption, but proper precautions are necessary to prevent accidents. Currently, fire precautions for wind turbines are not outlined in the Building Code of Australia.

### **Sustainable Water Sprinklers and Other Fire Extinguishing Devices**

Sprinklers are a common and effective form of automatic fire suppression. However, sprinkler systems have to be tested, which can consume large amounts of water. The insurance company FM Global performed a study comparing two identical rooms in a warehouse, one with sprinklers and one without. Both rooms were ignited in a similar fashion and observations were made. In the test, the non-sprinklered room released 76 times the amount of chemical energy as the sprinklered room (Wieczorek, 2010). In addition to reducing the amount of harmful emissions into the atmosphere, the amount of water saved was significant. The non-sprinklered room used 4221 total litres while the sprinklered room used only 1938 total litres to extinguish



the fire (Wieczorek, 2010). Thus the study suggests that the benefits of sprinklers are twofold: fire sprinklers aid in the extinguishing of fires and increase sustainability by reducing the overall effect of fires on the environment (Wieczorek, 2010). In particular, fine mist sprinkler systems are an environmentally friendly option because their small droplets act like a gas, but are not toxic like many halogen gases (Adiga, 2007). In addition, the National Fire Protection Association (NFPA) in the United States did a study on 1000 fires and found that the chance of death in a non-sprinklered building was about three times as great as that in a sprinklered building (Webb, 2007).

Fire protection systems require testing, which can result in large consumption of water. Pressure management programs have been put into place to limit the water loss and conserve water while still effectively testing fire protection systems (Thomas, 2007). Sprinkler systems have been found to cause the greatest amount of water consumption in both their water supply tests and pump load tests (Thomas, 2007). New water supply flow tests have been proposed which include static or pump shut-off pressure to prevent excessive water flow. In addition, a 30 minute pump load test has been created to reduce flow time (Thomas, 2007).

There are alternative methods for extinguishing fires without the use of water. For example, water extinguishing devices are not commonly used in a room that contains sensitive electronic equipment. Water from sprinklers may cause irreparable damage to the electronic equipment. Instead, halons and hydrofluorocarbons are two classes of extinguishing gases that have been used to replace water. These chemicals are very good at extinguishing fires and efficiently reducing water usage while maintaining fire safety. However, these chemicals have been found to cause extreme harm to the environment. Today, these halons and hydrofluorocarbons are being phased out due to their hazardous effect on the ozone layer (Pitts, 2009). One of the most environmentally acceptable systems has been found to be FM-200 because it does not deplete the ozone (Wierenga, 2001). The problem with FM-200 is that a larger quantity of the fire suppressant is required to fully extinguish fires.

Appendix D presents a summary of research evaluating fire extinguishing devices based on their sustainability and fire protection properties. Overall, it is evident that the development of fire fighting equipment can take both fire safety and sustainability into account.

## **Efforts to Integrate Sustainable Building and Fire Safety**

Some organisations have already recognised the challenges associated with integrating sustainable building and fire protection. These organisations have taken first steps in attempting to influence these two industries to collaborate more often. Some of these organisations have published articles or web documents to encourage discussions in online forums. These forums and documents can promote discussions between these industries and provide awareness.

### **United States NASFM's *Bridging the Gap***

The National Association of State Fire Marshals (NASFM) in the United States has taken the initiative to provide information to the sustainable building industry. On the NASFM website, a guide entitled “Bridging the Gap: Fire Safety and Green Buildings” details specific

ways in which fire protection concerns have been left out of sustainable building designs (Tidwell, 2010). This guide was published in an effort to discuss how fire protection measures can be incorporated into sustainable design. Specifically, it addresses difficulties fire fighters encounter when responding to a fire at a sustainable building site (Tidwell, 2010). This information is valuable in helping to pinpoint areas where the global sustainable building design process should include fire safety.

In addition, the NASFM has submitted modifications in construction codes to the International Code Council (ICC). The ICC is in the process of updating the International Green Construction Code (IGCC) that will make recommendations to sustainable builders in an effort to make them aware of the precautions necessary to ensure fire safety. These proposed changes to the IGCC will be considered at a conference in May 2011. The NASFM is initiating communication on how to promote fire safety in green buildings through both passive measures like the website but also directly through the current international building code legislation revisions. With the proper legislation in place, the sustainable building industry will be encouraged to use fire safe designs in future buildings.

### **Walker Fire Protection**

Walker Fire Protection Systems have taken the initiative to develop sustainable options for fire protection organisations. The ways in which these organisations can incorporate sustainability without compromising fire safety are divided into two categories in their publication entitled *The Ten Key Principles of Green Fire* (Taylor, 2006).

The first category comprises sustainable solutions related to water. One possibility involves using fire pumps that can recirculate grey water used for testing fire sprinklers (Taylor, 2006). A second solution details a sprinkler drain system to bring reused test water to the pumps (Taylor, 2006). A third solution describes how sprinkler drain valves can be installed in a floor-by-floor arrangement or into localised zones (Taylor, 2006). Walker Fire Protection has installed these types of innovative designs to conserve water and maintain fire safety in buildings.

The second category deals with sustainable solutions related to materials. Reduction of PVC sheathed cables and the use of low halogen type materials is suggested as a sustainable alternative solution to other construction materials (Taylor, 2006). Limiting chromium plated sprinkler heads and replacing them with brass or painted finish is presented as a viable option to reduce hazardous environmental runoff (Taylor, 2006). In addition, using photoelectric detectors in place of ionisation detectors is proposed to reduce the risk of radioactive material being released into the atmosphere (Taylor, 2006). Finally, flexible sprinkler systems allowing for changes in layout as well as modifications of a building are described.

The solutions proposed and practised by Walker Fire Protection are a notable example of the fire protection industry making an effort to be more sustainable. However, more collaboration between the fire protection industry and sustainable building industry is needed to have greater impact. Other groups are also trying to achieve a working relationship between the fire protection industry and the sustainable building industry.

## Projects that Address Fire Safety and Sustainability

Fire protection organisations around the world are trying to determine how best to collaborate with sustainable building organisations. Since new research and ideas are emerging related to this effort, FPA Australia can learn from the mistakes and successes of other organisations. In this section we highlight some organisations FPA Australia might monitor.

The Leonardo Academy in the United States has written a paper entitled “Sustainability Assessment and Improvement Strategy Development for the Fire Suppression Industry: An Overview of Issues.” The Leonardo Academy is a highly respected sustainability organisation in the United States. This organisation works to oversee sustainable developments and assess sustainable impacts of people and buildings by using the LEED rating system among others. The paper outlines goals for increasing the sustainability of fire suppression systems and what is necessary in order to reach these goals.

The Greater Manchester Fire and Rescue Service created a guide to help individual fire stations become more sustainable. FPA Australia has contacts with a large number of fire brigades. One method for the fire protection industry to show willingness to compromise with the sustainable building industry would be to adopt some of the changes outlined in this paper.

The paper also gives a brief explanation as to why fire and rescue services need to become more sustainable.

The Institution of Fire Engineers has made one of the first attempts at communication between fire protection and the sustainable building organisations in the form of a blog<sup>1</sup>. This blog was created to encourage informal debate and spread information among experts in the fields of fire protection and sustainability. The website is intended for global use for professionals to share successful practices. One of the objectives is to discuss and develop guidelines and standards to implement sustainable design with fire protection. The creators of the website hoped to influence everyone involved in the building design process by making them aware of the sustainability issues and fire protection issues. This interactive blog could be an effective forum for FPA Australia to post some of the findings of this study for feedback from other professionals worldwide.

## The Role of FPA Australia

The ultimate goal of FPA Australia is to support its members by providing the community with fire safety information as well as building awareness about fire protection. Part of this mission includes influencing decision makers and communicating the fire safety message. FPA Australia wants to educate its members and the community so that they can understand the concerns of fire protection industries and be willing to discuss how to design fire safe and sustainable buildings. One of FPA Australia’s goals for this study is to find ways to reach out to the sustainable building industry in order to create a line of communication between the two industries.

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<sup>1</sup> <http://ifefessig.blogspot.com/>

## METHODOLOGY

The ultimate goal of this project was to assist FPA Australia in developing an action plan to provide information to both the sustainable building industry and the fire protection industry regarding the benefits of creating buildings that are both fire safe and sustainable. Through discussions with regulators and designers of sustainable buildings and with fire protection experts, we aimed to identify mechanisms to promote more awareness about fire safe and sustainable buildings. In order to accomplish the project goal, we:

1. Identified ways in which the fire protection industry can work more closely with sustainable building design
2. Identified ways in which the sustainable building industry can work more closely with the fire protection industry
3. Identified challenges of building design associated with fire protection and sustainable design
4. Formulated an action plan to encourage the fire protection industry and sustainable building industry to begin communication and collaboration regarding buildings that are both sustainable and fire safe

### Understanding the Views of the Fire Protection Industry

In order to gain a better understanding of the fire protection industry's views of the relationship between fire protection and sustainability, we sought to learn different perspectives from experts within the industry. We interviewed a group of high-level experts from the fire protection industry to better understand opportunities to implement fire protection practices in sustainable design and construction. Some research questions that we aimed to answer in our semi-structured interviews included:

- What impact does sustainable design have on fire protection?
- What are the views of fire protection experts regarding sustainable design of buildings?
- How can fire protection systems be more sustainable?
- To what extent is the fire protection industry concerned about sustainable design?

We selected members of the fire protection industry who have frequent interactions with the building or construction organisations in Australia. All of the interviewees were referred by FPA Australia as knowledgeable experts in the field of fire protection. Most of the fire protection experts were chosen because they were familiar with sustainability practices in building design. By interviewing these subjects we sought to gain a better understanding of the relationship between the fire protection industry and the sustainable building industry. We conducted 19 interviews with fire protection experts. Their names and positions are listed in Appendix F. Using the information from these interviews our team hoped to discern why the fire

protection industry feels there is a lack of communication and integration between these two very important fields.

We conducted semi-structured interviews with all of the interview subjects in order to obtain answers to specific questions, while also allowing for appropriate follow up questions. The purpose of the semi-structured interview was to gain valuable information in an individualised way. At the beginning of each interview, we asked if the interviewee would allow us to record the interview and use his name and position in our report. We respected the interviewees' confidentiality by excluding names and positions in our report upon their request. We sent the interview questions to the interviewees in advance for them to look over and prepare responses if they wished. Each interview lasted for approximately one hour. Some of the interviews were conducted by telephone due to logistical issues. Within one day of each interview, we emailed the interview subject a thank you note with an attached summary, as seen in Appendix G, of the interview to ensure that they concurred with our summary.

Since all of our semi-structured interviews were conducted with experts referred to us by FPA Australia, it is possible that we did not receive a full and unbiased perspective from the fire protection industry regarding sustainable design. Since we interviewed selected experts, it is possible that the information we received does not reflect the community at large.

### **Understanding the Views of the Sustainable Building Industry**

We sought to understand some of the challenges that are involved with incorporating fire safety measures into sustainable buildings through interviews with sustainable building experts. Since the scope of the project addresses two different industries, we wanted both industries' opinions to be taken into consideration. To understand the opinions of the sustainable building community, we interviewed several experts. Through these interviews, we hoped to understand:

- What impact does fire protection have on sustainable design?
- What are the views of sustainable design experts regarding fire protection in buildings?
- How can sustainable construction designs be more fire safe?
- To what extent is the sustainable design industry concerned about fire protection?

From these interviews, we sought to understand how various experts envision opportunities for fire safety practices to be incorporated into sustainable buildings. By interviewing a variety of experts on sustainable building rating systems such as the Green Star Rating Tool we received feedback about the current views concerning fire protection. After learning more about the opinions of various experts, we drafted a set of preliminary recommendations to improve fire protection awareness within the sustainable building industry.

We selected interview subjects who are actively involved in the sustainable building industry in Australia. Some of the interviewees were referred by FPA Australia as knowledgeable experts in the field of sustainability, while other interviewees were direct referrals from sustainability experts that we interviewed. Most of the sustainability experts were chosen because they had considerable experience with sustainable design. By interviewing these

subjects we sought to gain a better understanding of the relationship between the sustainable design industry and the fire protection industry. We conducted three interviews with sustainable building experts, as summarised in Appendix G. Using the information from these interviews our team hoped to discern the sustainable building industry's views regarding communication between and integration of these two fields.

We conducted semi-structured interviews following the same procedures as explained above. Again, since the majority of our semi-structured interviews were conducted with experts referred to us by FPA Australia, it is possible that we did not receive a full and unbiased perspective from the sustainable building industry regarding fire protection. Since we interviewed a small number of experts, it is possible the information we received does not reflect the community at large.

### **Identifying opportunities for collaboration between fire protection and sustainable design**

In our analysis of the interviews, we looked for areas of consensus as well as disagreements between the experts in the two industries. We planned to identify possible intervention points to influence policy. The research questions we considered in our analysis are as follows:

- What are the challenges preventing the fire protection and sustainable design industries from working more closely together?
- What opportunities are available for the fire protection and sustainable design industries to collaborate more?
- How are the motives for constructing fire safe buildings different than those for constructing sustainable buildings?
- What are the ways for the sustainable building industry and fire protection industry to communicate more effectively?

We summarised the interviews in order to easily compare the ideas of the different experts. We used our digital recordings of the interviews to preserve specific direct quotes in our findings. Once the data was collected from the interviews, we summarized the specific information obtained in a logical manner and grouped the data into categories corresponding to policy, society, and technology. Policy included any information related to government regulations, building codes, or fire codes. The societal implications included underlying incentives, public image, and marketability associated with the two industries. Technology focused on specific designs which positively or negatively impacted the fire protection industry or the sustainable design industry. The data were then sub-categorised into implications for fire protection and sustainability. Based on this categorisation, we were able to make generalisations about the various views regarding the integration of sustainability and fire protection.

In order to generate useful analysis of the data collected through interviews, we created a table including all of the interviewees' names and responses to questions. We used this table to

find common trends and similar ideas. Obviously, there was a variance in the answers given by those experts interviewed, but enough similarity existed to draw preliminary conclusions.

### **Developing an action plan to promote communication between the two industries**

The results of our analysis were used to formulate an action plan to influence the fire protection industry and sustainable building industry on a larger scale. This action plan was intended to accomplish the following objectives:

- Raise awareness among the fire protection industry of the opportunities and advantages of sustainable initiatives.
- Raise awareness among the sustainable building industry of the opportunities and advantages of fire safe measures.
- Propose ways in which FPA Australia can communicate with its members the importance of sustainability in the fire protection industry.
- Propose ways in which FPA Australia can communicate with the sustainable design industry in order to take a more holistic approach to building design.
- Propose ways in which the fire protection industry and sustainable building industry can collaborate and communicate on building design.

In this action plan, we made recommendations to FPA Australia intended to raise awareness about the lack of integration between fire protection and sustainability. Specifically, we suggested ways in which FPA Australia can inform its members on the topic of sustainable building. In addition, we developed ways in which FPA Australia can be proactive in supporting correspondence and interaction between the sustainable building industry and the fire protection industry. We informed FPA Australia of what we found to be the most effective form of communication, in order to continue to improve communication between fire protection and sustainable building industries.



## FINDINGS

In this chapter, we present findings regarding the challenges and opportunities associated with the incorporation of fire protection and sustainability into the design of buildings throughout Australia. The information is organised in terms of holistic approach to design, incentives for fire protection and sustainable building, rating schemes, and communication.

Since most of our interviews were with representatives from the fire protection industry, most of our findings reflect their perspectives. We were, however, also able to interview some individuals involved with sustainable building, so our findings were informed by some of those perspectives as well. However, it is important to note that these findings are limited by the relatively small representation of sustainable building experts.

### Holistic Building Design

Instead of simply adding regulations and requirements to enforce strict policies, several fire protection experts recommended more collaboration between the two industries during the building design process. Many of the fire protection experts stated that if people could see the big picture problem resulting from the fields working independently of one another, they would be more likely to address the issue in a constructive way. Holistic design allows for communication between various engineers, architects, designers, and builders in order to attain a final product that satisfies all fields. Many fire protection experts reported that the current design process sometimes lacks this cooperation between fire protection engineers and sustainable design experts.

**Both fire protection experts and sustainable building experts argued that in order to construct a sustainable and fire safe building, all designers and engineers should be involved with the building design process from the beginning.**

Most of the fire protection experts that we interviewed think that the fire protection industry and the sustainable building industry should collaborate at an earlier stage. Arup is one company whose holistic approach to building design has produced several successful outcomes. Peter Johnson from Arup described the approach his company takes to building design as *total engineering*. According to Mr Johnson, a building designed with total engineering will provide for better overall construction and better suit the people who will utilise the building. In Mr Johnson's view, sustainable design and fire protection should merge into one industry. He felt that one way to accomplish this goal would be to provide fire protection information to architects so that they would be more knowledgeable when drafting building designs.

Another company that incorporates sustainability and fire engineering into its building design is Umow Lai. Dr Weng Poh, the Associate Director and Principal Fire Engineer of Umow Lai, shared his company's philosophy. He conveyed that Umow Lai encourages experts and engineers from different disciplines to work together on projects. Dr Poh explained that this promotes communication and learning between fire protection engineers and Ecologically



Sustainable Development (ESD) consultants. He explained that by collaborating in the same work space, both sides can discuss decisions about designs in person.

Several of the experts mentioned that some current building design projects do not follow a holistic approach. Justin Leonard of CSIRO believes that individuals involved with the design process are primarily concerned with their own business, and that this is not conducive to a collaborative environment. He thinks that architects, designers and engineers are mainly concerned with their part of the project but do not attempt to communicate with other parties involved in the design process. Alex Webb, also of CSIRO, added that fire protection engineers get involved at a very late stage in the building design process. This poses a problem for older buildings that undergo renovations. For example, Paul Verheijden of Integrated Fire Services explained that fire sprinkler layouts are difficult to modify after a building is constructed.

**Several fire protection experts recognised that a transition to holistic design might be a challenging process because of the restrictions of the Building Code of Australia.**

Several experts argued that the Building Code of Australia (BCA) already covers fire protection, warranting no need for change. Russell Porteous, the treasurer of FPA Australia, felt that the BCA does address both the concerns of fire protection and sustainability, and saw no reason to have extra collaboration. An Australian Building Codes Bureau (ABCB) representative agreed with Mr Porteous' viewpoint. However, the representative went on to say that most of the problems between sustainability and fire protection occur when a building adds either sustainable design aspects or fire protection aspects without considering the effects on the other.

While changes are being made to the BCA each year, a building regulation expert suggested that it is nearly impossible for the BCA to keep up with the rapidly evolving sustainable design industry. Tim Adams commented that the guidelines in Section J of the BCA entitled *Energy Efficiency* are constantly changing. While, Mr Adams mentioned that the BCA coming out 1 May 2011 will include lighting specifications, he also recognised that the BCA does not cover all aspects of sustainable design. Mr Adams explained that each year the BCA adds some new sustainable building regulations, but there are often many areas of sustainable design that are not included.

In contrast to the rapidly evolving field of sustainability, several fire protection experts explained that the fire protection industry may be slow and resistant to change. James Fox, CFA Chief Officer, believes that the fire protection industry might have to convince its own organisations to change before it tries to change the rest of the building industry. Mr Fox voiced his concern that the fire protection industry is very traditional and proud of its past. As a result, he stated that the fire protection industry can sometimes be resistant to change. Various building experts explained that the move to a more holistic design will be difficult and time consuming for everyone involved, but will lead to a safer more sustainable future.

## Incentives for Promoting the Construction of Fire Safe Buildings

A major theme among fire protection experts interviewed was that life safety is the first and foremost responsibility of fire protection systems in Australia. The BCA is written to provide fire protection measures that focus primarily on life safety (BCA, EO1). According to several fire protection experts, the BCA does not focus enough on fire protection of building property. Therefore, the building itself can require significant renovations using materials, resources, and capital to repair damages caused by a fire. Several experts stated that this was not a sustainable way to approach building fires.

**Most fire protection experts identified life safety as one of the primary incentives for creating fire safe buildings, as outlined in the Building Code of Australia.**

According to an ABCB representative, the BCA is written with life safety as its primary objective. Several fire protection experts stated that the BCA provides the requirements for constructing a building that is fire safe. We have heard many fire protection experts say that most building designers and owners were simply trying to meet the minimum fire safety requirements as outlined in the BCA. The BCA is law, and as such it is mandatory that all buildings meet the regulations provided. The BCA attempts to ensure that the building occupants will be safe, that the fire brigade can extinguish a fire efficiently, and that the neighbouring buildings will not catch fire. Several fire protection experts explained that while this is very important, it does not mean that the regulations in the BCA will prevent a building from burning down. A few experts also pointed out that a burning building releases large amounts of carbon emissions into the atmosphere, and is thus very harmful to the environment.

James Fox of CFA pointed out there are no incentives for constructing a fire safe building; instead, he argued, there are negative reinforcement for constructing buildings that are not fire safe. Negative reinforcement generally includes fines and penalties for buildings that do not meet the requirements of the BCA. While there are some incentives for constructing fire safe buildings, these incentives are not always apparent. Andre Mierzwa from FM Global explained that there are reductions in insurance premiums for buildings that include outstanding fire protection measures. FM Global does extensive research on buildings to determine the level of fire risk in the building, and ascertain if the fire protection measures are enough to counteract that risk. However, many of the fire protection experts that we interviewed were unaware of those incentives.

**A few fire protection experts indicated that some organisations see reasons for going beyond the BCA to achieve higher levels of fire safety.**

Some experts have seen buildings go above and beyond the minimum amount of fire protection outlined in the BCA. These occurrences are not seen as the trend but rather as anomalies. Alex Webb stated that he had seen some larger corporations becoming more fire safe

in an effort to increase the occupational health and safety of their employees. Warren Knight, a building surveyor from the city of Melbourne, explained that some companies increase their fire protection methods to ensure the longevity of their business. Other fire protection experts had seen similar occurrences but stated that each one had a relatively specific reason for these increased fire protection systems. For example, Mr Fox discussed that Royal Australian Mint buildings include extreme fire protection measures simply because of the valuable contents of the buildings. Carlos Santin, the Executive Officer of Ozone Protection, mentioned that certain military and governmental buildings require extra fire protection methods to safeguard secret information.

**Several fire protection experts reported that fire safety is often taken for granted by the public until there is a catastrophic loss of human life.**

We heard from several fire protection experts in the field that since the chance of building fires is low in most of Australia, people are not particularly concerned about fire safety. Numerous fire protection experts stated that it usually takes a catastrophe to cause people to be concerned about fire safety. In some ways, the Black Saturday bush fires in Australia in 2009, which killed 173 people, allowed for this sudden awareness. Chris Wyborn, from CFA, was involved in the Royal Commission's Findings, and he explained that these devastating fires created a shift away from biodiversity back to life safety. In addition to this devastating event, Chris Wyborn also mentioned the Childers Hostel fire, which killed 15 backpackers. This catastrophe in Northern Queensland resulted in alterations to legislation to better address commercial fire safety.

Fire experts even agree that there are a small number of deaths related to fire in Australia. Numerous fire protection experts told us that because of the relatively small number of fire related deaths in Australia, most people see no reason to increase the fire protection of buildings. However, Mr Verheijden pointed out that if Australia did not have such strict policies with regard to fire, then these numbers would most likely be much higher. The fire fatalities are much higher in the United States, and Mr Verheijden suggested that this is due to the fact that the fire regulations are not as strict. Regardless of the number of fire fatalities, most fire protection experts suggested that the fire protection industry needs to better market its efforts in sustainability. We heard from Mr Porteous that the fire protection industry needs to find a way to make fire protection "sexy," to appeal to people in a way that would convince them of its importance.

### **Incentives for Promoting the Construction of Sustainable Buildings**

Experts from both the fire protection industry and the sustainable building industry suggested that sustainable building is very appealing to a wide variety of people due to the incentives that it offers. A variety of experts view the financial and economic factors as major incentives for sustainable building. According to many building experts, there is a growing societal pressure to become more sustainable.

**Many fire protection experts reported government incentives such as minimum energy efficiency requirements in the BCA that have led to an increase in sustainable buildings.**

Though the BCA is not exactly an incentive, it provides government regulations to encourage sustainability. Section J, entitled “Energy Efficiency” was recently added to the BCA to provide minimum requirements for buildings to be more sustainable in their energy consumption. Commissioner Tony Arnel, of the Victorian Building Commission, explained that adding Section J to the BCA is just one policy instrument that is being used to deliver energy efficiency. Commissioner Arnel stated that this legislative tool is used globally, and has been found to be very effective. Commissioner Arnel indicated that legislation to increase the sustainability of buildings can bring about positive environmental impacts.

**In addition to meeting energy efficiency regulations, several fire protection experts noted that sustainable buildings also offer economic and financial benefits that make them attractive to building owners and occupants.**

Several fire protection experts said that financial motivations are closely associated with sustainable building. Building experts stated that building owners have realised that they can charge higher rent from tenants based on the sustainability rating of a building. According to several fire protection experts, rating schemes such as the Green Star Rating Tool have contributed to this economic advantage. Peter Wilkinson, from Fire Protection Association United Kingdom (FPA UK), stated that if there is a financial incentive for a prospective buyer to consider a particular building, the building owner has motivation to find ways of making the property appealing. Overall, fire protection experts agreed that sustainable building is a thriving industry because of the increased amount of money charged to tenants, and considered economic factors as the primary incentives for creating sustainable buildings for tenants. In addition, many building experts also noted that a more sustainable building leads to energy savings for tenants, which reduces the overall running costs in the long run. Peter Wilkinson explained that lower energy costs of a building over its lifespan would be a significant incentive for a prospective buyer.

A few office buildings are moving towards sustainable work environments in an attempt to increase productivity. Umow Lai, a building design consulting firm, recently moved into a building that received a six star rating on the Green Star Rating Tool. According to a study done by an independent consultant, the overall productivity increased by 13 per cent in this new work environment. These data were obtained through surveying staff members before and after the move. A similar study was done by the Victoria Building Commission, where Commissioner Tony Arnel reported an increase in worker productivity by 4 per cent since relocating to the Goods Shed North building in Melbourne. Increased worker productivity might show a direct correlation with economic productivity. With the results of these studies, Umow Lai and the

Building Commission are trying to serve as model organisations which utilise sustainable working environments in an attempt to increase productivity.

**Several experts from the building industry mentioned that social responsibility plays a role in the construction of sustainable buildings.**

Many building experts indicated that people are increasingly concerned about their impact on the environment. Several fire protection experts noted an increase in clients' requests to become more sustainable. With this growing concern, these clients are taking on the responsibility of cutting back on energy consumption, water consumption, and use of non-renewable resources. Some of our interviewees stated that by choosing to live or work in a sustainable building their clients feel they are "doing the right thing" and helping to preserve the planet for future generations. In addition, Dr Jonathan Barnett of AECOM stated that tenants are willing to pay more for environmentally sustainable features in an attempt to improve their public image. Dr Barnett also explained the societal pressures associated with sustainable buildings. He described the "feel good" sentiment that people express when they live in a sustainable building. This sentiment drives a person to feel that they have made a positive contribution to society. In addition, Peter Wilkinson defined sustainability as being "trendy." Many experts in both fields mentioned the idea of sustainability being popular and appealing. These experts also stated that people are inclined to join the sustainable building movement because of their concern about the environment.

### **Motivating the Integration between Fire Protection and Sustainability**

Current sustainability rating systems do not incorporate fire protection into their categories for rating. Some experts believe that this is a mistake, because fire protection can add to the lifetime of a building and thereby increase the sustainability of the building. Experts suggested several options for incorporating fire protection into rating buildings.

**From a fire protection standpoint, the Green Star Rating Tool considers the individual characteristics that make a building sustainable, but does not necessarily consider the lifelong sustainability of a building.**

The Green Star Rating Tool includes many categories that determine the sustainability of buildings. These include but are not limited to water usage, energy usage, indoor environment quality, and materials used (Wilson, 2006). The idea behind the rating system is that those buildings that add more sustainable design aspects are rewarded with a higher number of green stars. Of course, there are inherent decisions that builders and designers must make in order to ensure fire protection measures provide safety to future building occupants. Several fire protection experts whom we interviewed were concerned that during the design process the number of sustainable features sometimes becomes more of a priority than ensuring fire safety.

Several experts in fire protection expressed concern with the checklist of criteria involved in the Green Star Rating Tool. Dr Poh described this checklist as somewhat misleading because it does not factor in aspects of the overall building design. In some cases these aspects might be incompatible with fire protective measures. Dr Poh stressed the need to have active lines of communication between engineers, architects, and designers to address all aspects of the design on a case by case basis. Similarly, Justin Leonard described how “the ticking of boxes in a checklist” is not a realistic way to examine the full cradle-to-cradle design of a building. He felt that the tendency is to go above and beyond in the area of sustainability for a building, but not dedicate the same amount of time and effort to fire protection.

**Some fire protection experts believe that fire protection measures should be incorporated into existing rating schemes, while others argue for new rating schemes or additions to the Building Code of Australia.**

Many professionals expressed a desire to incorporate fire protection into the current Green Star Rating Tool. The existing system rates buildings on different features of sustainability, but many fire protection experts believe that fire protection is an important aspect of sustainability. Many professionals that we spoke to reiterated the fact that when a building burns to the ground, it is not sustainable. Mr Knight observed that building fires release a large amount of carbon emissions into the atmosphere. In addition, Mr Knight explained that there are increased carbon emissions from building reconstruction and more materials are used. Some fire protection experts stated that by adding fire protection to the already existing Green Star Rating Tool, some of the long term sustainability concerns could be addressed. Greg Buckley from New South Wales Fire Brigade pointed out that if comparing two buildings with no chance of fire, the one without fire protection measures will actually be more sustainable. Unfortunately it is impossible to predict which buildings will have fires. Mr Buckley suggested that in the case of fire, it is probable that a building with good fire protection measures will contain or extinguish the fire, and a building without good fire protection measures will burn to the ground.

While supporting the idea of incorporating fire protection into the Green Star Rating Tool, many experts recognised this would be difficult to accomplish. One fire protection expert discussed the use of risk calculation to determine the relative risk of fire in a building. With this method, it would be possible to include fire protection into the Green Star Rating Tool. Many experts told us that simply putting extra fire protection measures into sustainable buildings is not necessarily the most effective solution. For example, FPA Australia’s Mr Wright explained that depending on the contents of a commercial building, the appropriate fire protection measures will vary. Mr Knight explained that a risk analysis must be performed to quantify the risk of fire in a building and the amount of potential damage that could be caused. This number could then be compared to the potential monetary and environmental costs of installing extra fire protection measures. From this calculation, it would be possible to determine if it would improve the sustainability of a building to include more fire protection measures. Mr Buckley even suggested an equation that could be used to calculate whether or not to include more fire



protection standards. As seen in Mr Buckley’s emailed response in Appendix H, his equation considers the cost of water testing, the carbon emissions from fire, costs of building replacements after fire damage, and additional factors. This calculation would be challenging due to the assumptions that would be made based on the probability of a fire of a certain severity. However, Buckley believes the calculation would provide the Green Star Rating Tool with a useful value that could be included in the sustainability rating of the building.

Other experts believed that it is unreasonable to try to incorporate fire protection into the Green Star Rating Tool. They believe that a separate system should be created to rate buildings simply based on the fire protection of the building. This system would be similar to the Green Star Rating Tool but would take into account sprinkler systems, fire doors, smoke alarms, and fire escapes instead of sustainability factors. Mr Porteous suggested a “Red Star Rating Tool” that would rate buildings on a similar 6 star rating system. Mr Porteous suggested that buildings with top of the line fire protection methods would be granted 6 stars. According to Mr Porteous, people would feel safe living or working in these buildings. Dr Poh suggested a “Negative Flame Rating Tool” that could determine the relative risk of fire in a building. Both of these fire protection experts specified that these systems should be separate from the Green Star Rating Tool and would most likely be easier to implement.

### **Encouraging Communication between the Fire Protection Industry and the Sustainable Building Industry**

Throughout our interviews, we asked experts where they received most of their information in an attempt to find effective methods of communicating with both industries. We found that most experts in the fire protection industry and the sustainable building industry drew on journals and conferences to further their learning within their fields. However, there was little to no overlap between the journals and conferences that these experts used, making it challenging for us to target one specific medium.

**Both fire protection experts and sustainable building experts receive information primarily from their own journals and conferences with little interchange of ideas between the two groups.**

Experts from both industries reported that they receive the majority of their information through journal articles and conferences. All of the experts agreed that the most effective way to educate both industries would be through these media. However, the industries currently draw on different journals and conferences and there are no common venues to encourage sharing of ideas and research.

Most fire protection experts in Australia receive FPA Australia’s quarterly magazine *Fire Australia* and the journal *Fire Risk Management*, produced by the Institute of Fire Engineers. These two publications were suggested by multiple experts as an effective way of educating the fire protection industry in Australia about concerns related to specific sustainable design aspects.

This would also be a good way to educate fire protection organisations of ways that they can make their fire protection systems more sustainable.

The sustainable building experts that receive journals concerning sustainability mainly received different journals. Commissioner Tony Arnel and many other experts receive sustainable information from the Victoria Building Commission's quarterly magazine *Insites* as well as the Building Code of Australia. Owen Gooding, from the Department of Sustainability and Environment, receives information through *Green* magazine. Some building experts receive information from the magazine *Ecolibrium* as well as from the Building Designers Association of Victoria's publication *BDAV news*.

There was a general consensus among those interviewed that a conference including the sustainable building industry and the fire protection industry would be beneficial in establishing more communication between the two industries. This conference would allow for debate and discussion between these industries. Fire protection experts told us that they attend a large number of conferences each year and would be willing to attend conferences about incorporating sustainability into fire protection.



## RECOMMENDATIONS

This study revealed a need for further collaboration between the fire protection industry and the sustainable building industry. Through our interviews, we heard a variety of opinions about how and why these industries have not been well integrated and the ways in which these industries can work more closely together. In this chapter we present recommendations regarding the next steps that the Fire Protection Association Australia might take to advance this conversation in Australia. These recommendations are aimed primarily at raising awareness about sustainability among FPA Australia members, and increasing communication between the fire protection and sustainable building industries.

**We recommend that FPA Australia develop and promote a definition of sustainability for the fire protection industry.**

Through our interviews and background research, we heard several different views about the definition of sustainability. Based on conversations with fire protection experts, we have attempted to define sustainability with regard to fire protection to provide a starting point.

*Sustainability within the fire protection industry involves application of fire safety systems and design measures that support and promote building characteristics that are environmentally friendly during the buildings' daily use. These systems and designs must reduce the fire risk and impact that such characteristics and uses might contribute to throughout the full life expectancy of the building. Daily use characteristics include reducing harm to the environment by minimising energy consumption, water consumption, material consumption and fire risk.*

**We recommend that FPA Australia survey its members, to further explore the opportunities for integration and communication between the fire protection and sustainable building industries.**

The goal of a survey would be twofold. The first objective would be to prompt fire professionals to think about the role of sustainability in the context of their work. The second objective would be to generate statistical evidence that FPA Australia can use to further awareness within the fire protection industry about sustainability and its impact on fire protection.

FPA Australia hopes to raise awareness about the relationship between fire protection and sustainability. We have drafted a short survey that FPA Australia can circulate to acquire quantifiable data regarding members' views. The survey questions were formulated based on our interview experiences and the themes that were commonly heard throughout. We created multiple choice questions for easy analysis. The survey, included as Appendix I, is meant to extend the work of our project. The interviews that we conducted were only a small number of the fire protection professionals that FPA Australia is interested in. Through the use of this

survey, FPA Australia will be able to gauge what kind of action plan would best address the fire protection industry.

**We recommend that FPA Australia host a conference for its members focused on the topic of sustainability, as well as a joint conference with professionals from the sustainable building industry to build consensus about integrating fire protection and sustainable building.**

Many conferences are held each year by FPA Australia but none are dedicated solely to the topic of sustainability. We suggest that the first step for FPA Australia should be to organise a discussion through the format of a national conference in order to define what sustainability means for the fire protection industry. Once the fire protection industry obtains objectives for sustainability, fire protection experts will be in a better position to interact productively with the sustainable building industry. Following this conference, we suggest that a combined conference between FPA Australia and a sustainable building organisation will foster learning and understanding between experts in both fields. We propose that FPA Australia provide information at these conferences to both industries and provoke discussion and debate in a constructive manner.

We recommend that some of the experts who currently work for companies that incorporate sustainable building and fire protection into their design present at these conferences. Leading fire safety specialists Jonathan Barnett from AECOM, Peter Johnson from Arup, and Weng Poh from Umow Lai would be effective keynote speakers on the issue of a design process that considers sustainable building and fire protection.

Subsequent speakers could address specific fire protection industry topics related to sustainability like fire sprinklers, atria design, and types of insulation. A conference including such high-level experts as speakers would require a significant amount of planning by FPA Australia. However, if advertised to the fire protection industry effectively, this forum would allow differing views and possible solutions to be discussed.

**We recommend FPA Australia publish an article in *Fire Australia* to provide awareness about the relationship between fire protection and sustainable building design.**

The purpose of this article would be to raise awareness regarding the relationship between sustainable building design and fire protection and to direct people to the FPA Australia website where they can receive more information. The article could be the Executive Summary from this report.

**We recommend that FPA Australia’s website include more information about sustainability in the context of fire protection.**

We recommend adding a link to FPA Australia’s website to inform the fire protection industry about the opportunities for the fire protection industry to become involved in sustainability and actions that the fire protection industry can take to be more sustainable. We recommend that FPA Australia provide information on its website including:

- A definition of sustainability that is applicable to the fire protection industry
- Examples of other attempts to integrate sustainable building design and fire protection from around the world
- A blog or interactive tool to allow experts to further discuss and debate
- Appendices A-D to allow experts in the field to compare specific technologies
- A link to this report

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## Appendix A: Table of Sustainable Materials Considering Fire Protection

Material	Sustainable View	Fire Protection View
Timber <sup>a</sup>	Renewable resource	Burn at high rate and high temperature, contributes to faster spread of fire
Insulation Foam <sup>b</sup>	Helps to regulate the indoor temperature without the use of electricity	Used for building support, so when burned it weakens the structural integrity of the building. Structures can collapse due to melting caused by fires.
Cellulose nanofibrils, graphene, and Halloysite <sup>c</sup>	Lessen the impact of halogen fire suppressants on the ozone	Currently in development, unsure of unintended consequences
GFRP <sup>d</sup>	Large carbon footprint	Fire resistant material, often used in floors

*Note.* The data above has been taken from the following sources: a (Lie, 2010), b (Tidwell, 2010), c (NIST, 2010) d (Correia, 2010)



## Appendix B: Table of Sustainable Design Considering Fire Protection

Design Aspect	Sustainable View	Fire Protection View
<b>Atria</b>		
Atrium <sup>a</sup>	Increases light in large buildings to decrease energy consumption	Difficult to detect and extinguish fires
Vertical/Horizontal Curtains <sup>b</sup>	Block open layout design in an atrium	Separate and compartmentalise floors to prevent fire spread
Dilution Method <sup>c</sup>	Atrium concept remains	Forced air prevents smoke from entering other levels
<b>External Designs</b>		
Sun Screen <sup>d</sup>	Reduce heat in building to lower AC costs	Materials could be harmful to fire fighters
Sun Shade <sup>e</sup>	Reduce heat in building to lower AC costs	Materials could be harmful to fire fighters
Sky Light <sup>f</sup>	Increase light in rooms to decrease energy consumption	Cause structural weaknesses in ceiling
Vegetated Roofs <sup>g</sup>	Produce oxygen	Weight causes structural weaknesses in building. Plants can catch fire.
<b>Natural Ventilation</b>		
Open Central Stair <sup>h</sup>	Part of energy efficient natural ventilation system	Could allow extensive fire spread
External Ventilation Cavity <sup>i</sup>	Part of energy efficient natural ventilation system	Could allow fire spread between levels in a building

*Note.* The data above has been taken from the following sources: a (Chow, 2005), b (Foley, 2007), c (Foley, 2007), d (Mahlman, 2007), e (Mahlman, 2007), f (Mahlman, 2007), g (Tidwell, 2010), h (Stratton, 2007), i (Stratton, 2007)

## Appendix C: Table of Sustainable Power Devices Considering Fire Protection

Power Devices	Sustainable View	Fire Protection View
Wind Turbine <sup>a</sup>	Produce energy for the building	No shut-off switch in the case of a fire, could cause harm to fire fighters.
Solar Panel <sup>b</sup>	Produce energy for the building	Extra weight on roof causes structural weaknesses in the case of a fire
Hydrogen Fuel Cells <sup>c</sup>	Emit less greenhouse gases than carbon fuels	Compressed hydrogen or natural gas vessels, which could explode in a fire

Note. The data above has been taken from the following sources: a, b, c (Tidwell, 2010)

## Appendix D: Table of Sustainable Extinguishing Devices Considering Fire Protection

Extinguishing Devices	Sustainable View	Fire Protection View
Sprinkler System <sup>a</sup>	Wastes water on test runs.	Extinguishes fire quickly when personnel are not present
Hybrid Fire Extinguisher <sup>b</sup> FM200	Less damaging to ozone than halon gases	Large quantity of suppressant needed
Innergen <sup>c</sup>	Mostly environmentally friendly by releasing 100% nitrogen gas	Requires additional manufacturing when switching from halon containers
Water Insulated Walls <sup>d</sup>	Uses a lot of water in order to fully insulate the wall	Makes it more dangerous for fire fighters to create alternative exit points if necessary
Alternative Devices		
VESDA (Very Early Smoke Detector Alarm) <sup>e</sup>	Replaces sprinkler systems and thus saves water used in testing	Does not extinguish fire, only alerts local fire brigade

*Note.* The data above has been taken from the following sources: a (Wieczorek, 2010), b (Wierenga, 2001), c (Barnett, 2011), d (Harmathy, 2010), e (Verheijden, 2011)

## **Appendix E: Interview Protocol**

### **Introduction**

We are a group of students from Worcester Polytechnic Institute (WPI) in the United States who are conducting a project on the Design of Buildings that are Fire Safe and Sustainable on behalf of FPA Australia.

We hope to learn your perspective on the topics of fire protection and sustainable design through this discussion. With your permission we would like to record our interview with you for information to be used in our paper. We will include a summary of our interview, which we will submit to you for review before it is included. Please be aware that you are not obligated to answer any of these questions, and we are willing to exclude any information that you wish to keep discreet. Will you let us record this interview? Will you let us use your name and position in our report?

### **Interview Questions**

What experience do you have working within the fire protection/sustainable design industry?

What does your job entail?

### **Challenges Faced**

Some new sustainable buildings are being built without sprinkler systems which are a large part of making a building fire safe. This is one example of how sustainable building and fire protection can sometimes conflict.

Do you see one consideration (sustainable building or fire protection) as more important than the other? Why?

What do you believe are some reasons for this conflict?

### **Incentives**

What do you think are the primary incentives for constructing a building that is sustainable?

How do these differ from incentives for constructing a building that is fire safe?

Are you aware of the Green Star Rating Tool for sustainable buildings? Currently Green Star does not include criteria for fire safety in their sustainability evaluation of buildings.

Should fire protection measures count towards achieving a higher Green Star Sustainability

Rating of a building? (If they don't explain, ask them to explain their reasoning.)

### **Fire Protection and Sustainability**

Can you give any examples of specific problems that you have seen in integrating fire protection and sustainability?

### **Opportunities**

In the future, what opportunities do you see for combining these two fields in order to construct buildings that are both fire safe and sustainable?

What are the barriers for combining these two fields in order to construct buildings that are both fire safe and sustainable?

### **Social Implications**

In your job, what changes have you seen in your clients' requests to become more sustainable?

In your job, what changes have you seen in your clients' requests to become more fire safe?

How have you addressed these requests?

What positive impacts do you foresee if the fire protection industries and sustainable building industries worked together?

### **Deliverables**

Where do you receive information from regarding fire protection?

Where do you receive information from regarding sustainable design?

What would be the best ways to convey information to the (sustainable building or fire protection) industry? [Whichever the interviewee is a part of]

### **Follow-up Leads**

Is there anything else that you would like to share with us?

Who would you recommend that we contact to further our understanding of the issues facing the fire protection and sustainable building industry? (Especially sustainable building industry)

## Appendix F: Table of Interviewees

Name	Organisation(s)	Position(s)	Specialty
ABCB Representative	Australian Building Codes Bureau	N/A	Building Regulations
Arnel, Tony	Victoria Building Commission, Green Building Council of Australia	Building and Plumbing Commissioner, Chair: GBCA	Sustainability
Adams, Tim	Building Designers Association of Victoria	President	Sustainability
Barnett, Jonathan	AECOM	Technical Director Fire Life Safety, Australia and New Zealand	Fire Protection
Buckley, Greg	NSW FB	Assistant Director of Built Environment and Research	Fire Protection
Chladil, Mark	Tasmania Fire Services	Management Planning Officer	Bushfires
Davis, Rob	Fire Design and Commissioning	Fire Engineering Manager	Fire Protection
Fox, James	CFA	Chief Officer	Fire Protection
Gibson, Michael	Kay & Burton	Managing Director	Sustainability
Gooding, Owen	Department of Sustainability and Environment	Policy Officer	Bushfires and Sustainability
Hughes-Brown, Benjamin	Defire	Private fire safety engineer	Fire Protection
Johnson, Peter	ARUP	Fellow	Fire Protection and Sustainability
Jurgeit, Christopher	FPA Australia	Chair, NSW	Fire Protection
Knight, Warren	City of Melbourne Building Team	Executive Officer	Building Survey
Lee, Barry	Lee Fire Management Pty. Ltd.	Principal	Fire Protection
Leonard, Justin	CSIRO	Ecosystem Sciences Division	Bushfires and Sustainability
Mierzwa, Andre	FM Global	Australian Operations Chief Engineer	Fire Engineering for insurance risk assessments
Poh, Weng	Umow Lai	Associate Director Principal Fire Engineer	Fire Protection and Sustainability
Porteous, Russell	FPA Australia & Maintenance Essentials	Treasurer: FPAA CEO: Maintenance Essentials	Fire Protection
Santin, Carlos	FPA Australia	Executive Officer- Ozone Protection	Sustainability and Fire Protection
Verheijden, Paul	Integrated Fire Services	Principal Fire Engineer	Fire Protection
Webb, Alex	CSIRO	Industrial Research Services	Fire Protection
Wilkinson, Peter	FPA United Kingdom & Loughborough University	Fire Engineer  Professor	Fire Protection
Wyborn, Chris	CFA	Acting Manager Community Safety of Southern Metro	Fire Protection

## Appendix G: Interview Summaries

### ABCB Representative

In an interview with a member of the ABCB, we learned that the Building Code of Australia (BCA) has four main objectives. All four of these objectives are important, but the protection of human life is the first priority. Our source feels that the building code, if followed exactly, wouldn't create any problems between the industries of fire protection and sustainability. The problem comes when the designer improves on one of these aspects while not considering the impacts that these changes have on other industries.

This difficulty could be addressed with more communication between the two industries. Sustainable designs are often created with good intentions, but the designer is sometimes unaware of the issues that this design poses for fire safety. While it can sometimes be difficult for designers and organisations to meet all of the building codes, it is required by law and ensures safety.

Our source doesn't feel that there is anything preventing the creation of buildings that are both fire safe and sustainable. However, it would be a challenge for both the sustainable and fire protection industries in that it would require a large amount of communication. The recommended way of communication would be through journals and conferences. The source recommended that the fire protection industry needs to treat sustainability with respect, yet should not be afraid to address issues that impact fire safety.

Our source outlined the fact that there weren't incentives to construct fire safe buildings, just the fact that all buildings must be up to code. One suggestion was there should be a reduction in insurance premiums as an incentive for safer building designs. Energy efficiency is part of the Building Code of Australia's requirements, and there have been monetary incentives to push companies to become more sustainable. Sustainability is also seen by society as a good initiative and can often be marketable. The idea of including fire protection designs as part of the Green Star rating tool would require that the fire protection industry shows that it would help achieve the objectives of Green Star. Including an objective such as reducing losses from fire would be effective in incorporating fire protection into the Green Star Rating Tool. While including fire protection incentives in the Green Star Rating Tool could be a step forward in the integration of these two fields, it could be very difficult. In addition, the Green Star Rating Tool is a voluntary program, so it would not create a legislative regulation.

### Adams, Tim

Tim Adams specialises in building design and construction. He is the President of the Building Designers Association Victoria. Mr Adams has experience working with bush fires. He has volunteered in the past to participate in a Bell Rating program for buildings coordinated by the Victoria Building Commission.

Mr Adams was a proponent of integrated building design for architects to be able to work with engineers on promoting fire safe and sustainable buildings. Mr Adams pointed out the limitations of the Green Star Rating Tool. Currently there is no Green Star template for single

unit residential buildings, only multi-unit residential buildings. He maintained that the Building Code of Australia contains all the Australian standards necessary to construct buildings. Victoria requires 5 star energy efficiency for a building fabric: walls, insulation, windows, and roof. This excludes appliances and lighting within the building. Starting 1 May 2011 there will be a new regulation for lighting which allows 5 Watts or less per square meter. Further regulations might address energy efficiency with regard to heating and cooling.

Mr Adams identified several incentives for building sustainable buildings. The first incentive mentioned was the human comfort experienced by living in a sustainable building.

The second incentive would be the money saved by using sustainable building designs and energy efficient appliances. For fire protection incentives, Mr Adams discussed how life safety is covered in the BCA but not necessarily building safety.

Mr Adams talked about how until recently buildings were built without considering sustainability. Buildings used to be designed almost solely on aesthetics but now comfort and energy efficiency are important considerations. He acknowledged that Australia is the world's number one emitter of greenhouse gas emissions per capita. Now, however, he has witnessed a focus on buildings. A result of this is the Carbon Tax which the government of Australia is proposing to reduce carbon emissions and increase energy efficiency. Mr Adams has seen more sustainability requests for building designs but no requests for increased fire safety.

Mr Adams attends BDAV conferences and BDAV monthly workshops.

## Arnel, Tony

Tony Arnel is the Victorian Building Commissioner and also the Victorian Plumbing Commissioner. Commissioner Arnel works as a state regulator for buildings.

Victoria's building industry is worth approximately 25 billion dollars yearly. Victoria is one of the most productive states in Australia in relation to building work. With 23,000 Building Practitioners that are registered by the Victorian Building Commission, the commission works as an investigative body and is a separate government entity that works as a statutory body. The commission reports to a Minister, similar to a state legislature.

The Building Code of Australia applies nationally but each state administers the code separately. The building industry is seen as a way to improve sustainability at the least cost, while still providing good outcomes. Commissioner Arnel explained that regulations are one policy instrument used to encourage energy efficiency.

Commissioner Arnel's work as the Plumbing Commissioner incorporates considering the use of water in fire protection, while also considering the impacts on sustainability. He works in the refurbished Goods Shed North Building in Docklands. The Good Shed Building is 130 years old, and was originally used as a storage facility for various products to get shipped throughout Victoria. It was created as an example of sustainable building along with adaptive reuse. The Good Shed Building was the first heritage building in the state of Victoria to achieve a 5 Star Rating. The Victorian Building Commission used this building to demonstrate leadership to other industries, and encourage more sustainable retrofitting of heritage buildings. The building uses rainwater harvesting through a roof collection system. The rainwater is filtered through a pump and used throughout the building. The building does not have sprinklers, but it does have a VESDA system, which allows for efficient smoke detection to alert occupants to get out of a building in the case of a fire. A fire engineer designed the VESDA system and fire safety aspects as part of an alternative solution to satisfy the Performance



Requirements of the BCA. A building surveyor was then brought in to assess this system.

Based on these expert opinions, the building was approved. By moving into the Good Shed Building, the workers were found to be 4% more productive. This increase in productivity can be attributed to the sustainable work environment that provides a comfortable, unique, and clean work place.

For a long time, sustainability was regarded as somewhat experimental. However, the theory of passive design demonstrates that sustainability has been around for a long time. While the concept of sustainable building is seen as something new, most of the technology principles are not at all new. Sustainable building is becoming a popular movement worldwide. There is a world council rating that has 80 countries affiliated with it. However, there is not one single rating system that all of these countries follow. Instead, there are several different systems, mainly specific to each country, but with the same principles and ideas.

The task of making already existing buildings more sustainable has been one of the most challenging according to Commissioner Arnel. By working with just new buildings, Commissioner Arnel explained that they cannot change enough buildings to make a real sustainability impact. There is a need for a program to deal with already existing buildings. As a result, Melbourne is currently working on a project known as 1200 Buildings. The idea behind this project is that 1200 existing commercial buildings will be retrofitted to become more sustainable. The project is based on owner driven investments. While there are no direct government incentives, there will be taxation breaks. The buildings are not required to get a Green Star Rating, but they do have certain sustainability guidelines that they have to meet.

The growing demand for sustainability can in part be contributed to the fact that tenants want to live and work in sustainable buildings. Tenants are becoming more concerned about indoor air quality. By using less toxic paints and more environmentally friendly carpets, the building can be more sustainable and improve the indoor air quality.

Commissioner Arnel identified building design as a holistic process that needs to consider life safety, health, and amenity. He recognised that sustainability has been added to the BCA because of its importance in reducing greenhouse gases, decreasing water consumptions, and saving energy and other non-renewable resources. Commissioner Arnel sees sustainable building as a package deal, with many industries working together to achieve the same goals.

With an integrated design, the building will work to full capacity. The addition of new fire technologies could potentially help sustainability. Recently, sustainability has been driving the growth of new technologies. Materials like timber have been reintroduced into the building industry due to their sustainability attributes. However, materials like timber need modern fire protection technologies to make these materials fire safe.

Commissioner Arnel stated that some of the main incentives of sustainability are doing the right thing for the environment and making better commercial decisions. The sustainability movement used to be seen as edgy and experimental, but now if you don't do it, you will be missing out on modern results. Commissioner Arnel explained that it is possible to have many green credentials without compromising fire safety. Since all buildings have to meet the BCA, most occupants assume that if the code is met, the building is safe. The fire safety is not usually a concern because it is often taken for granted.

The Green Building Council of Australia holds an annual conference entitled Green Cities. This past February, the conference was held in Melbourne. The next conference will be in March 2012 in Sydney.

Commissioner Arnel suggested that FPA create a value proposition outlining what FPA Australia can contribute to energy savings and how fire protection can complement sustainability. Commissioner Arnel stated that by raising awareness among FPA Australia members, more people will pick up on the expertise and contribute effectively to sustainability.

## **Barnett, Jonathan**

Jonathan Barnett recently started working at AECOM, but before that he was a fire protection engineering professor at Worcester Polytechnic Institute (WPI) for 28 years. Dr Barnett received a Bachelors and Masters degree in Civil Engineering and then went on to get his PhD in Mechanical Engineering at WPI. In addition to his work at WPI, Dr Barnett also worked in a small fire engineering company in Boston for four years. He is a national leader in fire safety engineering and life safety.

Dr Barnett felt that the size of the facility needed to be considered when assessing the fire risk of a building. In a small building, a fire is seen as a rare event. While residential sprinkler systems can sometimes be beneficial, it is often hard to convince builders of their importance.

Residential sprinklers could potentially reduce the number of fire stations, but the cost benefit of this alteration must be assessed. The money spent to install residential sprinklers could prove to be unnecessary and potentially better spent somewhere else.

In speaking with Dr Barnett, we learned about specific fire protection technologies that work to create more sustainable options. There are three types of options for replacing halons in fire suppression. The best option is the watermist, which proves to be the most environmentally friendly. The second best option is known as Innergen, which is mostly environmentally friendly. The Innergen uses Nitrogen in bottles. The bottles are not the same as the halon bottles, so they require some manufacturing. However, the nitrogen is 100% clean, so the actual gas released to the environment is not harmful. The third option is the FM-200 which is a very simple switch from the halon because it uses the same bottles. It is better for the environment than the halons, but the FM-200 is still somewhat harmful to the environment.

One of the proposed methods of pushing sustainability throughout Australia is seen through the Carbon Tax. The Carbon Tax would charge each household as much as \$800 each year to become “greener.” The current sustainability incentives include economic savings and societal pressures. The economic incentives apply to savings in running costs, which can be quite marketable, particularly to perspective tenants. The feel good incentive applies to people feeling that they are contributing to society in a positive way.

The fire protection industry does not have these same types of incentives. Instead, they just have regulations that spell out what each building requires in terms of fire protection. In the United States, tax cuts are available for people who increase their fire protection. These same incentives are not seen in Australia. There are no tax reductions available for those that increase their fire protection in Australia.

Dr. Barnett sees the Green Star Rating Tool as a good way to incorporate fire protection measures with incentives. Since fire protection systems can benefit both life safety and

sustainability, they should be part of a system like the Green Star Rating Tool. Since adding in fire protection is often very costly, it is best to consider fire protection early on in a project to save money.

The Building Code of Australia's Deem to Satisfy states that a building meets the code in that it is safe to the building occupants, the fire brigades, and the neighbors. The Building Code of Australia does not certify that a building is fire safe, but rather that the occupants can get out in a timely fashion, that the fire brigades can efficiently extinguish the fire, and that the surrounding buildings will not catch fire as a result of the building going up in flames. The Building Code of Australia does not address property damage as a result of a fire.

Dr. Barnett stated that sustainable buildings are always more of a risk in terms of fire protection. However, it is possible to add fire protection measures to compensate for this risk.

Dr. Barnett feels that more sustainable designs are good provided that appropriate protection is used to counter the risks of the sustainable designs.

Dr. Barnett receives most of his fire protection information from Engineers Australia, Society of Fire Safety, various fire protection conferences, the National Board, the Australian Institute of Architects, and FPA Australia. He is personally very interested in sustainability, and he receives most of his sustainable information from the news and various journals.

### **Chladil, Mark**

Mark Chladil is a bush fire specialist who works on the exterior exposure of buildings. He has a background in planning. Mark Chladil's currently works as a fire management planning officer specifically as a bush fire officer. He works on the technical support and scientific support in Tasmania.

Mark Chladil stated that historically fire protection has been more important in that it has been around for longer than sustainability. However, he sees that fire protection is decreasing as sustainability rises. He sees it as a fad among the designers, and he hopes that these two industries will be able to overcome the challenges that are currently preventing them from working more closely together. Mark Chladil sees commercial incentives for these industries collaborate more often.

Mark Chladil mentioned that fire brigades often create intervention models, where they assess communities and determine whether they can accept reduced protection based on the risk analysis. This intervention plan often promotes a higher level of risk, especially with regard to potential fire risk.

The sustainability incentives include regulatory requirements, marketing incentives, and social norms. One of the regulatory requirements is the Building Code of Australia, which has minimum energy efficiency requirements. These regulatory requirements create more demand for specific systems, which promotes more manufacturers and eventually more cost efficiency and choice for the consumers. In addition, there are marketing incentives for start up companies to rent space in a building that is sustainable or has a high Green Star Rating. As the majority of buildings push towards more sustainable options, the growing environmental movement has

become a social norm. Various organisations feel a social responsibility and as a result the market begins to provide more sustainable options.

While fire safety has been in the marketplace for a longer time period, people are still negligent of the fact that buildings are fire proof. It is also a common misconception that buildings burn down at a rate that is slow enough for them to get out of the building. People put a lot of their trust in the fire brigades, and count on them to save lives in all fire situations. Mark Chladil also pointed out that there is not an energy brigade to make up a sustainability protection committee.

Mark Chladil discussed how sustainability also incorporates the life of the building, which is not considered by the Green Star Rating Tool. The Green Star Rating Tool does not discuss the durability of a building or the return of investment on a sustainable building. These considerations often demonstrate that the building returns are much lower than the costs. The Green Star Rating Tool does not do enough to account for the risk of death or injury to a building occupant.

The fire protection industry serves to extend the life of a building and ensure the life of the people in the building. Mark Chladil feels that with these life sustainability contributions, the fire protection initiatives should be worth sustainability credit.

Since Mark Chladil mainly works with bush fires, he has worked to remove vegetation outside of buildings in an attempt to reduce fire risk. He also mentioned that wind turbines can often disrupt biodiversity and have been found to impact migratory paths of birds. The area around the wind turbines is usually cleared to protect the outer shell of the turbines in an effort to prevent the spread of bush fires.

Creating a bush fire safe building is dependent upon the environment. For example, an amber proof building in a tropical environment needs to be fully enclosed with air conditioning, which creates a large ecological footprint. The increasing energy to cool buildings often corresponds with the decreasing fire safety for bush fires. Sustainable aspects such as air flow and shade trees can benefit both fire protection and sustainability. The implementation of vegetative roofs is not very common, but it can result in fire damage if the vegetation is not well maintained.

Mark Chladil also discussed the water supply and water pressure concept with regard to sustainability. He has seen that water mains in towns are sometimes historic and have constraints, but the demand for commercial water is increasing. The design of water mains that boost the water pressure often show more leaks and cause increased maintenance costs. Larger commercial buildings are often designed to operate at a higher pressure, and reducing this pressure can be hazardous.

Mark Chladil feels that the major barriers that are preventing the integration of sustainability and fire protection are the regulations that fail to force people to consider both. Some examples of these two industries attempting to merge are seen in the heritage buildings that use retrofit systems and energy efficiency along with fire protection. Mark Chladil feels that solutions are available to improve the lack of integration between these two industries.

The main objectives of the sustainability community involve creating more energy efficiency in an effort to decrease running costs. The return rate is long term, and often takes decades to retrieve. At the same time, people want to be fire safe, but they are usually unwilling to compromise the aesthetics and biodiversity issues associated. The ideal situation would be to achieve both sustainability and fire protection at a reduced cost. Mark Chladil feels that this could be the only potential problem with integrating these two fields: the costs of working together.

Mark Chladil receives most of his information on fire protection and sustainability through journals and conferences. He has seen recently that the fire protection industry appears to be more concerned with sustainability. He is not sure if it is due to the forced regulations or if the fire protection industry is truly interested. The increasing push for sustainability is certainly growing, and fire protection seems to be joining the movement.

### **Davis, Rob**

Rob Davis was a fire fighter for 13 years in South Africa. He has over 20 years of experience working as a fire protection engineer. He also has a global perspective after working in South Africa, the United Kingdom, and Australia. Rob Davis had experience working as a structural engineer before he became a fire protection engineer. He has worked in Australia for the past 8 years as a fire protection engineer. Davis works with alternative based solutions for fire protection performance.

Rob Davis expressed that he sees fire protection as being more important than sustainability due to the fact that fire protection provides life safety. However, he doesn't see the differences between fire protection and sustainability as a conflict, but instead as a challenge.

Rob Davis worked on refurbished heritage buildings which involved some aspects of fire protection as well as sustainability. Some of the buildings that Davis has worked on included atria to enable natural light and better ventilation. From his experience, he did not run into any specific problems with regard to fire protection conflicting with sustainable design.

Even though Rob Davis did not directly see any conflict, he was aware of the challenges that sustainable designs often present to fire protection. He supported the idea of adding fire protection incentives into achieving a higher Green Star Sustainability Rating of a building.

Since fire protection ultimately has an impact on the environment, Davis explained that fire protection should add to sustainability. In the case of a fire, the smoke and water usage are damaging to the environment, causing a push for sustainability with regard to fire protection.

Davis expressed that the two biggest motivators pushing sustainability are financial incentives and perception. He especially emphasised that the push for this sustainable image is growing increasingly popular, particularly in larger corporations as well as in government organisations. Davis stated that nearly all buildings are designed to achieve the minimum fire safety. Fire protection has been well established throughout Australia but the challenge to integrate sustainability and fire protection still exists. Davis sees fire protection and sustainability as remaining very separate in terms of their experts, however he does see more collaboration in the future between these two industries.

Rob Davis acquires most of his information with regard to fire protection from journals such as the Fire Risk Management and the FPAA Journal. He also mentioned that he attends many conferences where he learns about what other experts in the field are doing. Davis does not receive any information about sustainability alone, only when sustainability is associated with fire protection. He suggested journals as one of the best modes of communication. This is especially effective in Western Australia, where Rob Davis currently lives, because it is a very remote area. By reading journals, people in Western Australia can communicate with other global experts.

In recent years, Rob Davis sees sustainability as becoming significantly more common. With systems such as the Green Star Rating Tool, people are requesting more sustainable buildings. Ideally, Rob Davis would like to see sustainable buildings achieved without any negative impacts on fire protection. He does not see any harm in the sustainable building industry and fire protection industry working together in the future. However, the current system recognises sustainability achievements but not fire protection achievements. The current fire protection must comply with the Building Code of Australia, but with the growing incentives for sustainability, it would be appropriate to add more of an incentive for fire protection. One of the proposed suggestions is to offer insurance incentives for corporations that increase their fire protection. Rob Davis suggested that since corporations are driven by finances, the insurance companies should give incentives in the form of reduced premiums based on fire protection.

Rob Davis suggested that we look into a voluntary organisation called City Switch. The City Switch organisation is found in many cities including Perth and Melbourne. The organisation encourages companies to commit to improving sustainability in the office. City Switch pushes energy efficiency in the work place in an attempt to improve the environmental impact of companies.

### **Fox, James**

James Fox has worked for CFA for 23 years and is now a Chief Officer. He was part of the 2009 Victorian Bushfire Royal Commission.

James feels that the most important design criterion for any building is that of life safety. He sees the challenges between the two industries as the cost of the sprinkler systems and the aesthetics of the building. The sprinklers have a high monetary cost to install and maintain, but they also have a high environmental cost to create the pipes and the amount of water required to test the sprinkler systems.

The aesthetics of a building is another barrier. James sees many existing buildings being retrofitted to be sustainable in an attempt to utilise a unique design and give the building more heritage. This gives the building a healthy indoor environment and makes people feel good while working there. The owners, designers, and the members of the Green Star Rating Tool want to create buildings that have a healthy indoor environment. However, fire protection devices are seen to take away from this environment, with red fire boxes and other systems.

James has seen a large number of organisations approach him looking for compromises on the aesthetics of the fire protection devices.

James also pointed out the differences in the incentives to build sustainably versus fire safety. Sustainable construction is rewarded with a high Green Star Rating, and some government incentives. While fire protection is regulated by the government, it also uses negative reinforcement to make sure people comply with the codes. Buildings do not get rewarded for following the codes and maintaining their systems, they only get fined if they don't. He suggested that fire protection should try to work on more positive reinforcement, such as working with insurance companies to lower premiums for safer buildings.

He thinks that fire protection working with the sustainable building industry is the future, but sees this taking a large amount of work. The fire protection industry is very traditional and are proud of their past. This causes them to sometimes be slow to change. He sees one of the first ways that the two industries can work together is by using recycled water for fire sprinkler systems.

He receives fire protection information mostly through the FPA Australia newsletter. He doesn't receive publications about sustainability but instead receives most of the information through word of mouth. He recommended that we distribute our information through electronic media, such as a website or a Facebook Group.

### **Gibson, Michael**

Michael Gibson is an architect on the design team for the city of Melbourne. He works at the Council House 2 building.

Michael Gibson believes that the building code requirements address both fire protection and sustainability sufficiently. The buildings in Melbourne tend to be above average in meeting the building code requirements. The council's approval varies, but it considers both passive and active aspects of the building.

Michael Gibson discussed many specific fire protection technologies and their impact on sustainability. Adding in fire stairs to a building provides a useful fire escape as well as an alternative to using the lift. By using the stairs instead of a lift, the building will be more energy efficient and therefore more sustainable. Another fire protection technology that was discussed was sprinkler systems. Michael could see how water is sometimes wasted in flushing the sprinklers, and he suggested the use of a gas retardant, which could be more expensive but less wasteful. He pointed out that smaller buildings often have a lower risk of fire and damage, and as a result do not need sprinklers. In contrast, larger buildings often have higher risk of fire and damage due to the large compartments and multiple levels, and as a result need sprinklers. With hard wired smoke detectors required in every kitchen and corridor, Michael sees the chance of fire as very low. The assessment of risk and loss must be done in order to determine the extent of the fire protection required for a specific building.

The Council House 2 is a highly sustainable building and has a unique heating and cooling system. The air comes in from the floor at 20 degrees Celsius and takes 30 minutes to rise from the floor to the ceiling. The air is completely clean and filtered and the temperature regulation is similar to that of opening a window. In addition, the ceiling has a high thermal mass to stabilise the building temperature. At night, the building uses what is called a night

purge system. This night purge is like a computerised window opening, where it cools down the building with the cold night air for the next day, and flushed out the air in the building. This building also uses the water from sprinkler flushing to water trees and plants. These sustainable attributes provide a comfortable work environment with significant benefits to the environment and serve as a model for the city of Melbourne.

Michael saw a fire safe building as being more sustainable in that the compartmentalisation for fire controls is also beneficial for heating and cooling. By putting in features such as fire walls, the building is serving as both sustainable and fire safe. Fire walls are massive constructions that restrict fire spread, but they also act as thermal mass to stabilise temperatures. Unfortunately, dry wall and plaster wall are more commonly used because they are less expensive. These cheaper options are not nearly as sustainable or fire safe, but people tend to choose them because they are more affordable.

Michael also discussed many sustainable design aspects and their potential impact on fire protection. He addressed that atria are not necessarily economical in that they take up large amounts of space that cannot be rented out. He does not see them as a fire risk, but more as a problem in that they take up valuable space. In addition, due to Australia's warm climate, these atria often get too hot and require more air conditioning, which makes them less sustainable.

Atria are commonly used in malls and shopping centers because studies have shown that people who get access to natural light are likely to stay longer. He also talked about insulation and the different options available. He feels that people are making decisions based on price more than sustainability or fire protection. He sees that people who are choosing the less sustainable or less fire safe insulation are generally just looking for the cheapest option. Some of the most sustainable materials such as the prefabricated materials are very expensive. These prefabricated materials are made in the suburbs and fully assembled before they are trucked into the city.

Michael explained that steel is commonly used in Australia because it is readily available. Steel melts in high temperatures and therefore the Building Code of Australia has specific requirements for steel. The Building Code of Australia requires that all steel is either sprayed with a fire retardant or encased in plaster board. Some people might argue that this makes the steel less sustainable in that it requires more materials to be used. The plasterboard encasing is often costly and not as aesthetically pleasing. It would be more efficient to use concrete or timber because of it better meets the fire code, but it is more expensive and not as readily available in Australia.

Michael pointed out that under the fire code external features are not regulated. As a result, vegetated roofs and other similar design aspects often fall outside of the building code. Michael recognised that vegetated roofs need an irrigation system due to the climate in Victoria. Since the climate in Victoria is more Mediterranean, and recently more extreme weather there is a larger push towards sustainable options. Green roofs can often benefit in extreme weather such as flooding in that the water hits the soil on the roof first and tends to delay the accumulation on the ground, preventing flooding.



Michael expressed that money is the main incentive for constructing sustainable buildings. A secondary incentive was identified as wanting to do the right thing. Currently a 4.5 Star rated building is cheaper to build than a standard building, a 5 Star rated building costs the same as normal construction, and a 6 Star rated building only increases standard construction costs by approximately 6%. The marketing that goes along with these ratings is quite significant. Michael believes that most of the commercial buildings are looking for money savings, and that is why all buildings have not become 6 Star rated. There has been a push towards more sustainability, but mainly just from government institutions. He has not seen the sustainability requests from private institutions in the same way.

Michael sees fire protection as something that has to be done, not an incentive. He does not see people going above and beyond, if anything people try to do less than the code.

However, if people try to do less than the code they must get the approval of the Metropolitan Fire Brigade.

Michael receives most of his fire protection information from the Building Code of Australia, building manufacturers, and building surveyors. He receives most of his sustainability information from websites, blogs, and technical reports.

### **Gooding, Owen**

Mr Gooding clarified the various laws which contribute to the overall construction process. There are building laws, planning laws, as well as biodiversity laws which pertain to environmental protection. In Australia, “land use planning” involves zoning controls (ie. residential, commercial). Certain permit requirements fall under different zoning regulations.

The situation becomes very complex from a town planner’s point of view. The town planner must gather regulations from the Department of Sustainability and Environment (DSE), City of Melbourne Water, and the County Fire Authority (CFA). Often times meeting all of these different regulations can be challenging to near impossible.

Mr Gooding expressed that the incentives to designing a building that is fire safe are currently off the radar for private home owners and corporate executives. He also mentioned the lack of financial incentives for such groups.

Mr Gooding communicated to us that sustainable solutions are those which integrate all aspects of problem. This includes economic, environmental, and social components.

Mr Gooding stressed the need to incorporate fire safety into the Green Star Rating Tool. The issue of integrating fire safety and sustainable design was described by Mr Gooding as a human behavioral issue. People tend not to think about fire protection except when they have to meet certain fire codes when constructing a building.

Mr Gooding said that he only gets fire protection information from the building surveyor when he trying to design a building. He gets information on sustainability online and from Green magazine. He thought a web-based material would be essential for our project.

## Johnson, Peter

Peter Johnson began his career working at a testing and research laboratory in 1975, where he worked until 1995. He attended WPI between 1984 and 1986, where he received a Masters in Fire Protection Engineering. In 1995 he started working for Arup in London before coming to work in Australia at the Melbourne office.

He has been consulted on the Baltic Sea Tunnel which connects Denmark and Germany via an underground route. He has seen Arup incorporate a consistent focus on sustainability for 10 years now. Arup's vision aims to use the concept of total engineering: this means the building and people who work in it constitute a single functioning entity. He communicated that the Arup company slogan reflects this vision: We shape a better world. Arup also has an innovation team led by Chris Luebkehan which plans the future of the company and attempts to foresee potential difficulties Arup might encounter.

Peter Johnson said that fire protection is probably more important than sustainability due to the fact that people and property need to be protected in the case of a fire. He also expressed that he does not believe that fire sprinklers are left out of buildings because of their water use, but rather because of the cost of installation.

Mr Johnson conveyed that the incentives for constructing sustainable buildings include the high premiums that these buildings can charge for rent and the government's political agendas to market sustainability. Mr Johnson also described how the incentives for constructing fire safe buildings were mainly building code regulations. However, he also included protecting human life from an occupational health & safety perspective as another incentive for fire safe buildings. He was concerned that the legislation was not having enough of an impact to influence more fire safe designs.

When discussing the Green Star Rating Tool, Mr Johnson expressed that the sustainability rating system should include fire protection. He feels the fire protection industry should be more involved in the debate to include fire safety measures in the Green Star Rating Tool.

Mr Johnson noted several specific problems encountered when incorporating fire protection and sustainability. The first was energy efficiency which included the use of sandwich panel insulation in sustainable design. Now nanoclays are being used instead of the insulation. Heavy timber frame buildings also pose a problem but not as much as lighter timber. The heavier timber can withstand a fire better than older, lighter timber frames. The heavy timber construction is common in Canada, Finland, and Sweden due to the amount of woodlands available to them. But Australia and the United Kingdom also utilise this sustainable design.

Mr Johnson felt that the sustainable design and fire protection industries should merge into one field. One opportunity to do this would be to provide information to architects so that they would be more knowledgeable when drafting building designs. Client requests received by Mr Johnson included double ventilation designs as well as a certain reduction in material which would still ensure fire safety.

The sources from which Mr Johnson generally receives his information include FPA Australia journals, conferences, newsletters, professional articles, and Arup internal communications. As far as the presentation of our findings, Mr Johnson suggested press releases, newspaper articles, journal articles, seminars, and workshops as effective ways to reach a large number of professionals. Mr Johnson saw the positives of the two industries working together as better fire safety and cost effective construction.

He suggested we contact someone from Umow Lai, the Property Council, and architects.

### **Jurgeit, Christopher**

Christopher Jurgeit has been a fire fighter for 33 years. He has spent the last 11 years as a fire safety engineer and the last 7 of those years as the Manager of the Fire Safety Unit. His job is wide ranging. He works with various building consultants and designers to help them meet the performance requirements for their fire protection systems. He is also involved with Building Code reform and recycling water for fire fighting.

He sees both fire protection and sustainability as important, but feels that fire protection is more important. He feels that it is most important to protect the life of the building occupants before all else. He sees that fires are harmful to the environment because of the amount of water used in extinguishing the fire and the amount of smoke pollution from the fire. He feels that it would be beneficial to add fire protection to the Green Star Rating Tool but it will be very time consuming and will probably take a few years.

He has seen buildings omitting certain fire protection systems in the name of sustainability. He understands that the systems affect the environment through the production, insulation process, and water consumption needed to test the systems. However, he feels that sustainability is just an excuse used by the building designers and owners for why fire protection measures are excluded.

He thinks that the fire protection industry and sustainable building industry working together earlier in the design process would be helpful but it needs to have a continued presence in the maintenance of a building. He gave us an example of a building he helped to design: It was a building that was built very sustainably and had high performing fire protection systems during the design and right after construction. However, he returned to the building a couple of years after it was built and noticed that fire protection and sustainable aspects were not maintained properly.

He said that he only receives information about fire protection and most of this information is through the journal published by the Institute of Fire Engineers. He recommended that the most effective way to reach both industries would be through journal articles.

### **Knight, Warren**

Warren Knight started his career working in architecture in the 1980s. He then moved to building surveying in the late 1980s. He spent time working on performance based codes.

Warren was in one of the first groups of students to go through the program to become certified in performance based codes. While he is not an expert in sustainability or fire protection, his

experience as a building surveyor has given him exposure to both fields. His current job at the Council House 2 involves managing a building team for the city of Melbourne. He has 25 technical staff members that work under him. He works mainly on building related work and policies. He is also a long standing member on the Building Appeals Board.

Warren identified that sustainability and fire safety both have a primary goal of providing a reasonable level of safety. Life safety is an extensive concept that incorporates the social impact of losing a life. The social consequence of a life lost due to fire is significant, and could be seen as unsustainable. Warren suggested that there needs to be a balance between resources and energy to provide sustainability while also reducing fire spread by establishing fire protection. This idea of weighing the impacts of both fire protection and sustainability on a case by case basis creates the ideal situation. Warren came up with the idea of finding a way to measure the impact of both fire safety and sustainability. In order to do this, the potential risk, probability, and likelihood of fire would all have to be assessed. In addition, the impact of sustainability and the statistics associated would have to be considered. Based on these data, a formula could be devised to determine the outcome of the building as a whole. While this is a logical idea, it could be challenging to get enough meaningful data, especially with regard to fire statistics and quantifying fire loss as well as carbon impact.

Warren explained the difference between active and passive fire suppression systems. Active fire suppression systems have one benefit, which is to prevent fire spread. Some examples of active fire suppression systems include sprinklers and hydrants. On the other hand, passive fire suppression systems have secondary benefits in addition to preventing fire spread. An example of a secondary fire suppression system would be a fire wall, which also provides an acoustic barrier. These passive fire suppression systems could be seen as sustainable in that they act to provide multiple services within a single design aspect.

In addition to fire suppression systems, Warren had valuable knowledge about sustainable design aspects. He mentioned that architects are moving towards more sustainable building materials such as timber. Timber is a very sustainable building material in that it is grown in timber forests within the country and it provides a positive environmental impact. Buildings made of timber have been found to have a negative carbon footprint. Not only do the buildings not leave any carbon footprint, but they also help to decrease the carbon footprint by the nature of the material. In addition, certain timber buildings can be very fire safe in that the timber alone cannot easily catch on fire. A building made of timber with the proper fire protection measures is ideal for meeting the needs of a building that is both sustainable and fire safe.

Warren identified that the major sustainability incentives include being recognised as a good corporate citizen, having an edge over competitors, growing government incentives, and increasing energy efficiency requirements. He pointed out that fire protection incentives are not really seen. Instead, most people just assume that minimum fire protection requirements are met. Building surveyors usually have enough background to certify that fire safety requirements are met, but not all building surveyors are expert enough. In Australia, the work safe requirements

are taken very seriously. The punishment for not complying by these requirements can result in fines of hundreds of thousands of dollars as well as jail time. As a result, these requirements are not overlooked.

With regard to the Green Star Rating Tool, Warren suggested the addition of a section on potential loss. This could include fire safety, but also loss on a larger scale. By minimising loss, sustainability is increased. The social and environmental impact of losing a building or a life is not sustainable.

Warren has seen a bigger push toward sustainability from the big corporate organisations. However, he does not see requests for more fire safety. People are aware that the new buildings in Victoria are fairly safe, and as a result, there is no push towards more fire safety.

Warren is aware of fire protection information from his work as a building surveyor. In his job, he is required to know the fire protection measures that buildings are forced to follow. Warren is also constantly learning about sustainability through his work as a building surveyor. He has learned a lot from the Council House 2, where he works. The Council House 2 was built as a model for the city of Melbourne in that it is a 6 star rated building. The building contains timber window frames, unpainted ceilings, and furniture moved from other locations. These design aspects are subtle, but provide lower carbon emissions and fewer toxins to the environment.

Warren recommended that if we have a conference or seminar, we should include organisations like the Design Institute, the Committee Building Surveyor, and ABCB. It is important that we spread our message through professional bodies and allow people to agree or disagree with the concepts and ideas that we've found. By providing statistics, he feels that people will be able to better consider the options and give valuable feedback. Warren also suggested the idea of a web based document such as a professional blog to instigate a discussion.

## Lee, Barry

Barry Lee was the Technical Director for Wormald Fire before working with Tyco Asia-Pacific. He also served as President of FPA Australia and is an Honorary Life Member. He currently runs his own business, Lee Fire Management Pty Ltd. He has over 50 years of experience in the industry and serves on several Standards Australia committees as well as serving as the chair of the ISO Fire Safety Coordination Group.

Mr Lee expressed that there is no inherent conflict between fire protection and sustainability. Fire protection may not fully understand sustainability, especially due to the fact that there are many definitions. He felt that fire protection is more important simply because of the value of life safety.

Incentives for creating sustainable buildings include a positive corporate image as well as lower energy costs. In his opinion, Green Star Rating Tool should include a fire component because of materials lost and carbon emissions released in the case of a fire.

Incentives for creating fire safe buildings primarily concern protection of human life. Another key incentive is the possibility of reduced insurance premiums for buildings with fire protection measures. Mr Lee mentioned that even after smoke alarms and sprinklers are installed there is still the issue of maintenance and testing these systems.

From a social perspective, Mr Lee has not seen sustainability requests very often in the fire protection industry. He has seen more requests to go above and beyond the BCA because of the life safety risk associated with fires.

The opportunities are available to educate both industries on how to create fire safe and sustainable buildings. Architects who consider all aspects of design make use of the environment while still incorporating necessary measures related to fire protection.

One of the primary barriers for private property owners creating sustainable homes is the cost associated with such designs.

Mr Lee said he believes literature articles, seminars, symposiums, and networking through various organisations such as NFPA and IFE would be beneficial for deliverables.

Mr Lee suggested we look into FM Global as well as the Leonardo Academy in Madison, Wisconsin.

## Leonard, Justin

Justin Leonard has worked for 16 years at CSIRO's Ecosystem Sciences department. He has worked on fire related test methods and has mostly specialised in bush fires. Part of his job requires conducting a post bushfire survey on site to assess damage and prevention of such fires. In addition he has done work in the lab on fire testing in order to relate results to the study of bushfires.

Mr Leonard felt that minimum fire safety standards should not be compromised under any circumstance. He was unsure if alternatives to sprinklers would be viable solutions from a fire safety standpoint. However, he expressed that sustainability is just as important as fire protection. In particular, the design life of a building needs to be sustainable. In other words, if a building cannot withstand a fire and has to be rebuilt, then that building is unsustainable.

The Australian energy rating system defines sustainability based on the 'cradle-to-cradle' approach. This involves analysing materials used in construction from their inception, to their use, to how they can be recovered when the building is demolished.

In fact Mr Leonard insisted that there isn't necessarily a conflict or clash between sustainable building and fire protection, but rather there needs to be a holistic approach to the two disciplines.

The incentives for creating a sustainable building include the "greenwash" philosophy which enables building owners to declare their property is green, or sustainable. This is tied to a positive public image for such property owners who can say they have incorporated sustainable aspects. Marketability and energy star savings are two additional incentives mentioned by Mr Leonard.

The incentives for fire safe buildings are limited to the regulations for fire standards. But it was emphasised by Mr Leonard that it was not that sustainable design could not be integrated with fire protection measures but rather that no forum has allowed the two to share knowledge and ideas.

The design process was described as inherently business-like and thus no one industry (design, building, fire protection) is concerned with the interests of another industry.

Rather than adding a fire protection component to the Green Star Rating Tool, Mr Leonard suggested clarifying how the fire protection industry measures the fire safety of a building before meeting with the sustainable building industry. This might include a fire protection rating tool for buildings.

Mr Leonard receives his information from work colleagues and other professional sources such as FPAA, AIFFS, and conferences.

Mr Leonard suggested recommending a focus group between the two industries as our final deliverable for this project.

### **Mierzwa, Andre**

Andre works with FM Global on the insurance side of fire protection. He works with new buildings, mainly commercial projects. He has been working in the field for 35 years and works with standards too. He specifically deals with sprinklers and brush fires.

If sprinklers are taken out of buildings, the sustainability decreases because the lifespan of the building has been compromised. FM Global has produced a couple of reports on the environmental sustainability of buildings. One report talks about the impact of sprinklers on burning buildings. The other report talks about the lifespan of buildings and how sprinklers can have an impact. There was also an article published in *Fire Australia* 2 years ago.

The biggest issues concerning sustainability in building are the materials used for construction. Insulation requirements often don't take into account fire protection. This includes sandwich panels, and curtain walls and cavities. Section J of the BCA does talk about polystyrene. There was a firework disaster in Beijing at a 5 star hotel involving insulation. At an apartment building in Shanghai they retrofitted insulation, and it caught fire and killed 30 people.

Sprinkler standards do not take into account the building structure. They only provide for the occupants of the building and what is inside of the building. Sprinklers designed for polystyrene insulation must use more than 3 times as much water to keep the fire contained. Solar panels sometimes are not secured to the roof properly and can be problems in the wind. Solar panels also pose dangers to fire brigades. FM Global has produced a data sheet on Green Roofs in the 1 series. Atria have been dealt with pretty well in the BCA.

Incentives for producing sustainable buildings include public recognition, appeal to tenants, responsibility to building codes, feelings of social responsibility and free advertising. Incentives for producing fire safe buildings include corporate risk management, risk rewards from insurance companies and business protection, and obligation to building codes. Insurance rates do decrease with more fire protection measures.



In terms of the Green Star Rating Tool, fire protection should absolutely count toward a higher sustainability rating. This should be done by assessing the risk of fire and reducing that risk. Data sheets need to be produced and shown to clients to show guidelines for fire safe and sustainable buildings. People need to be made aware of fire risks. Too often people simply just follow the BCA.

The BCA is beginning to require more sustainability measures. It is possible to sell energy back to the city. People are still requesting standard fire safety measures.

He receives fire information from *Fire Australia*, NFPA, and a British fire journal. An AIRIA building is being constructed out of timber. It is 6 stories and has minimal heating and cooling costs. There is a 50-page pdf article on the concept of the building.

There are more problems with sustainability than fire. Flooding and wind are also big problems for insurance companies. They cause much more monetary damage than fires. Developers have a lack of good flood maps.

## Poh, Weng

Dr. Weng Poh works for Umow Lai, an engineering consulting firm that employs over 120 staff in its Melbourne office. It employs approximately 20 Ecologically Sustainable Development (ESD) specialist consultants and 10 registered fire safety engineers. He is the Associate Director and Principal Fire Engineer at Umow Lai. He has an extensive background in fire safety engineering and is also a Green Star Accredited Professional.

Dr. Poh explained how the Building Code of Australia's prescribed fire safety systems are designed by fire protection engineers, while the alternative solutions are the responsibility of fire safety engineers.

On the subject of sprinkler protection of buildings, Dr. Poh insisted that fire sprinklers do not conflict with sustainability. This is attributed to the fact that sprinklers control the development of fires in a manner which reduces carbon emissions, reduce building and property damage, and saves buildings from being reconstructed. Replacement of property and reconstruction required resources, energy, and cost.

Although there may be differences in the ways building design is driven by ESD or fire safety engineers, Dr. Poh does not see that there should be any fundamental philosophical conflict between sustainability and fire safety. Dr. Poh stressed a need for communication and respect between the two engineering disciplines. If fire and ESD engineers worked together, he saw no reason why a building could not be both fire safe and sustainable. In his experience, if this collaboration is done correctly, the resulting building achieves fire safety and sustainability.

The current incentives given for creating a sustainable building, particularly a commercial building, are mainly driven by market forces. These include financial considerations and marketing. For property owners, the green star rating may be used to market the building to attract tenants. Dr. Poh admitted that ESD consultants would list other incentives for constructing sustainable buildings, such as saving the environment.



Unlike ESD, fire safety is rarely used as a market driver for constructing a building, according to Dr. Poh. This is due to the fact that most people take fire safety in buildings for granted. Australia generally has a good fire safety records for buildings, and fire safety in building is not perceived by the general public as a concern. Dr. Poh explained that the general public would often only react and demand actions after a catastrophe. An example is the research and other actions put into bush fire safety after a significant bush fire occurred in Victoria a couple of years ago.

Dr. Poh considered the Green Star Rating Tool (GSRT) is useful but felt that, in some areas, it is inflexible in allowing better solutions to be incorporated. The main reason was that GSRT is simply a checklist of criteria that sometimes does not factor in unique aspects of each building design project. The communication of all the engineers, designers, and architects is required in order to treat each design on a case by case basis.

Some challenges in incorporating fire safety and sustainability were shared by Dr. Poh. Water harvesting tanks appear wasteful if they cannot be used for fire fighting purposes. Anaerobic digesters placed inside buildings may increase fire risk with respect to methane production. Open space layouts like those created by atria allow smoke spread through a building. Insulation materials with higher combustibility or smoke production may also increase fire risks. These issues need to be properly addressed from a fire safety viewpoint.

Dr. Poh explained there are many opportunities for sustainability and fire engineering professional to work more closely together. He pointed out the recent approach taken by Umow Lai was to reorganise the office such that engineers from different disciplines are located in the same office space instead of in separate areas. This promotes communication and allows engineers from different disciplines to learn from one another. Dr Poh also believe that, when the design team is working on a project, each discipline should take time to explain the basis of their design to the design team so that issues may be addressed effectively through corporations from various disciplines.

Dr. Poh has noticed a trend to use sustainable design. In his opinion, sustainable design should eventually become the norm rather than the exception, and it should become part of each discipline in the design of buildings.

Umow Lai has a wide range of clients who demand different levels of fire safety for their buildings. Some projects are mainly driven by building cost so the clients want only the minimum acceptable safety level. However, some clients have strategic buildings that require the highest fire safety measures not only to protect the occupants but their contents and to maintain business continuity.

Dr. Poh receives fire information from journals, conferences and technical seminars. He receives sustainability information from meetings and ESD consultants. He suggested that we could publish our findings in *Fire Australia* and conduct an enticing seminar.

He also suggested we get in touch with architects who are likely to have a different perspective in building design.

## Porteous, Russell

Russell Porteous worked for about 20 years in the fire protection field since 1988. He started with Wormald and worked there for 13 years. Now he owns his own business as the CEO of Maintenance Essentials. Maintenance Essentials install and maintain sprinkler systems. Since starting the company 10 years ago, Russ now employs over 30 professionals and 8 contractors.

Russ conveyed that buildings that require sprinklers have them and that the BCA does a good job of making buildings fire safe and economic. He said that overall general safety is key element in new buildings. For existing buildings, fire protection is sometimes a secondary issue.

As far as incentives for constructing a building with sustainable options, Russ communicated that the owners of such buildings would get recognition from the community. The type of tenants such an owner would cater to would probably be wealthier clients in the city rather than rural developments. This includes targeting government tenants. However, no such recognition or incentive seems to be given for constructing fire safe buildings. Most homeowners do not really strive to make sustainable homes

The building code has inherent incentives. While Deemed-to-Satisfy meets the minimum requirements, the Alternative Solutions method is not necessarily sustainable due to the maintenance costs associated with it. Because Deemed-to-Satisfy is outlined in the BCA and Alternative Solutions are not, a contractor may install a system like a sprinkler when it is unnecessary. This wastes money, time, and energy, thus potentially making Alternative Solutions unsustainable. According to Russ, the BCA has standards for creating buildings that fire safe and sustainable.

Russ was not familiar with the Green Star Rating Tool. He was familiar with a different rating system. He doesn't think that fire protection should add to green star rating of a building. He proposed another rating system for the fire protection aspects of a building. The lack of marketability of fire protection was highlighted by Russ as one reason why there are very few incentives for constructing safe buildings. Community expectation is established by effective branding, according to Russ.

Clients have made requests to become more sustainable through improved maintenance of fire safe systems. No one has asked to eliminate ionisation smoke detectors even though they are not the most sustainable option. Some people are not as concerned about fire safety as sustainability. For example, people take for granted that the building is safe. Socially, Russ did not see a need for the two fields of sustainable design and fire protection to integrate and work together at the moment.

Russ receives information on fire protection from the NFPA in the U.S. in the form of published papers and their website. He receives information regarding sustainability from the Victoria Building Commission which publishes monthly or quarterly magazine.

In order to get information distributed to the sustainable building and fire protection industries, Russ suggested submitting an article to FPA Australia's *Fire Australia* magazine as well as the NFPA and Building Commission publications.

Russ suggested we contact David Swinson and someone from Standards Australia.

## Santin, Carlos

Carlos Santin was appointed Executive Officer to this role in May 2008. He was previously Manager, Industry Development – Health, Safety & Environment at the Plastics & Chemicals Industries Association. In that role, he had a strong focus on working with government, industry and community stakeholders on legislative and issues impacting on the chemical industry.

Carlos has particular expertise in chemicals management and regulation, in areas of hazardous substances, dangerous goods, transport and the environment.

In his current role, Carlos reports to the ODS & SGG Board and plays a pivotal role in granting technician licenses, halon special permits, trading authorisations and monitoring industry compliance.

Carlos works on a special project involving ozone depleting and synthetic greenhouse gas extinguishant agents and his role is to implement the *Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995* on behalf of the Department of Sustainability, Environment, Water, Population and Communities.

Carlos gave us a brief background on the licensing scheme that is used to oversee the use of Halon but specifically all ozone depleting and synthetic greenhouse gas extinguishants such as for example FM-200.

Two issues emerged in the early 1980's that focused the world's attention on the condition of the earth's atmosphere. These issues were the on-going depletion of the stratospheric ozone layer and the enhanced greenhouse effect (leading to global warming).

Both effects are exacerbated by the emissions of vaporising liquids used in fire fighting applications. Extinguishing agents, such as, halon has a very high ozone depleting potential, while the release of hydrofluorocarbons, such as, FM200 contribute to global warming.

These extinguishing agents are referred to as ozone depleting substances and synthetic greenhouse gases or ODS & SGG.

In his 1992 Environment Statement, billed alongside climate change initiatives, then Australian Prime Minister Paul Keating announced AU\$4.6 million for the establishment of a national banking facility for storage and recycling of halon. With the success of Australia's phase-out plan, recovered halon from decommissioned fire-fighting equipment was rapidly accumulating in the hands of governments, industry and the community, and a National Halon Bank (NHB) was needed urgently to collect and store the growing surplus. Established in 1993, the NHB was created as a government business enterprise responsible for the collection, decanting, safe storage and destruction of halons. The NHB now also destroys a range of other ODS, HFCs and PFCs. Under the management of the Commonwealth, the NHB harnesses industry expertise through DASCEM Holdings Pty. Ltd., which operates the NHB and provides its services. For more than a decade DASCEM and the NHB have enabled Australian individuals, small and large businesses and government to dispose of their halons safely at a convenient 'one-stop' shop, with the security of government backing. To ensure the long-term management of Halon stocks, a government-industry task force developed an Australian Halon Management Strategy, which estimated future essential civilian halon use requirements until 2030 and set aside 50-70 tonnes of halon 1211 and 250 tonnes of halon 1301. Essential ADF halon uses were secured from a portion of the remaining surplus, with the rest provisionally earmarked for destruction.

Regulations developed under the Commonwealth *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (as amended in 2003) replaced state and territory ozone protection legislation. A number of states and territories at the time indicated that they intended to repeal their regulations to ensure no confusion.

The purpose of the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* is to reduce the amount of ozone depleting and synthetic greenhouse gases being emitted into the environment. It does this by imposing restrictions on their storage, handling and use. The Act also bans the use of substances such as halon – minor use allowed as per exemptions include in the Regulations.

The Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (as amended in 2005) contain controls relating to: import/export/manufacture licensing; manufacture and disposal of scheduled substances used in the fire protection industry. These regulations do not restrict the use or availability of ozone depleting substances or synthetic greenhouse gas based extinguishing agents. Except for the use of halon there are no plans to restrict, prohibit or withdraw any of the currently available fire extinguishing agents.

The regulatory system under the new Regulations consists of:

- Fire Protection Industry (ODS & SGG) Board
- Six Extinguishing Agent Handling Licences
- Trading Authorisations to acquire, store or dispose of an Extinguishing Agent
- Halon Special Permit to possess halon for use in fire protection equipment

In 2004, FPA Australia was appointed by the Minister for Environment and Water Resources as the implementing agency for those parts of the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* that relate to the fire protection industry. This is a clear recognition by the Government that the industry, represented by FPA Australia is in the best position to achieve the objectives of the legislation in a way that meets industry's needs. It highlights the high standing that the fire protection industry has with the government. However, it also places a clear obligation on our industry to work effectively and efficiently to achieve substantial reductions in the emissions of ozone depleting substances and synthetic greenhouse gases (ODS & SGG) and to rigidly comply with the provisions of the legislation.

Carlos Santin's views on sustainability were very broad in that they were not restricted to building sustainability. He expressed that sustainability also has a life perspective. He sees sustainability also encompassing the importance of human life and core values. Carlos believes many industries making attempts to become more sustainable. He suggested that the building commission take into account these good efforts being made and use them in an attempt to push other industries to become more sustainable – industries which they currently regulate. He believes that the major problem with sustainability is that people are not aware of the definition. Without understanding the definition, it is difficult for people to make a personal connection with sustainability. He sees the fire protection industry as evolving and this will not be something that stops – all industries learn and move forward with the help for example: technology. A good initiative to consider is the evolution of halons has shown an increasingly sustainable effort been made within the fire protection industry.

Carlos Santin recognizes that the fire protection industry would learn from greater communication and partnerships with faster evolving industries in the area of sustainability such

as the mining and chemical sectors. A good current initiative is the collaboration between the chemical and fire protection through holding events such as Hazmat Conference. Greater collaboration and sharing of knowledge is required. He sees education as a sustainable practice in that it helps industries evolve and grow to better a larger population. He suggested that communication is a key component in spreading our findings and furthering the outcomes which are required. He also pointed out that face to face interactions tend to be most effective, especially in small groups that provoke discussions.

Carlos obtains most of his fire protection information from international fire protection websites, government sources, and newsletters from specific companies. He receives most of his sustainability information from the building commission or other industry such as mining and chemical.

### **Webb, Alex**

Alex Webb has worked in the fire protection industry for the past 18 years. During his first seven years, Alex Webb worked as a researcher. He also has experience working as a fire safety engineer for building design including residential and commercial buildings. Alex Webb has worked on roads, infrastructure, and fire testing as well. In his current job at CSIRO, Alex Webb works on fire safety engineering as a consulting engineer. Alex Webb manages fire tests and deals with the fire safety code. In some of the projects that he has worked on, he has seen sustainable building designs.

Alex Webb clarified that water use is only a small part of sustainability. He addressed that fire protection is not necessarily more important than sustainability because it depends on your personal perspective and on the frequency of fires. The primary incentives that are driving the sustainable building movement include regulations, marketing, energy ratings, capital expenditures, reduced running costs, and ethical reasons. Alex Webb sees a large amount of sustainable design going into refurbishing existing buildings. In terms of fire safety incentives, the regulations are key in requiring legislation to maintain standards of fire protection. The only other incentives come from bush fires and the push to prevent the spread of bush fires through fire safe designs.

Alex Webb felt that the Green Star Rating Tool should include fire protection and add to the overall Green Star rating. Through Alex Webb's work, he has run into some specific problems with regard to integrating fire protection and sustainability. He has seen challenges with the use of atria, recycled materials, solar panels, insulation, green roofs, and passive night purge. The passive night purge is a way of getting the cool air from the overnight temperature drop into the building. From a sustainability standpoint, this is an energy efficient cooling system, but the air was found to be contaminated from the exhaust. As a result fans were found to be more effective. By assessing new technologies from both a fire safety and a sustainability stand point early on, building design would be more efficient.

The main barriers for the lack of integration between the industries of sustainability and fire protection were identified as communication, education, and timing. Since the fire

protection engineers do not get involved in the building process until later, it is often challenging to catch some of the potential fire risks.

Alex Webb receives most of his fire protection information from peak bodies, journals, conferences, peers, formal education, magazines, and email groups. Some of the journals that he recommended included *Fire Australia*, *Fire Materials*, and *Fire Protection Journal*. Alex Webb receives most of his sustainability information from the Building Commission. He suggested that the best mode of delivery for our project would be through journals and conferences.

Alex Webb worked on a shopping center that aimed to meet a 6 star rating. He also worked on a shopping center in Malaysia that followed the LEED certification system in an attempt to increase the marketability of the building. Alex Webb has seen clients requesting more fire safety in bush fire areas, but mostly people are only concerned about meeting the regulatory requirements outlines in the Building Code. He has assisted sustainable building designs by making informed decisions about fire protection, especially focusing on occupational health and safety.

If the fire protection industry and sustainable building industry worked more closely together, Alex Webb predicts that the test methods would need to be altered to apply to both fields. He sees that sustainable buildings could be created without the worries about potential hazards, which would increase public confidence and improve the environmental returns. Alex Webb did not see any negative impacts that would come as a result of the fire protection industry and the sustainable building industry working together.

The homeowners are being pushed towards more sustainable building due to the regulations and the tax breaks. The only fire protection incentives are the regulations. Alex Webb feels that this might not be a very effective incentive. Larger corporations are working to increase sustainability with incentives such as improving their corporate image, marketing, and savings in energy use. The larger corporations are pushing for fire protection in an attempt to increase their occupational health and safety while also reducing their insurance premiums.

## Wyborn, Chris

CFA is a community safety and education organisation with areas that work with planning and building of new developments and areas that work with educating the public about fire safety concerns. Chris is currently managing the Southern Melbourne region. He worked as a volunteer fire fighter for about 25 years. He joined volunteer fire fighters at age 11 but has been an actual fire fighter since 16. He has worked at this branch of CFA for 10 years. He usually heads the Fire Safety Team where he works with building regulations and bush fires.

There are around 2000 employees that work at CFA in all of Victoria. The fire brigades operate on a state wide level and will never operate on a nationwide level. AFAC is a national advisory board that has political power but cannot dictate how the brigades perform.

There is a difference between the structural fire point of view and bush fire behaviour point of view. For bush fires, there has been a shift away from biodiversity back to life safety. This shift is based on the Royal Commissions Findings after the Black Saturday Fires of 2009 where 173 people died. From a structural fire point of view there has been a shift away from fire safety toward sustainability. In other words, fire safety has been put on the “back burner.”

The incentives for constructing sustainable buildings include reduction in running costs and gaining a marketing advantage. The incentives for building fire safe buildings are mainly life safety, but people mainly just want to save money. People are generally not too concerned about fire protection and follow the minimum requirements set by the BCA. There is no legislation that requires homeowners to disclose the Bush Fire Risk Assessment to people when trying to sell their home. The public needs to be informed about the issues with fire safety especially concerning commercial establishments

One example of conflict between sustainability and fire protection is at Phillip’s Island. It is a popular tourist attraction, but it is a small town with small fire brigades. CFA has attempted to convince building owners to have higher fire protection standards but they do not want to pay to have sprinklers installed.

Sustainability has a “feel good nature” to constructing sustainable buildings. Fire protection deals with preventing death and destruction and people do not want to think about death. The fire protection field needs to find an avenue to bring fire protection into the Green Star Rating Tool. There has not been enough research to show that fire protection is actually sustainable. Researches need to calculate fire risk, potential fire damage and repercussions from fire damage. Fire protection should lobby the government to get them to consider integrating fire protection into the Green Star Rating Tool.

In Chris’s experience, normal house fires use 100,000 litres of water from hydrants to put out fires and factory fires use up millions of litres of water to put out fires.

Some of the barriers of integration between these fields include legislation and marketing. For legislation, it is difficult to lobby for new legislation in the BCA. For marketing, there is competition between the two fields. There has been an increase in sustainability requests, but clients don’t always make these requests based on achieving sustainability. There have been no requests to increase fire protection in new developments.

An example of a devastating fire is Childers Hostel Fire in Queensland. This incident has pushed Queensland to have more legislation toward fire protection. Laws are created after a catastrophe, not to prevent catastrophes.

Chris receives fire protection information from FPAA’s magazines and website, seminars, and forums. He receives sustainability information is received by word of mouth or random magazines. We need to engage strong sustainability advocates and convert them into understanding fire concerns. We can get statistics from Building Commission, CFA annual report, and Victoria University.

## Verheijden, Paul

Mr Verheijden helped us understand more about water conservation and current industry standards for installing fire sprinkler systems. He provided valuable statistics on the amount of water used unnecessarily by pumps and other such devices. He also provided us with some potential ways to communicate with both the fire protection and sustainable design industries, which will be very helpful for our project.

Mr Verheijden clarified the difference between fire safety and fire protection in Australia. While fire safety is the protection of human life, fire protection is the protection of property and buildings. Our project will seemingly focus on fire protection. He also shared with us that fire codes are state wide in Australia but building codes such as the Building Code of Australia are produced on a national level.

The Building Commissioner, Tony Arnel, deals with the initial processes with regard to fire protection codes and building design. Tony Arnel appoints a general manager who delegates tasks to technical experts who deal with specific design and construction issues. Building surveyors check the designs proposed by the company constructing a building. Then, they check the building after it is constructed but before the company can occupy it. Finally, the installation of the sprinklers occurs. The layout of the sprinklers is very difficult to change after the installation process is completed. The trend seems to be that larger companies are concerned with their public image so they are more willing to pay for sustainable options in order to say they are working towards a greener environment. Smaller companies and home owners do not have the finances often times to afford such green initiatives. In addition, they are not as concerned about their public image.

Mr Verheijden and his company Integrated Fire Services (IFS) have published “Seven Water-Saving Opportunities.” The adjustment of pumps is one solution. Approximately 500 million litres of water are used unnecessarily in Victoria alone. This allows for a possible savings on water of 60-70%. According to Mr Verheijden, tanks are not very cost effective in re-circulating water. It is difficult to regulate a standard for tests of sprinklers for every building and organisation because it varies on a case by case basis. Changing policy is not easy: it requires a long term effort and must be approved by legislators and higher ups.

Mr Verheijden had some concerns about VESDA (Very Early Smoke Detection Apparatus) systems. He addressed the fact that VESDA may work in saving the lives of the building occupants, but not in protecting the building from damage.

Mr Verheijden revealed where he receives his information on fire protection. These sources include *Fire Australia* magazine, *Engineers Australia*, *Society of Fire Safety—Institution of Fire Engineers*, *Plumbing Insight*, *Insight Australia*, technical society newsletters, conferences, and word of mouth. Mr Verheijden also directed us toward the City of Melbourne Green Building Project as a viable lead.





## Appendix H: Emailed Responses

### Buckley, Greg

#### Interview Questions:

What experience do you have working within the fire protection/sustainable design industry?  
28 years in urban fire service, 20 as operational fire fighter/officer, 8 involved in building fire safety and investigation.

What does your job entail?

Oversee 3 business units in building fire safety and represent AFAC on building code committee. Various other policy functions in area of building fire safety.

#### Challenges Faced:

Do you see one consideration (sustainable building or fire protection) as more important than the other? Why?

The two considerations are not inconsistent and should be seen as quite compatible. A building is clearly not sustainable if it burns down. Sustainability needs to factor total energy and resource costs over the full life-cycle. Fire protection therefore plays an important role in achieving sustainability targets. The conflict arises because of the inherent uncertainty surrounding fire. A building with no fire protection that doesn't have a fire clearly wins hands-down on sustainability but this is not known at the outset. The correct approach is to apply a probabilistic analysis and consider the range of possible scenarios and the impact on life-cycle environmental impacts. This would yield an Expected Environmental Cost and then the appropriate design would be the one with lowest cost. Consequently, it is not sensible to say whether sustainability or fire protection is the more important. To be effective, all environmental costs need to have a dollar value, e.g. building owner deciding whether to have a sprinkler system that may be not required (or building regulators trying to determine whether to require such a system); cost of system (and assuming the life-cycle costs of materials are reflected in price such waste disposal/recycling of pipework, carbon cost of manufacture, etc) + cost of water over life of building for testing etc = \$X, compared with CO<sub>2</sub> emissions from fire + waste disposal of burnt-out remains + life-cycle costs of building replacement materials and energy of construction = \$100X x probability of big fire over 50 year life of say  $p = 0.011 = \$1.1X$ . Decision for sustainability → install sprinklers.

The above ignores life safety issues. So, minimum necessary fire safety regulation for life safety is most important followed by property and environment considerations based on the above.

What do you believe are some reasons for this conflict?

Different agendas of competing interest groups. A lack of understanding and communication between these groups to find common ground.

**Incentives:**

What do you think are the primary incentives for constructing a building that is sustainable?  
Primarily regulation but also money and public acceptance. Building owners would like to recoup upfront capital costs with reduced building running costs.

The ultimate goal is to preserve the environment for the long term but this is a public good and private interests are the means to achieve it. Full cost of environmental impacts needs to be mandatorily included in all aspects of building project so developers can make an economic decision which is in their interest that also satisfies the community's interest of sustainability.

How do these differ from incentives for constructing a building that is fire safe?

Very similar. Fire safety generally forced by regulation and/or financial considerations through reduced insurance premiums.

Should fire protection measures count towards achieving a higher Green Star Sustainability Rating of a building? (If they don't explain, ask them to explain their reasoning.)

Yes. Reasoning as above.

**Fire Protection and Sustainability:**

Can you give any examples of specific problems that you have seen in integrating fire protection and sustainability?

Multi-storey timber buildings. Not a big problem here yet but finding increased use overseas. Presumably the timber use is seen as more renewable and less energy intensive than concrete. This could be reasonable provided the life-safety minimum threshold as discussed above is met. This may well be dubious.

**Opportunities:**

In the future, what opportunities do you see for combining these two fields in order to construct buildings that are both fire safe and sustainable?

The biggest opportunity is to broaden the view from considering buildings in isolation to one of considering the overall urban planning framework. More gains are then achievable, principally with how water is provided. If we rely on fire brigades for fire protection then we need a substantial reticulated water supply network which has been historically the case but this can be

wasteful. With greater local solutions for water provision, domestic tanks, twin systems of potable and recycled water, etc, the sole user of big piped systems is the fire brigade. The fire brigade can be reduced in the system if homes are more self-sufficient through domestic sprinkler systems. This also reduces house fire losses. Water sustainability is then linked to improved home fire safety.

What are the barriers for combining these two fields in order to construct buildings that are both fire safe and sustainable?

Vested interests. Different sectors of economy have an interest in the status quo. Government departments also don't consider the big picture but work in their particular patch addressing their problems. There needs to be a drive from central areas of government.

### **Social Implications:**

In your job, what changes have you seen in your clients' requests to become more sustainable?  
No experience here.

In your job, what changes have you seen in your clients' requests to become more fire safe?  
Generally clients are resistant and seek only to meet minimum regulatory requirements.

What positive impacts do you foresee if the fire protection industries and sustainable building industries worked together?

Improvements for both. If fire protection is appropriately recognized for sustainability then it will obtain greater penetration as there will be more incentive to incorporate to meet various greenstar schemes. Sustainable building industry will also have another outlet to explore in terms of exploring use for new materials and possibly integrating systems, e.g. use of sprinkler system for general water supply to reduce piping?

### **Hughes-Brown, Benjamin**

#### **Interview Questions:**

What experience do you have working within the fire protection/sustainable design industry?

I have a diploma of mechanical engineering from Canberra Institute of Engineering, an undergraduate degree in mechanical engineering and diploma of engineering practice from the University of Technology, Sydney and a Masters of Fire Safety Engineering from the University of Western Sydney. I started work as a fire safety systems designer and fire safety engineer with Norman Disney and young in 2003. In 2009 I started work with the New South Wales Fire Brigades as their Senior Fire Safety Engineer. In 2011 I moved to my home town of Canberra to work with Defire as a private fire safety engineer. In 2008 I became a chartered professional

engineer and registered with the National Professional Engineering Registry as a mechanical engineer and specialist in fire safety engineering as administered by Engineers Australia. In 2009 I became a member of the Institute of Fire Engineers.

What does your job entail?

My current job entails undertaken review of building designs against the Building Code of Australia and identifying areas of non-compliance, in addition undertaking fire engineering assessments on the deviations to demonstrate that the performance requirements of the Building Code of Australia are maintained. My job also includes liaising with clients, architects, developers, and authorities such as building certifiers and fire brigades.

**Challenges Faced:**

Do you see one consideration (sustainable building or fire protection) as more important than the other? Why?

No, both are equally important. Fire is a major contributor to how a building is not sustained. In the International Fire Engineering Guidelines it details that the life of a building includes its construction and then either modification, being demolished or being subject to fire. It probably should also note that buildings are subject to natural disasters as well including flooding and earthquakes. FM Global recently reported that if you prevent a fire from occurring or minimizing the impact of a fire to the object or general area of fire origin that you can sustain the building through its design life and maintain its carbon footprint to reasonable levels. Should a fire consume the building, the carbon released from the building materials results in a carbon footprint up to three times that otherwise generated from the natural building life.

What do you believe are some reasons for this conflict?

I don't believe there is a conflict, simply an undiscovered country. During my years with the NSW Fire Brigades, I saw many opportunities to enhance the sustainability of buildings with fire safety systems including the use of natural ventilation for human comfort as well as smoke relief in the event of a fire without the need for costly mechanical smoke hazard management systems or ventilation systems. In addition the re-circulation of test water for the wet safety systems of hydrants and sprinklers as well as the fire systems reservoir tanks being used for the air conditioning cooling systems and domestic water supply.

**Incentives:**

What do you think are the primary incentives for constructing a building that is sustainable?

peace of mind and having the modern developments of a society for us as well as our grandchildren.

How do these differ from incentives for constructing a building that is fire safe?

They don't you can have both, unfortunately it does depend on the design team involved as well as the budget and finances of the project.

Should fire protection measures count towards achieving a higher Green Star Sustainability Rating of a building? (If they don't explain, ask them to explain their reasoning.)

Yes to a certain degree. There are processes such as testing the systems that waste a great deal of water, these provisions should be given the opportunity to be used on all buildings even retrospectively. Other systems such as fog type sprinkler heads have been demonstrated to reduce the water demands on the system. Having the capacity to move this system from a proprietary product to a mainstream design would help lower the demand of water supply whilst maintaining sustainable buildings.

**Fire Protection and Sustainability:**

Can you give any examples of specific problems that you have seen in integrating fire protection and sustainability?

One of the most challenging projects was the use of natural ventilation, due to the building design, it was a challenge to ensure that the development of the smoke did not compromise the egress paths of evacuating occupants. Through several computer simulations as well as hot smoke tests to commission the system it was achieved.

**Opportunities:**

In the future, what opportunities do you see for combining these two fields in order to construct buildings that are both fire safe and sustainable?

There are great opportunities, we have only just scratched the surface but it will require evidence based robust analysis, because we are dealing with peoples lives we can't just rush in as we may get it wrong. Previously we would over engineer to account for the unknowns, through advancements in computer simulations and their accuracy the need for over engineering is reducing but we can't completely hang our hat on them. As our evaluation and evidence based analysis improves so can our building designs and the marriage of sustainability and fire and life safety will be able to prosper.

What are the barriers for combining these two fields in order to construct buildings that are both fire safe and sustainable?

As detailed above, qualifications of the engineer and the ability to appropriately evaluate it.

**Social Implications:**

In your job, what changes have you seen in your clients' requests to become more sustainable?

Given that I work in the Australian Capital Territory with a large government presence, the main aspect has been the minimum requirements for government buildings to have energy ratings.

In your job, what changes have you seen in your clients' requests to become more fire safe?

Unfortunately its more about cost saving than fire safety, we and the fire brigades need to work with the clients to maintain minimum levels of life safety are maintained.

How have you addressed these requests?

By highlighting the reality of their request and that there are some serious consequences for getting it wrong especially life safety and legal issues.

What positive impacts do you foresee if the fire protection industries and sustainable building industries worked together?

Safe buildings that are sustainable but have not compromised the expected level of safety of the community

**Deliverables:**

Where do you receive information from regarding fire protection?

Building regulations, industry seminars, circulars, journal publications, and industry magazines.

Where do you receive information from regarding sustainable design?

as above but also from green council groups.

What would be the best ways to convey information to the (sustainable building or fire protection) industry? [Whichever the interviewee is a part of]

by encouraging cross pollination of the disciplines, too many engineers keep to the little world and expertise. We need to break down these walls and work together.

**Follow-up Leads:**

Is there anything else that you would like to share with us?

I think that your questionnaire is a steep in the right direction and I hope that it does progress and trigger many further discussions as well as actions on sustainability and fire safety.

Who would you recommend that we contact to further our understanding of the issues facing the fire protection and sustainable building industry? (Especially sustainable building industry)

Property councils, fire brigades, fire engineers.

**Peter Wilkinson**

**Interview Questions:**

What experience do you have working within the fire protection/sustainable design industry?

I have nearly 20 year experience working in the fire safety and fire engineering, with limited experience of the sustainable design industry.

What does your job entail?

I manage teams of risk surveyors, fire consultants and fire engineers who undertake commercial property insurance surveys, fire risk assessments and provide fire engineering advice to a wide range of clients.

**Challenges Faced:**

Do you see one consideration (sustainable building or fire protection) as more important than the other? Why?

In the UK, most buildings are constructed without fire sprinklers. I have heard the argument that the embedded carbon involved in the manufacture of steel pipe can be used as a reason for not installing sprinklers, but surely the creation of resilient buildings that have the inherent ability to detect, control and suppress fire is a sustainable objective. Sustainability seems to be a consideration of more importance than fire safety because it is politically very current and an area generating much media interest. However, fire safety is still just as important when building designs are gaining approval from the AHJ.

What do you believe are some reasons for this conflict?

Conflict seems to arise as political and economic priorities are not clear.



**Incentives:**

What do you think are the primary incentives for constructing a building that is sustainable?

- Kudos (it is very 'trendy' at the moment)
- Economic/financial incentives (lower fuel costs over building life-cycle)

How do these differ from incentives for constructing a building that is fire safe?

Fire safety is always a 'grudge' purchase. The client only wants to pay for the minimum required.

Should fire protection measures count towards achieving a higher Green Star Sustainability Rating of a building? (If they don't explain, ask them to explain their reasoning.)

I'm not aware of Green Star Rating, but I'm sure it is similar to BREEAM in the UK. Fire protection measures should be included in such tools/schemes so that fire safety is not forgotten. The two objectives can complement each other if properly considered.

**Fire Protection and Sustainability:**

Can you give any examples of specific problems that you have seen in integrating fire protection and sustainability?

The sustainability requirement for better performing thermal insulation has seen the re-introduction of wall systems including polystyrene-based materials into buildings, which have well known poor performance in fire.

The requirement for sustainable building materials has seen the introduction of timber-framed commercial buildings. We have suffered many notable construction site fires in timber-framed buildings.

The sustainability for 'green' roofs involving covering in plants such as grasses, sedum, etc. can, if not properly irrigated, create surfaces with poor resistance to flame spread allowing fire to spread to adjacent buildings.

The requirement to utilize recycled materials in a sustainable way has led to the use of novel materials such as tiles made from used vehicle tires used as external cladding.

**Opportunities:**

In the future, what opportunities do you see for combining these two fields in order to construct buildings that are both fire safe and sustainable?

There are limited opportunities as the industries are quite separate and the goals are very different. Multi-disciplinary engineering consultants can work in a more co-ordinated way, but generally it depends on how the architect manages the project.

**Deliverables:**

Where do you receive information from regarding fire protection?

British Standards, NFPA, SFPE, etc.

What would be the best ways to convey information to the (sustainable building or fire protection) industry? [Whichever the interviewee is a part of]

Consulting engineers are continually bombarded by information in the form of unsolicited emails, direct mail, sales presentations, etc. The best way to attract the attention of

busy professionals is to offer genuine CPD (continuing professional development) training events, with accreditation from the relevant learned societies.

**Social Implications:**

In your job, what changes have you seen in your clients' requests to become more sustainable?

It is the role of the professional engineer to advise and inform their client in order to define a brief that is most appropriate to the clients' needs, budget and business. Sustainability is probably being promoted as a way of reducing building life-cycle running costs, and is therefore attractive to the client.

In your job, what changes have you seen in your clients' requests to become more fire safe?

The client only wants a building to be 'more fire safe' if legislation dictates, or if their insurer demands.

What positive impacts do you foresee if the fire protection industries and sustainable building industries worked together?

A co-ordinated approach would help to minimize the risk of conflict later in the design/construction process and help to design buildings that are genuinely more resilient, in terms of resilient to fire and to climate change.

What negative impacts do you foresee if the fire protection industries and sustainable building industries worked together?

There can be nothing negative. Closer working is the only option.

## Appendix I: List of Possible FPA Australia Survey Questions

Based on the definition of sustainability given below, please answer the following survey questions.

Sustainability within the fire protection industry involves application of fire safety systems and design measures that support and promote building characteristics that are environmentally friendly during the buildings' daily use. These systems and designs must reduce the fire risk and impact that such characteristics and uses might contribute to throughout the full life expectancy of the building. Daily use characteristics include reducing harm to the environment by minimising energy consumption, water consumption, material consumption and fire risk.

- 1) How long have you worked in the fire protection field?
  - a. 0-5 years
  - b. 5-10 years
  - c. 10-20 years
  - d. 20+ years
  
- 2) How would you characterize the organization that you work for?
  - a. Pro sustainability
  - b. Not focused on sustainability
  
- 3) On a scale of 1-10, 1 being **not** important and 10 being **extremely** important, how important do you think environmental impact is in the design and construction of buildings?  
1      2      3      4      5      6      7      8      9      10
  
- 4) Should fire protection measures count towards achieving a higher sustainability rating for a building?
  - a. Yes
  - b. No
  
- 5) Which of the following sustainability considerations have you been involved in with you work? Choose as many as you wish.
  - a. Energy efficiency
  - b. Water efficiency
  - c. Use of environmentally friendly materials and renewable resources
  
- 6) What kind of factors (if any) prevent fire safe construction of sustainable buildings?
  - a. Cost

- b. Lack of communication
  - c. Lack of awareness
  - d. Lack of product
  - e. Poor promotion of product
  - f. There is nothing preventing fire safe construction of sustainable buildings
- 7) Have you been exposed to sustainable design elements that impact fire safety?
- a. Yes, proceed to question 8
  - b. No, skip to question 9
- 8) What examples of sustainable construction elements have you been exposed to that impact fire safety? Choose as many as you wish.
- a. Use of more combustible materials such as timber
  - b. Reduction in fire and smoke compartmentalization in buildings to allow for more natural light and air flow (i.e. atrium or large open spaces)
  - c. Sun screens/shades
  - d. Wind turbines
  - e. Vegetative roofs
  - f. Solar panel roofs
  - g. Skylights
  - h. Sandwich panel insulation
  - i. Hydrogen fuel cells
  - j. Other \_\_\_\_\_
- 9) Which of the following fire safety aspects do you feel pose the largest negative impact on the environment?
- a. Water usage from sprinklers
  - b. Water usage from hydrants
  - c. Fire resistant/retardant material
  - d. Ozone depleting halon fire extinguishers
  - e. Hybrid fire extinguishers (FM-200 extinguishing systems)
  - f. Other \_\_\_\_\_
- 10) The Building Code of Australia allows for alternative solutions to promote creativity without the restrictions of the “Deemed to Satisfy” guidelines. Do you think that these alternative solutions have a role to play in developing more sustainable buildings?
- a. Yes
  - b. No
- Explain

- 11) Do you think that the fire protection industry can contribute to the environmental impact of buildings?
- Yes, proceed to question 12
  - No, skip to question 13
- 12) What would be the best way to reach both the fire protection industry and the sustainable building industry to promote awareness about the opportunities for collaboration and integration between the two fields?
- Website
  - Published guide/pamphlet
  - Article in magazine or newspaper
  - Seminars
  - Summit
  - Other \_\_\_\_\_
- 13) Do you feel that there needs to be an increase in communication between the fire protection industry and the sustainable building industry?
- Yes
  - No
- 14) Would you be interested in attending a conference addressing both sustainable building and fire protection?
- Yes
  - No
- 15) Are there any other observations you would like to add?

## **Appendix J: Summative Team Assessment**

Our team efficiently worked to constructively monitor each other. In the beginning of our project, it was challenging to remain focused throughout the work day. However, we addressed this issue by allotting ten minute breaks every two or three hours to enhance our focus. Since most of our interviews were done in groups of two, we had to adjust to work with only one other person. This allowed each of us to take on more responsibility for the project rather than relying on the group as a whole. Once we completed our interviews, we moved into writing and revising. The writing was often done individually and then revised as an entire group. We found that it was most effective for one person to read aloud while the rest of the group commented on specific changes. This process was time consuming, but allowed everyone to have a fair say in the revising and promoted good group discussions.

We had some challenges with communication during the beginning of this project. We were able to work through these challenges by attending group counseling sessions. After these sessions we were able to work more effectively because our problems had been discussed. More open lines of communication were beneficial to our group work mentality. These better communication techniques were continued for the remainder of our project, and proved to be very helpful. When we did face challenges as a group, we often used compromises or turned to the advisors for clarification. By working out the majority of our group problems at an early stage of the project, we were able to determine the strengths and weaknesses of each group member and assign tasks accordingly.