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CRC





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Stage 1: Low Carbon, High Performance Schools



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Foreword

This report was written to further current understanding and knowledge on how to best deliver low carbon, high performance schools in the Australian context. While several international studies have demonstrated the benefits of green, low carbon schools, little research has been undertaken done in Australia. The authors, having been involved in the creation of the first officially certified Carbon Neutral school in Australia, were keen to explore how this process could be made easier to enable more schools to achieve this status.

The report is written for anybody working with schools, including teachers, admin and school support staff, Education Departments, academics, professionals, parents and the general public. The report aims to highlight the multiple reasons for pursuing carbon reduction, and provide some ideas and incentives to encourage greater uptake. It is hoped that by identifying some of the barriers and challenges facing schools wishing to decarbonise, solutions can begin to be sought.

This research project was funded through the CRC for Low Carbon Living (CRCLCL). The CRCLCL is a national research and innovation hub that seeks to enable a globally competitive low carbon built environment sector. With a focus on collaborative innovation, the CRCLCL brings together property, planning, engineering and policy organisations with leading Australian researchers. The CRCLCL develops new social, technological and policy tools for facilitating the development of low carbon products and services to reduce greenhouse gas emissions in the built environment and is supported by the Cooperative Research Centres (CRC) program, an Australian Government initiative.

For more information, go to www.lowcarbonliving.com.au.

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We would like to acknowledge all the participants who attended the Low Carbon Schools Workshops, held at the City of Fremantle in July and August 2014, as well as those who filled out the survey. Your time and contribution to this research was greatly appreciated.

Disclaimer

While we endeavoured to make this report as comprehensive as possible, we acknowledge various limitations around the tools and programs, state and territory carbon-related targets, and data collected at the Education Department level. Obtaining information on all of these was difficult, and thus the results are not intended to be conclusive or exhaustive. In many cases, the information provided gives a glimpse or example of. The authors take responsibility for what appears in this report.

Peer Review Statement

This report has been reviewed by the CRC Program Leader of Engaged Communities Stephen White, and the CRCLCL Board.

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Acronyms

AuSSI	Australian Sustainable Schools Initiative
BER	Building the Education Revolution
BCA	Building Code of Australia
CERES	Centre for Education and Research in Environmental Strategies
CN	Carbon Neutral
CNC	Carbon Neutral Committee
CO ₂	Carbon Dioxide
CO ₂ -e	Carbon Dioxide Equivalent Emissions
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DoE	Department of Education
EfS	Education for Sustainability
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
HVAC	Heating, Ventilation, and Air Conditioning
IAQ	Indoor Air Quality
IEQ	Indoor Environment Quality
LED	Light Emitting Diode
NCOS	National Carbon Offset Standard
NSSP	National Solar Schools Program
PV	Photo Voltaic
SAP	Sustainability Action Plan
SEMP	School Environmental Management Plan
SETS	School Environment Tracking System
SFSSH	South Fremantle Senior High School
VOCs	Volatile Organic Compounds

Executive Summary

This report explores how we can best deliver low carbon, high performance schools in the Australian context. High performance in this report refers to both the buildings and physical infrastructure in schools, as well as improved academic performance due to the increased health and productivity benefits associated with better buildings and facilities. There are also significant educational benefits, as students begin to learn more about resource efficiency and building performance within their curriculum, and share this knowledge with the community. This is the next agenda for low carbon, high performance schools.

Abundant opportunities and reasons for taking action were highlighted in the research, though several barriers and obstacles were also identified that are currently preventing greater adoption by schools. These will need to be addressed in the future in order to encourage more schools to be actively involved in reducing their carbon footprint. Various tools, programs and initiatives were also examined that can assist schools with this process. Below are the key findings from this research.

Key benefits to schools to improve overall performance by pursuing carbon reduction

Implementing practical, low carbon, sustainability initiatives in schools, including retrofits and upgrades to buildings and behaviour change programs for students and staff, can significantly reduce resource consumption (particularly energy and water) in schools. This not only reduces their carbon emissions, but can result in considerable financial savings from decreased utility bills. There are also several documented social benefits of low carbon, green school buildings including improved health, productivity and increased performance of students and staff. These are a result of better day lighting, air quality and indoor environment (including visual access to plants and greenery). Therefore, pursuing a sustainable and low carbon agenda in schools will help to create a new generation of high performing schools, both in terms of people and their buildings and facilities.

Furthermore, as sustainability is one of only three national cross-curriculum priorities, teachers can use school buildings as living laboratories to educate students about the importance of sustainability, climate change and reducing resource consumption, thereby providing hands-on learning opportunities. There are countless opportunities to embed low carbon and sustainability initiatives into the school curriculum, although there is currently a lack of materials and resources (i.e. lessons plans) available that teachers can readily pick and use, specifically in relation to practical initiatives.

Various links between schools and the wider community have been identified in numerous studies. Much of the literature on Education for Sustainability (EfS) has documented the key role schools can play in educating and engaging the local community on sustainability issues and how schools can become a hub or centre for sustainability.

Key issues, challenges and problems facing schools attempting to decarbonise

Existing literature, together with results from surveys and workshops, highlighted the broad variety of sustainability initiatives being implemented in schools. However, it also revealed that few schools in Australia are currently systematically calculating their carbon footprint, or know or understand the impact that their sustainability initiatives have had on reducing their carbon emissions. No studies have been conducted that document the overall carbon abatement opportunities available within school sector in Australia.

Carbon footprinting has been identified as an important starting point for any school wishing to pursue carbon reduction and improve their operational performance. As the saying goes: 'you can't manage what you don't measure'. However, very few schools are currently undertaking this process, despite the documented benefits. Literature on the barriers facing schools was discussed through three separate themes: grassroots, administration and conceptual.

From surveys, interviews and workshops conducted with key stakeholders as part of this research, the key issues preventing schools from calculating and reducing their carbon footprint include financial barriers, time restraints and a lack of interest and knowledge of the subject by teachers. Additional challenges included: relying too heavily on key sustainability champions within schools, which mean initiatives often fall over when they leave; concern from schools about negative community perceptions of associating themselves with 'being green' (i.e. where parents are working in energy intensive/mining fields); the lack of a universal carbon framework for schools or guidelines and/or tools to assist them in calculating their carbon footprint; no systematic approach for how to reduce emissions in schools; the lack of available data on the cost-benefit analysis of various sustainability retrofits, upgrades and initiatives, and; the lack of teaching and learning resources, materials and lessons plans, to embed low carbon initiatives into curriculum.

Opportunities to develop carbon performance benchmarks and targets for schools

Measuring the carbon footprint of a school provides the critical starting point when beginning the process for reducing the carbon and/or environmental impact of a school. Conducting a carbon footprint analysis of a school allows a baseline to be set across a variety of sources of emissions (i.e. energy, water, transport and waste) within a school using a common metric (i.e. carbon). This allows schools to track their progress and compare themselves with other schools. Currently, schools are unable to compare their carbon reduction achievements as few schools have calculated their emissions, and no standardised process exists for doing so.

There are currently no carbon performance benchmarks available for schools in Australia, and from literature reviewed, no studies that are developing them. If an online carbon footprinting tool was made available to all schools in Australia, the utility data uploaded could be used to create a database of schools carbon performance, which could be used by researchers and policy makers to establish benchmarks for schools.

Identification of existing school sustainability programs, which focus on carbon

This research examined and reviewed existing sustainability programs, initiatives and tools to determine how many included, or specifically focused on, carbon. Carbon tools were distinguished from programs and initiatives by their ability to actually calculate the carbon emissions within schools. Programs and Initiatives may provide guidance, resources and process for how to undertake a carbon footprint, but don't actually provide a tool to do the calculations.

The analysis revealed that despite the existence of countless sustainability programs in Australia, very few actually targeted carbon and only one was able to quantify the range of carbon emissions that are generally included in a carbon footprint (i.e. at a minimum, energy, water, waste and transport).

It was also found that while significant teaching and learning resources are currently available around broader sustainability topics, additional supplementary resources are required to ensure that the carbon footprint process and the associated carbon reduction initiatives are able to be embedded directly into the curriculum. This was deemed critical to the success of any new initiative. Ensuring that new tools, initiatives or processes could also be incorporated into existing programs was also highlighted as a key factor for the success.

Evaluation of tools in terms of their ability to quantitatively assess and reduce school-based emissions

As mentioned, very few tools were identified that focussed on carbon, and of those, there was no consistency in terms of what areas they targeted. Only one tool, namely the School Environmental Tracking Systems (SETS), was identified as being able to quantitatively assess carbon across a variety of activities that are usually associated with a carbon footprint. Other programs and tools considered different types of emission sources, highlighting the inconsistency amongst the tools.

One Federal Government led national sustainability program (i.e. the Australian Sustainable Schools Initiative – AuSSI) was highlighted, but this did not have a focus on carbon. There were several consultancies across the country that targeted schools and provided carbon footprinting, though it was difficult to obtain adequate information about the sources included in the footprints.

Identification of pathways to create a framework and system for schools seeking carbon neutrality

The research identified various existing carbon accounting frameworks and methodologies that could potentially be used for schools. The most well known of these is the GHG Protocol, developed by the World Resources Institute and the World Business Council for Sustainable Development. The Australian Federal Government has also created the National Carbon Offset Standard Carbon Neutral Program, which provides carbon neutral certification for businesses and products. Two additional GHG methodologies were developed in the UK for Low Carbon School projects.

These are all likely to be seen as too complex for schools in Australia. Nevertheless, they provide a good starting point, from which to develop a suitable framework and system.

Based on the findings above, a number of opportunities have been identified and recommended as further research. These are provided below.

Recommendations:

1. A Low Carbon, High Performance Pilot Program

This research recommends the development of a Low Carbon, High Performance Schools Pilot Study. This study would assess both the carbon footprint of schools and measure various health and productivity factors to

determine whether carbon can be used as a metric to assess High Performance schools within an Australia context. Key components of the pilot study include:

- The development of indicators to measure the effect of carbon reduction initiatives across a variety of sources;
- The development of suitable metrics to measure student and staff performance/productivity;
- The development of a national online carbon footprint calculator specifically for schools. This calculator could either be embedded into a broader platform (discussed below) or integrated with existing initiatives (such as the ResourceSmart AuSSI Vic platform). It would collect, calculate and publish carbon-related school utility data, which could then be used to create benchmarks for the carbon performance of schools across Australia;
- The development of an online platform that allows schools across Australia to communicate with each other and share information and experiences. This could assist schools to identify the most appropriate solutions, those that didn't work, and those that offer the greatest carbon reduction for the least cost.
- The development of a basic cost-benefit carbon calculator that provides simple Return-On-Investment (ROI) calculations to determine rough feasibility for low carbon retrofit initiatives and upgrades. This can help to highlight the key opportunities and appropriate payback periods for school administrators;
- The development of new curriculum-based materials and resources (including lesson plans) that are tailored around low carbon initiatives (i.e. using the carbon footprinting calculator mentioned above, analysing the carbon reduction opportunities associated with various initiatives, energy and water efficiency, local food production, student commute to school etc.). This will help to ensure that initiatives do not become the responsibility of, and therefore rely solely on, individual champions within a school. It will also provide exceptional opportunities for embedding sustainability into the curriculum, which is a national priority;
- Conduct a review of high-performing, low carbon schools across Australia to identify the key factors that contributed to their success, including popular and effective initiatives, governance structures, procurement processes, and community and industry partnerships. This should be filmed as Star Performing Schools and made available to all schools to encourage and motivate them to participate.

2. National Framework, Methodology and Certification for Low Carbon Schools

The creation of a national carbon accounting framework and methodology for schools would increase the credibility and comparability of carbon claims made by schools. It would also help to streamline the process, which could provide greater potential for replicability by other schools. This would also increase the useability of the data collected by schools.

Such a framework would include the minimum emission sources required within a school's carbon footprint, as well as the process for how schools can achieve carbon neutrality; similar to the process South Fremantle Senior High School went through. This framework and process should be developed collaboratively with schools and key stakeholders to ensure that it is applicable and viable in a schools context. The online calculator discussed above would need to be based on this. Having a standardised framework would also mean that any future carbon calculators developed (e.g. by consultancies, schools or research institutes), would be more consistent and able to feed data into the national database.

A certification process could be established through the CRCLCL for delivery through an accepted accrediting body. This would provide a mechanism to help motivate and incentivise schools on their journey, allowing them to celebrate their success in becoming a low carbon, high performance school.

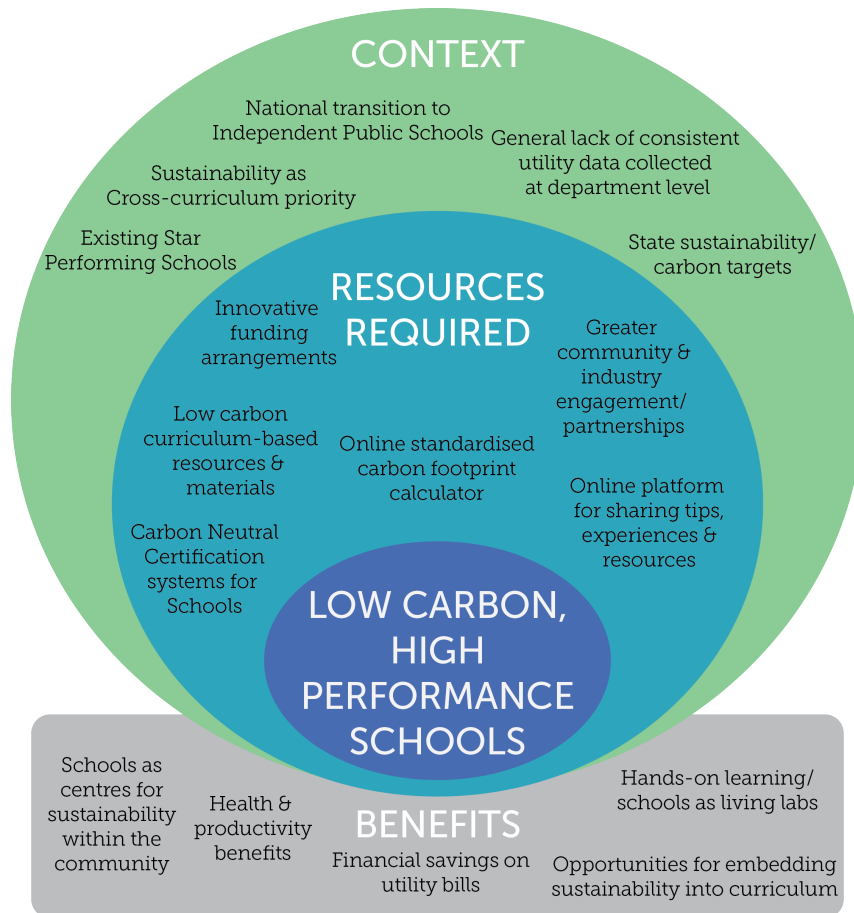
3. Community Partnerships and Innovative Funding Models

Future research should explore further opportunities around innovative community and industry partnerships that can both ramp up the speed and cost-effectiveness of implementing low carbon and other sustainability initiatives in schools, whilst engaging wider with the community on such issues.

4. Sharing Resources

It is recommended that new opportunities be investigated for sharing resources between schools, including project officers/personnel that can assist with implementing carbon reduction initiatives. A network of people willing to assist in such sharing of knowledge could be created through this project.

It is also recommended that States and Territories consider sharing more of their resources, knowledge, and databases with each other. This can help to spread costs of developing new software or platforms between the states, particularly in relation to the AuSSI program.



Conditions for Mainstreaming Low Carbon, High Performance Schools in Australia.

1. Introduction

Overview

Climate change, the depletion of natural resources, together with rising energy and utility prices and the shift towards global carbon pricing are some of the key challenges facing Australia. Globally, scientists have insisted that a reduction in carbon emissions of 80 per cent is required by 2050 in order to keep global warming below two degrees of pre-industrial levels (IPCC, 2007).

Currently, around one third of global greenhouse gas (GHG) emissions are attributable to buildings and the built environment (Ibn-Mohammed et al, 2014). Many studies have demonstrated the abundant carbon abatement opportunities that exist within the built environment. These are predominantly based around energy efficiency, and include retrofitting and upgrading a largely aging building stock (CIE, 2007; McKinsey & Company, 2008).

As with all buildings and infrastructure, school buildings and facilities are rapidly aging and becoming increasingly inefficient. A recent audit on 27,000 Victorian government school buildings found that a quarter of them were below standard and required additional maintenance funding (School Maintenance Audit, 2009). Currently, no national benchmark exists for the performance of Australian schools, and little information is available to assist schools to understand how well or poor they are performing. A number of states are, however, developing and piloting a NABERS¹ tool for schools, designed to benchmark energy consumption in schools.

Electricity represents the largest proportion of energy consumption in schools, currently over 70 per cent of total energy use, with gas providing the remaining proportion (COAG, 2012). Public schools and hospitals are often responsible for over 50 per cent of state governments energy expenditure (Energy Efficiency Council, 2011). A study by COAG (2012) estimated that total energy consumption for all schools in Australia in 2012 was currently around 7.0 PJ. This had risen approximately 22 per cent since 2009 and represents around 1.8 Mt CO₂-e, expected to rise to 2.3 Mt CO₂-e by 2020.

While energy consumption accounts for a large percentage of a school's carbon emissions, it should be noted that emissions also arise from a variety of other activities that occur within and outside school boundaries. These emissions all contribute to both a school's overall operational performance² and their carbon footprint. Calculating the emissions from sources such as water and waste, and activities such as extra-curricular excursions (e.g. bus trips and flights), helps schools understand their true environmental impact.

Schools that address and actively reduce their environmental impact are often referred to as 'green' schools.³ In relation to the built infrastructure, green schools generally have lower operating needs, resulting in fewer carbon emissions and environmental impact, as well as lower utility bills. There is also variety of documented health and productivity benefits associated with green schools (Bell & Franz, 2008). These include an increase in student and staff productivity, demonstrated through improved student academic performance, less staff sick days, increased student attendance and overall improved health and wellbeing of students and staff (GBCA, 2013). These benefits are further discussed in Chapter 3.

Green schools could, therefore, also be classified as low carbon, high performance schools. This report identifies a low carbon, high performance school (named hereafter as a 'low carbon school'), as one that performs well across a variety of factors, including built infrastructure and operations, and human health and productivity. As carbon has long been used as a metric within Green Building certification systems, it could be argued that a correlation exists between decreased carbon and increased school performance (both of buildings and occupants). This demonstrates the potential for carbon to be used as basis for measuring the wider performance of schools.⁴

Using carbon as metric for performance provides the opportunity to calculate the impact of a variety of activities in a consistent manner using a common unit of measurement or 'a common metric' (UNEP, 2010), rather than using inconsistent units of measurement (i.e. kWh, Litres and GJ). Carbon footprinting methods are further outlined in Chapter 3.

¹ National Australian Built Environment Rating System (NABERS) is used to rate the energy efficiency of spaces such as offices, homes, and shopping centres.

² Operational performance in this context refers to factors relating to the built environment and not the overall academic performance related to the course, programs or study offerings within a school.

³ Green schools are often, but not always, certified through organisations such as Green Building Councils.

⁴ However, with previous research primarily being conducted in the USA and Europe (GBCA 2013), further research and studies are needed in the Australian context to strengthen the link between low carbon schools and student performance and health.

For schools, calculating and examining their total carbon footprint (i.e. going beyond purely energy) can assist them to understand the hidden environmental deficiencies associated with their current buildings, systems and processes. It can also help schools to measure the impact or success of various sustainability initiatives that they have implemented, or intend to implement. In many instances, schools are unaware of the impact of their initiatives as few programs, initiatives or tools focus on, or examine, the total carbon footprint of schools.

In many cases, addressing resource inefficiencies and implementing sustainability and low carbon initiatives in schools can prevent thousands of dollars being wasted on utility bills each year as well as hundreds of tonnes of unnecessary carbon emissions. There are many success stories of schools across the nation saving significant sums of money through the implementation of sustainable measures (ResourceSmart AuSSI Vic, 2013). In the case of South Fremantle Senior High School – the first certified Carbon Neutral school in Australia - the financial savings on utility bills from implementing various energy and water efficiency measures and carbon reduction initiatives, were in excess of \$40,000 a year (pers comm 2014). This case study is presented in Chapter 2.

Aside from the social, environmental and financial benefits associated with low carbon schools, additional benefits include opportunities for providing hands-on learning experiences for students and the potential for increased community engagement around sustainability. School buildings and facilities can effectively be used as living laboratories to teach students about a range of environmental issues such as carbon, climate change, resource scarcity, renewable energy and resource efficiency, thus providing important hands-on, or experiential, learning opportunities for students. The process of combining theory with experience and practice is understood to be a powerful teaching method as it helps to create meaning from an experience (Tatwar, 2009; Wurdinger, 2005, p.11). The idea of hands-on learning and using schools as living laboratories involves a 'whole-school approach' to sustainability (AuSSI-SA, 2005). This practice is widely espoused within Education for Sustainability (Efs) literature (Gough & Sharpley 2005), which is discussed further in Chapter 3.

Many of the practical teachings from low carbon schools (particularly around increasing the efficiency of energy, water and waste systems) can also often be applied to homes and/or communities, making schools an important vehicle for community engagement, and students key sustainability ambassadors within the community.

Significance and Objectives

With low carbon schools now a part of the global, national and local agenda (IPCC 2014), carbon footprinting provides a pathway for measuring and reducing school-based emissions. Establishing a school's baseline carbon emissions allows schools to more easily identify, implement, and measure the success of a variety of initiatives that can reduce their carbon footprint and increase their overall performance.

Carbon footprinting is also particularly useful for schools who are already implementing a variety of sustainability initiatives, but don't have a meaningful or standardised process of measuring their impact. Using carbon as a metric essentially creates a common language and enables better comparisons to be made between schools across emissions sources. However, to date, there has been limited research into how low carbon initiatives and actions can be implemented within schools in Australia. Against this background, the significance of this research relates to the following:

- There is little awareness around the co-benefits of low carbon schools;
- Few schools are actively pursuing carbon reduction initiatives and little research has documented the reasons why;
- There are currently no benchmarks, baselines or standards for a school's carbon emissions' performance;
- There is confusion and uncertainty around existing tools, programs and initiatives and how they relate or compare to each other;
- There has been little quantitative evaluation of the impact associated with school-based initiatives or how schools are reducing their carbon footprint, despite a significant focus on carbon reduction at the state level, as well as a range of existing sustainability initiatives already in place in schools;
- There is currently no framework or guidelines that set out what low carbon or carbon neutrality means for schools;

In light of the gap in the research highlighted above, the objectives of the study are to:

- Identify the key benefits and opportunities for schools to improve their overall performance by pursuing carbon reduction;

- Identify the key issues, challenges and problems facing schools attempting to reduce their emissions, and what additional processes, resources and assistance schools need to help them actively measure, monitor and reduce their carbon footprint;
- Identify opportunities to develop carbon performance benchmarks and targets for schools;
- Identify and categorise the existing school sustainability programs, with a primary focus on carbon;
- Evaluate the tools in terms of their ability to quantitatively assess and reduce emissions at the school level;
- Identify pathways to create a framework and system for schools seeking carbon neutrality.

Research Scope and Limitations

The first stage of this project (this scoping study) involves a review of the benefits of low carbon, high performance schools and the main barriers preventing schools from taking action to reduce their carbon footprint. It also examines existing tools, initiatives and programs specifically targeting carbon in schools in order to understand what additional resources are needed to help increase the number of low carbon schools in Australia. Surveys, interviews and workshops with key stakeholders have helped to inform the discussion and analysis provided within this report. The results of these analyses will also inform the design of the second stage of this Low Carbon School Project.

While this report discusses the health and productivity benefits of low carbon schools, it is beyond the scope to review the assessment methods associated with this. Likewise, existing federal, state and local policies and targets relating to carbon emission are touched upon in the report, but it is beyond the scope to assess and analyse these in detail.

One of the major limitations of this research is around the availability of data surrounding current decarbonising tools and programs. Little detailed information was publicly available, and several programs were only conducted as pilot studies with little follow-up information provided. In most cases, the publicly available information was aimed at schools, and therefore didn't provide detailed information about methodologies or their overall impact or success. Therefore, in order to source further information, contact was made with program coordinators and affiliated stakeholders as well as key personnel in Education Departments and related government agencies. While in many instances, these contacts were able to validate or provide additional data and information on programs and tools, the information provided may be subject to bias.

The tools, programs and initiatives analysed in this study were limited to those available in Australia and focus specifically on carbon. A more comprehensive list of tools is provided in Appendix A. While it was not the intention to evaluate the impact or success of the initiatives, where information was readily available, this was included.

The surveys distributed to teachers and key stakeholders at the workshops and online represent a small sample size and are therefore not representative of all schools in a broader sense. Unanswered or incorrectly completed questions were not included in the data analysis so as not to skew the results.

As part of the desktop literature review, data was also collected on a selection of private consultancies that have conducted carbon footprints specifically for schools. This is not an exhaustive list.

Structure of Report

This report begins by providing some background for why low carbon, high performance schools should be pursued in the Australian context. Chapter 2 highlights the importance of sustainability in relation to the national curriculum, before discussing the role that State and Territory Education Departments play in supporting low carbon schools, including the data that is currently collected at this level. School funding arrangements are discussed in relation to the new focus on increasing the autonomy of schools. Chapter 2 ends with a case study of the first certified carbon neutral school in Australia.

Chapter 3 provides a literature review, which examines some of the main benefits of low carbon schools, including the improved student health and productivity, financial savings, hands-on learning opportunities and how schools can help to engage the community on environmental and sustainability issues. Chapter 3 also identifies existing carbon footprinting methodologies, and analyses the programs, initiatives and tools currently helping schools to reduce their carbon emissions.

Chapter 4 briefly discusses the methods used in this report, which enabled us to obtain information from key stakeholders about some of the barriers facing schools.

The examination of the barriers and limitations for schools attempting to decarbonise is provided in Chapter 5. The information provided in this section is a combination of a literature review and information gathered from the surveys, workshops and interviews discussed in Chapter 4.

Recommendations for further research are provided in Chapter 6, followed by the conclusion in Chapter 7.

2. Context

Introduction

As mentioned, low carbon, high performance schools are now part of the global, national and local agenda. The inclusion of sustainability as part of the national curriculum, and the development of the Australian Sustainable Schools Initiative (AuSSI), a federal Initiative, demonstrates the push towards low carbon, sustainable schools.

The majority of state and territory governments also have targets and goals around climate change, energy efficiency and/or carbon reduction for their government buildings, which includes schools. These targets often determine the role Education Departments play in assisting schools to reduce their utility expenditure and/or carbon emissions.

While previously, the motivation to reduce resource consumption and increase the operational efficiency of school buildings and facilities lay predominantly with State and Territory Government's Education Departments, who managed the buildings and paid the utility bills. However, with the recent push by the federal government to increase school autonomy (primarily in relation to budgets), the incentive for schools to take independent action to increase their efficiency is now greater than ever before, as schools become the primary beneficiaries of the utility savings. South Fremantle Senior High School, who became the first officially certified carbon neutral school in Australia, demonstrated how this process can be achieved, and the potential opportunities when schools can retain their utility savings.

The section below begins with a brief discussion around sustainability as one of Australia's three cross-curricula priorities, before outlining some of the targets at the State level, which can be seen as driving the push towards low carbon, high performance schools. This is followed by a section of how some more progressive Education Departments have been monitoring and tracking utility consumption in schools, and a brief analysis of school funding arrangements and the shift towards greater autonomy. This chapter ends with a case study analysis on South Fremantle Senior High School.

Sustainability as a Cross-Curriculum Priority

The importance of sustainability within education has been discussed extensively for many years. Abundant literature is now available on what has become widely known as 'Education for Sustainability' (EfS). EfS is defined as a teaching methodology that "examines and addresses interrelationships between the social, economic and environmental dimensions of development" (AuSSI-SA, 2005). The Australian Government has released a number of reports discussing EfS at a national level (Australia Government Department of Environment and Heritage [AGDEH], 2005; AGDEH, 2007; Australia Government Department of Environment, Water, Heritage and the Arts [AGDEWHA], 2009).

In 2011, the Australian Curriculum, Assessment and Reporting Authority (ACARA) included sustainability as a cross-curriculum priority in the Australian Curriculum (Kennelly, Taylor & Serow, 2011). The inclusion of sustainability was guided by the Declaration on Educational Goals for Young Australians in 2008, which stated that, "a focus on environmental sustainability will be integrated across the curriculum" (Ministerial Council on Education, Employment, Training and Youth Affairs [MCEETYA], 2008: p.14-15). In 2014, the Australian National Curriculum officially went into effect with sustainability as one of three cross-curriculum priorities (ACARA, 2014).

The cross-curriculum priorities are designed to be embedded across a range of subjects such as English, Mathematics, Science and History. The inclusion of sustainability as a cross-curriculum priority is undoubtedly beneficial to sustainability education in schools, however, there are criticisms about the way it has been included. There is concern that while students will benefit from learning about sustainability issues and concepts in the classroom, disconnects between the inclusion of sustainability in the curriculum and sustainable actions taken by the school may limit its effectiveness (Kennelly, Taylor, & Serow, 2011). This highlights the importance of action-based and experiential learning around sustainability and using the school as a living learning laboratory.

For schools actively pursuing carbon reduction, there are many benefits of embedding low carbon initiatives into school curriculum. Simon Hum, Project Advisor at Sustainability Victoria working on the ResourceSmart AuSSI Vic Program, argues that sustainability initiatives, which aren't integrated into existing programs and/or within the curriculum, are less likely to succeed in the long-term. By embedding initiatives into the curriculum, they become less dependent on the availability of passionate staff and community members and become the shared responsibility of several teachers through learning areas (S. Hum, pers comm, 20 Oct 2014). Henerson and Tilbury (2004) also highlight the importance of this, noting the need to design programs that are "linked to

the *national curriculum and policies as well as international priorities* to ensure that the program is relevant and does not add work to an already overcrowded education system” (p. 49). This is discussed further in Chapter 5 and 6.

State and Education Departments Sustainability Targets

As highlighted, the majority of states and territories have some form of carbon or climate change target or strategies in place that address government buildings, and therefore schools, although many of the reports and strategies are outdated. Appendix B provides examples of GHG targets, goals and associated actions for government infrastructure for each of the states and territories.⁵ These highlight the importance of targeting building efficiency, waste and transport and many had initiatives to increase the amount of solar energy generation.

The environmental or carbon-related goals and targets of each state can affect or determine the level of support offered to schools by their Education Departments. Limited information is currently available on this at the departmental level, however, there are various policies and targets in place at the state level that apply to all departments and agencies within a State, including Education. While it is outside the scope of this report to provide a detailed account of these targets, a few examples of states with proactive targets, goals and policies are highlighted below along with how this has affected support for schools.

The ACT has a mandate that all their government buildings and operations will be carbon neutral by 2020. This includes the Government Education and Training Directorate (ETD), which subsequently has a mandate to make all their schools carbon neutral by 2020. In addition to supporting the AuSSI program, the ETD has conducted comprehensive energy audits on all public schools and has committed to installing solar panels on every school roof through the ACT Solar Schools program with assistance from the National Solar Schools Scheme (NSSP), and was completed in 2013. It is worth noting that national and state initiatives do not target private or Catholic schools. However, the Catholic Education Office has also stated that it is contemplating running a similar process.

The Victorian State Government has invested the most money out of all the states to deliver the AuSSI program. A total of \$8.2 million was allocated to Sustainability Victoria to deliver the AuSSI program over four years. This program has provided support to hundreds of schools across Victoria to implement a variety of sustainability initiatives and reduce their carbon emissions as well as reduce their costs.

In other states such as WA and Tasmania, far fewer resources have been allocated to assist schools in reducing their resource use and utility bills. In Tasmania, despite the State Government deciding to not fund the AuSSI program, \$1 million to the Department of Education to carry out sustainable school retrofits.⁶ The Department of Education also built the Sustainability Learning centre, which delivers various sustainability school programs in conjunction with NRM groups and other organisations across the state. In 2010, approximately 44 per cent of all schools in Tasmania were engaged in sustainability in some way (pers comm, 2014).

Utility Data Collected at Education Department Level

Each of the State and Territory Education Departments collect school-related utility data, though the quality and level of detail varies significantly. It was difficult to obtain accurate information on utility data collected and how it is used by each of the States and Territories.⁷ A few examples are given below, where information could be sourced.

The ACT government appears to be the only state systematically collecting data on the GHG emissions from all of their government buildings, which includes schools. This is displayed on their Enterprise Sustainability Platform (ESP)⁸, a database that collects electronically fed energy (electricity and gas) and water data direct from utility providers, both in consumption units and cost (ACT Government, 2013). This information now underpins their annual GHG reporting and will be critical in helping the ACT government to achieve their goal of reaching Carbon Neutrality by 2020 (ACT Government, 2014).

⁵ In some cases it was difficult to find specific targets. It is outside the scope of this research to provide a detailed analysis of each state and territory carbon and sustainability targets and strategies.

⁶ Tasmania's Department of Education provided schools with \$20,000 or matched funding to undertake retrofits and upgrades to buildings and school infrastructure (see <http://www.talkingeducation.com.au/press-releases/tas-govt/1m-program-to-reduce-schools-carbon-footprint>)

⁷ The lack of available data on school buildings at the state level was also highlighted in a recent report by COAG (2012), which examined baseline energy data for a range of commercial buildings, including schools, across the states and territories. The authors of this report were unable to obtain energy consumption data from Tasmania, Victoria, WA and SA.

⁸ The ESP was implemented in July 2012 (ACT Government 2013).

In addition to the ESP, ACT schools have their own monitoring platform, which uses the electronically-fed utility data for electricity, solar energy production, gas and water to graphically display schools resource consumption.⁹ This platform is the only publicly accessible database displaying school-related consumption data, amongst the states and territories. Observers can examine individual schools performance for the four key areas mentioned above, over a day, week, month and year period as well as make comparisons between schools. The data is not converted to GHG emissions, but provided in Kilowatt-hours (electricity), Kilo Litres (water), and Mega Joules (gas). Figure 2 provides an example of the platform.



Figure 2: Screen shot of ACT Monitoring System for Schools (WaterGroup 2014).

NSW, VIC and SA are currently developing a department-wide data collection system to better manage and analyse school resource consumption data (primarily energy and water). However, it could not be determined whether this will be converted into GHG emissions.

NSW has developed an online web portal called WebGraphs¹⁰, where schools can log in and view their energy consumption and production (e.g. solar). The data, which is purely energy-related, can be viewed on a daily basis and is translated into CO₂ emissions. The energy provider, AusGrid, is contracted to provide and manage the data. It is unclear whether comparisons can be made between schools and the data/information is not publicly accessible.

For some states, collecting the data to input into the systems has proven particularly challenging due to the disaggregated and complicated nature of energy and water metering within individual schools. For example, in Victoria, some schools have multiple energy meters that are connected to different energy retailers, making it complicated from a Departmental perspective to collect and collate all the information in a systematic way.

⁹ See [http://www.outpostcentral.com/remote/\(S\(4fcwpa35fciksr5xwsopg5eb\)\)/cws/actschools/map.aspx](http://www.outpostcentral.com/remote/(S(4fcwpa35fciksr5xwsopg5eb))/cws/actschools/map.aspx)

¹⁰ More information about this platform is available here:

http://www.curriculumsupport.education.nsw.gov.au/env_ed/assets/docs/webgraphs_guide.pdf.



Figure 3: Screen Shot of NSW WebGraphs (AusGrid 2014)

While ACT provides the only publicly accessible, state-wide platform for monitoring and comparing resource consumption within schools (i.e. a Department-led initiative), Victoria provides the only bottom-up approach to monitoring and comparing schools, through their ResourceSmart AuSSI Vic platform (this will be discussed further in Chapter 3). There are benefits and limitations of both approaches. For example, the ACT platform provides schools with accurate and meaningful benchmarking data, though it is unclear how many schools actually use the platform, and/or for what purpose. As schools are not directly involved in the data collection process, there is the potential that they remain relatively disconnected. Participating Victorian schools are far more engaged as they are responsible for uploading the data to the platform. However, not all schools participate in the program, and not all choose to make their data publicly accessible, limiting the availability and accuracy of the benchmarking data.

School Building Management

Unlike some commercial buildings, which have building managers and systems in place to monitor and manage buildings, public schools rarely have a dedicated building manager employed onsite. This means that when building issues occur (e.g. leaks, breakdowns) it may take some time for problems to be addressed.

It is also quite common for agencies and departments outside of Education Departments to be responsible for managing and maintaining school buildings. This can potentially limit the direct role Departments of Education play in maintaining, upgrading and retrofitting facilities or supporting schools in this process. In the case of Western Australia, Building Management and Works (BMW – a business unit that sits within the Department of Finance), is responsible for maintaining all government buildings, which includes schools. Understanding the vast amount of buildings under their control, it is reasonable to expect that schools may not always receive the level of support needed to ensure optimal efficiency of their buildings and facilities. It also means that much of the school building and facilities-related data is disaggregated and spread between departments, increasing the complexity of obtaining relevant building-related information.

School Budgets and Funding Allocation Models - Increasing the Autonomy of Schools

Until 2014, public schools have lacked the incentive to actively reduce their resource consumption, as any cost savings made was unable to be retained and reinvested in the school. For example, if schools managed to reduce their utility bills, their budget allocation simply decreased in following year/s, thereby disincentivising any further action.¹¹ This is particularly challenging if a school must expend funds from their own budget to pay for the retrofits or upgrades.

This issue, known as 'split incentives,' is common in the commercial and residential property sector (Kesicki & Ekins, 2011). It generally refers to a situation where owners are reluctant to invest in building upgrades that primarily benefit their tenants (i.e. owners rarely pay the bills), and tenants are reluctant to pay for building upgrades as the capital expenditure ultimately benefits the owner. This could be interpreted similarly for public schools.

Nevertheless, most Education Departments across the States and Territories are now moving to increase the autonomy of their schools, giving schools more independence and responsibility over their budgets. This is part of the Federal Government's *Australian Government Independent Public Schools (IPS) Initiative*. This initiative has made \$70 million available to the States and Territories to assist their transitions towards more autonomous and independent public schools. Since the initiative was announced in early 2014, Tasmania, Victoria, Queensland, Northern Territory, South Australia and Australian Capital Territory have received funding from the IPS initiative.

Increasing school autonomy essentially involves the redistribution of responsibilities from the Departments of Education to the principals in schools, giving them more control over their budget and more importantly, over utility expenditure and savings. Schools with greater autonomy are likely to be more incentivised now to take action to fix building related issues or pursue efficiency opportunities, knowing they can retain the savings, thus addressing the issue around 'split incentives'. Research suggests that autonomous schools are higher achieving, and better serve the needs of the community (Australian Government: Department of Education, 2014).¹²

The majority of the States and Territories in Australia have now begun to develop new school funding models that deliver greater budgetary independence. These new models can be referred to as a "global budget", a "one-line budget" or a "student-centered funding model". The model essentially provides schools with a lump sum based on historical data, which schools then manage themselves.

This funding model varies from state to state, however, in most instances, school budgets are set for a certain period (e.g. three years), in which time, schools can keep their savings. After this time, each school's budget is recalculated and reset using the previous three years data, resulting in a lower allocation if the school has reduced their costs. Several States and Territories are still determining the exact process for their model.

It is expected that new funding allocations will make it more difficult for schools to increase their budget if school expenditures rise. A major problem that education departments are grappling with, therefore, is how to best equip schools to handle rising utility costs, which are often a result of increasing electronic teaching devices, such as computers and iPads, etc.

The First Carbon Neutral School in Australia – Case Study

South Fremantle Senior High School (SFSHS), a public school located in Western Australia, became the first officially certified Carbon Neutral School under the Federal Government's National Carbon Offset Standard (NCOS) Carbon Neutral Program. Having commenced their sustainability journey in 2007, they achieved their goal of Carbon Neutrality in 2012. The section below highlights their process and journey, which provides an inspiring and practical example for other schools.

Adopting A Holistic Approach



¹¹ However, this has not been the case in all States and Territories.

¹² However, not all agree. Smyth (2014) questions the validity of the claim including greater educational and performance outcomes.

From the beginning, SFSHS took a holistic approach in meeting its goal by involving students, teachers, parents and the local community in the process and positioning the school as a centre for sustainability. The school has implemented a range of sustainability programs and initiatives over the past seven years, including a series of energy and water efficiency retrofits, an active tree planting program for students and a Sunday farmers' market where school-grown produce is sold alongside local farmer's produce as well as a number of other local vendors.

Carbon Reduction Initiatives

The first initiative in 2007 was a greenhouse gas audit, which was funded through a grant from the WA Sustainable Energy Development Office. The audit revealed that significant wastage was occurring within the schools buildings and facilities, and highlighted a number of energy and water efficiency opportunities. Since this initial audit, countless initiatives has been implemented in the school including waterless urinals, LED lighting in car parks, the replacement of old, energy intensive bar heaters, and the installation of a solar PV system donated by Sungrid. A full list of initiatives is provided in Appendix C.

Figure 4: South Fremantle Senior High School Permaculture Garden (Credit: Kathy Anketell).

In 2009, the WA Department of Education, seeing the school's passion, commitment and progress, offered to switch the schools electricity from fossil fuel power to GreenPower™, which is sourced from 100 per cent Renewable Energy, meaning the school's electricity consumption became zero carbon.

The financial savings from implementing the range of initiatives has saved SFSHS in excess of 40 thousand dollars a year in utility bill costs.

Applying for official Carbon Neutral Certification

In 2012, the school decided to seek NCOS certification to become carbon neutral. Becoming Carbon Neutral under the NCOS framework requires a three-step process, starting with a comprehensive Greenhouse Gas (GHG) audit, or carbon footprint¹³ based on government approved GHG accounting methodologies. This is followed by the development of an Emissions Management Plan (EMP), demonstrating how the school intends to reduce their emissions during the certification period¹⁴. Finally, the school must purchase sufficient, eligible carbon offsets, equivalent to the schools net emissions in order to bring the remaining emissions to zero.

Calculating Emissions

Once the sources of emissions are identified, the calculation process requires access to utility bills, receipts, logbooks and other school records to gather the necessary information. This data is then calculated together with nationally recognised emissions factors provided by the Australian Department of Climate Change and Energy Efficiency to determine the school's overall carbon footprint. The NCOS program also requires the audit to be verified by an independent third party.

SFSHS's Footprint

The NCOS Carbon Neutral Program Guidelines outline specific emissions that must be considered when undertaking the carbon footprint. These include fuel, refrigerant leakage, electricity, gas, waste, paper and business travel. In addition to these, however, South Fremantle elected to report on several additional sources. These included emissions associated with the transporting and pumping of water and the treatment of wastewater. This has enabled SFSHS to gain a better understanding of its absolute footprint and develop a comprehensive framework that can be applied to other schools.

Figure 5 provides an illustration of the boundaries and scopes.

¹³ The terms Carbon Footprint, Carbon Audit and Greenhouse Gas Audit are used interchangeably.

¹⁴ The certification period is five years but reductions are measured on an annual basis.

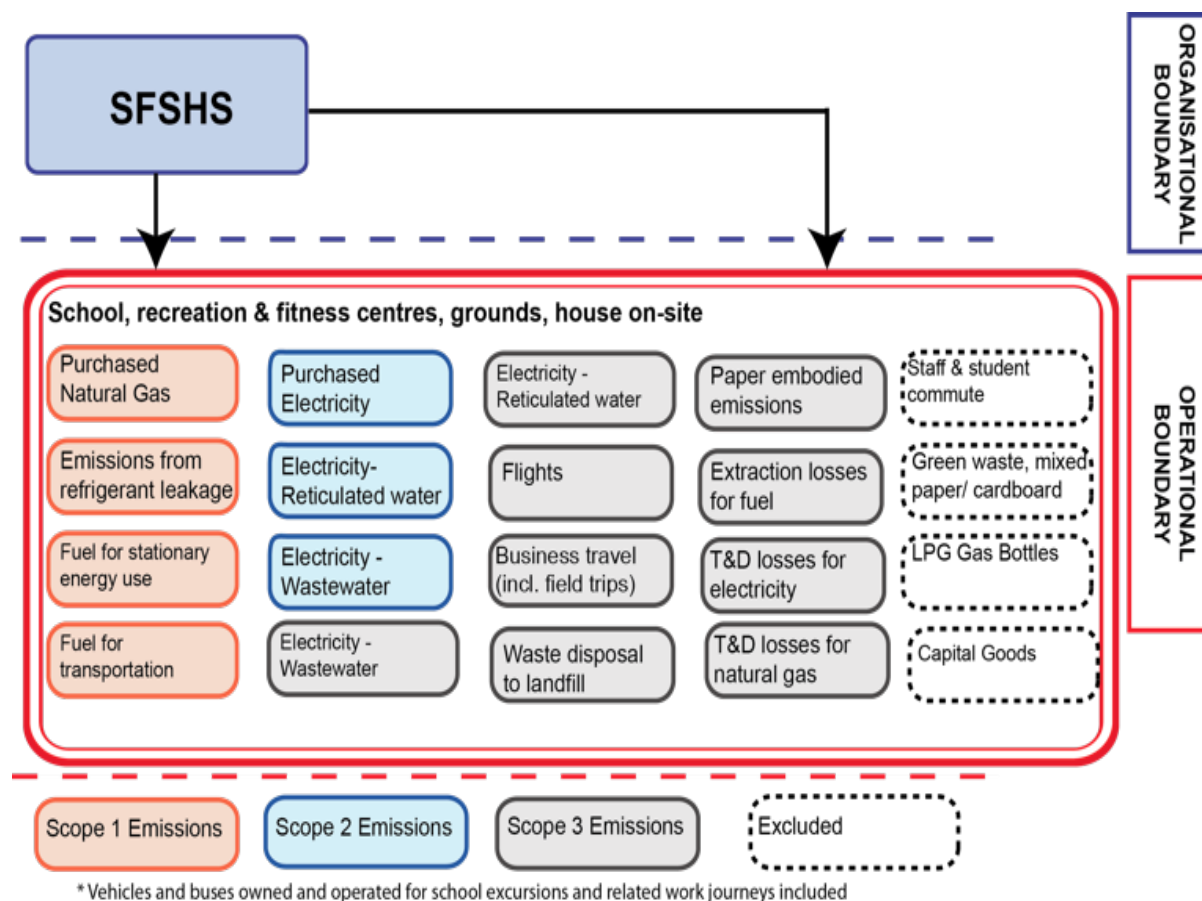


Figure 5: Organisational and Operation Boundaries for SFSHS (SimplyCarbon, 2014).

The total gross footprint for SFSHS in 2012 was 640.31 tonnes of carbon dioxide equivalent (CO₂-e), with the majority coming primarily from electricity (70 per cent or approximately 440tCO₂-e). As SFSHS purchases 100 per cent GreenPower™, the emissions associated with electricity were deducted from the gross carbon footprint leaving a net footprint of just under 200tCO₂-e. This amount was then offset by purchasing 200t of NCOS-recognised offsets from a carbon offset company.

By continuously searching for, and implementing, a range of new carbon reduction initiatives, SFSHS has managed to reduce their carbon footprint consecutively since they started annually conducting a school-wide carbon footprint (see Figure 6). It is likely that the reductions will begin to taper off as the SFSHS exhausts their options.

The South Fremantle High School case study has demonstrated to other schools that carbon neutrality is achievable and leads to tangible and quantifiable results in carbon reduction and financial savings. While the school maintained certification for two years, SFSHS did not pursue NCOS certification in the subsequent years due to the difficulty and costs associated with the process.

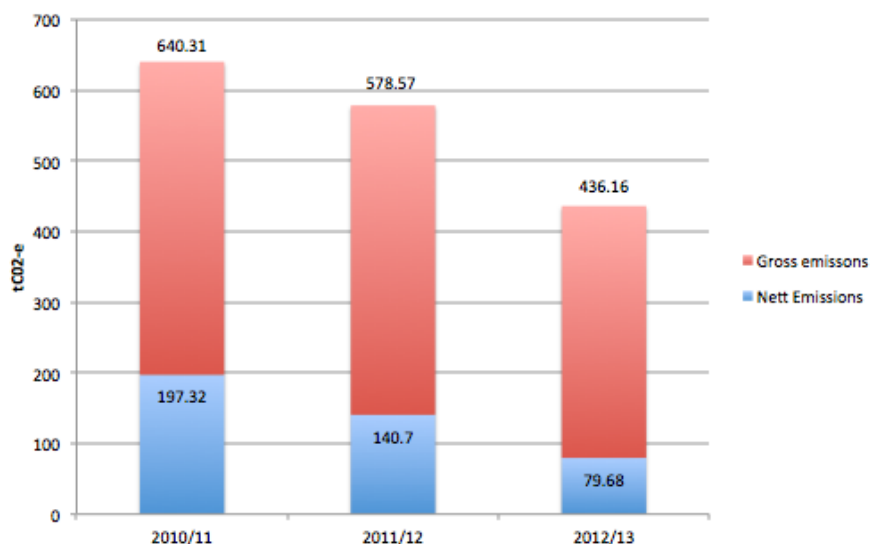


Figure 6: SFSHS Carbon Footprint Reduction: 2012-2014 (SimplyCarbon, 2014).

Creative Governance and Sustainable Procurement in Schools

There are many important lessons to be learnt from the experience of proactive schools that push the boundaries and search for new opportunities for innovative financing to implement low carbon school initiatives. South Fremantle Senior High School (SFSHS) - the first Federally certified carbon neutral school in Australia - has created a unique governance system that has allowed them to continue to pursue carbon reduction opportunities as well as various innovative funding and partnership arrangements to help them implement otherwise financially unviable initiatives.

Embracing community support

SFSHS's carbon neutral initiative was driven largely by the passion and enthusiasm of a number of sustainability advocates from the school and the local community. In order to meet its goal, the school made sure that students, teachers, parents and the local community were involved in the process, and positioned the school as a centre for sustainability.

Establishing a committee

The first step in SFSHS's Carbon Neutral journey was the creation of a working group to focus on reducing the schools emissions. This became known as the school's Carbon Neutral Committee (CNC). Committee members come from a variety of backgrounds and include teachers, parents, community members, councillors, academics and importantly, the principal. The committee has met fortnightly since 2007 to discuss various actions and measures that could be implemented to reduce the school's energy use and associated emissions, as well as initiatives to save water and improve the overall sustainability of the school. Having a group of dedicated people to continuously motivate each other and drive change within the school was paramount to the success of SFSHS, as was having the support and backing of the Principal.

Driving the Process

One of the first actions of the committee was the appointment of a part time Carbon Neutral (CN) Project Officer, who then coordinated the committee and drove the agreed-upon retrofit and behavioural change activities and initiatives within the school. The officer constantly sort out a range of new opportunities and was heavily supported by the committee.

The CN Project Officer was funded out of the school's budget in the first six months. After this time, the part-time position was completely funded through the financial savings from the schools reduced utility bills. In 2014, the WA Department of Education created an official job description for the position of Carbon Neutral Project Officer, which will make it easier for other schools to now appoint such a person in the future.

Innovative finance

One of the creative funding concepts that the CN Project Officer pursued was around solar photovoltaic systems. Being one of the more costly low carbon initiatives to implement, SFSHS decided to form a partnership with Sungrid and Solar Unlimited, which led to 32 households linked with the school installing

solar panels on their roofs. Based on this, Sungrid was able to donate an \$11,500 system to the school. This achievement was celebrated by a visit from Prime Minister Julia Gillard (then Deputy Prime Minister), who unveiled the solar array.

SFSHS also volunteered to have Light-Emitting Dioxides (LED) lights trials conducted in their school, which was funded by the WA DoE. They also installed Greensense monitoring software, which meters their electricity, gas and water consumption. Over several years, the software highlighted various leaks and inefficiencies associated with these resource systems. This, together with a range of other innovative energy and water reduction measures, resulted in significant emissions reduction as well as financial savings (approximately \$40,000 a year in utility bills).

SFSHS negotiated with the WA DoE retain these funds and reinvest them back into the program (previously these savings would be absorbed back into the DoE)¹⁵. As mentioned above, these savings were then used to fund the CN Project Officer, with the remaining funds being reinvested into further retrofits. This demonstrates how such an initiative can in fact be cost neutral. The CN Project Officer actively searches for new grants and other innovative funding solutions to finance further retrofits and emission reductions.

Leveraging community and networks

When the school decided to seek certification, two PhD candidates from Curtin University Sustainability Policy (CUSP) Institute were invited to join the CNC based on their knowledge of carbon accounting and GHG reporting. They were subsequently engaged to undertake the auditing and certification process and have since formed the consulting firm SimplyCarbon.

Understanding the limited financial capacity of public schools to fund such measures, SFSHS has successfully highlighted a range of innovative solutions to implement a variety of initiatives that would have otherwise been seen as unviable. These solutions have largely been based around community involvement, creative partnerships and utilising local resources. Through their creative leadership style, SFSHS has provided a unique model and example for other schools, which can now be replicated.

Conclusion

Most states and territories have some form of energy efficiency and/or emissions reduction targets in place, particularly in relation to their government buildings, which demonstrates a strong imperative to take action and provide solutions. School buildings and facilities offer a significant opportunity for Departments to reduce their energy and resource consumption, thereby reducing emissions.

Schools taking action to reduce their utility usage and carbon emissions reduce strain on the education departments, both financially (i.e. by reducing the likelihood of schools exceeding their budget allocation), and in terms of meeting carbon emission reduction mandates or targets at the State level.

With the transition towards increased school autonomy and the development of new funding allocation models by Departments of Education, there is now more incentive for schools to be engaged with this process than ever before, as schools are now more likely to be able to retain their savings. Systematically measuring and reporting on carbon emissions can also be very useful for schools, enabling them to have a consistent way to measure their sustainability actions in a more meaningful way. Providing a consistent framework, method and process to help schools calculate and reduce their emissions can actively help departments meet their own environmental targets.

¹⁵ This changed in 2014 with the implementation of the 'single-line budget' system.

3. Literature Review

Introduction

This chapter reviews literature on some of the well-known benefits linked with low carbon, green schools, before briefly examining existing carbon footprinting methodologies. These methodologies are discussed in terms of their applicability to schools. Existing programs, initiatives and tools that currently assist schools to reduce their carbon emissions are then identified and analysed in terms of their benefits and limitations. This chapter concludes by highlighting some potential issues for why there hasn't been greater uptake of these tools by schools.

Benefits of Low Carbon, High Performance Schools

There are numerous benefits associated with Low Carbon Schools. These include: improved student health and productivity;¹⁶ financial savings; the potential for hands-on learning, and; abundant engagement opportunities with the wider community on environmental and sustainability issues. These are discussed below.

Health and Productivity Benefits of High Performance Buildings

Indoor Air Quality, Health and Productivity

A large contributor to the benefits green schools experience with student and teacher health and productivity is the impact that sustainably designed and retrofitted schools have on indoor air quality (IAQ) compared to conventionally designed schools. Considering that people spend around 90 per cent of their time indoors, it has been found that there is little research around the indoor environment of buildings (Environment Australia, 2001). Factors such as the air people breathe, noise levels, daylighting and views can affect occupant health, absenteeism and productivity. These indoor environment factors are shown in Figure 7. Adverse indoor environments are often caused by issues such as a build-up of toxins like carbon monoxide, formaldehyde and volatile organic compounds (VOCs) with poor ventilation to these toxins, poor lighting, and low thermal comfort (Bell & Franz, 2008).

Studies show that poor air quality can have a significant impact on the well being of students and teachers, resulting in a decrease in productivity and can be a source of many absences due to illness (Environmental Protection Agency [EPA] 2013; Edwards, 2004). The term "sick building syndrome" was coined in the 1970s and linked poor indoor air quality (IAQ) with symptoms such as "headaches, eye, nose and throat irritation, dizziness and fatigue among occupants" (Too & Bajracharya, 2014).

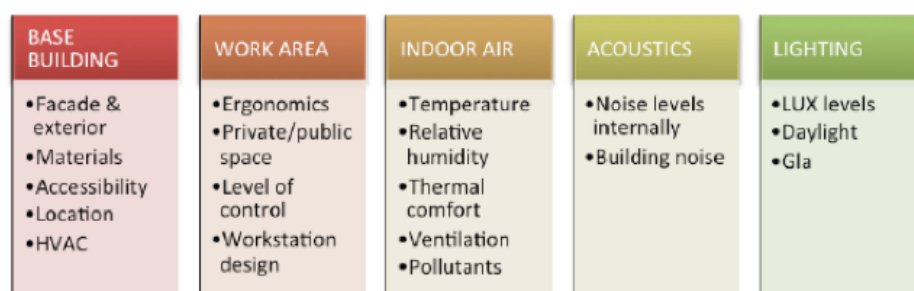


Figure 7: Indoor Environment Impacts inside Buildings (Hall, 2014).

IAQ and Ventilation

Improved IAQ is often an outcome of schools with sustainable designs or those that have gone through a sustainable retrofit. The retrofits often upgrade key aging infrastructure components, such as the heating, ventilation and air conditioning (HVAC) system to reduce energy and the costs associated, which in turn provides enhanced ventilation that can greatly improve student and teacher health (Baker & Bernstein, 2012).

Carbon dioxide levels in the air we breathe are measured in parts per million (ppm). The safe level for IAQ is considered to be 1000ppm, though schools often exceed (Blundell, 2012). However, studies show that even at

¹⁶ Student health and productivity benefits have been linked with 'Green Schools', which are generally schools that have sought GreenStar certification under Green Building Councils in various countries.

this level (1000ppm) cognitive performance is impeded (Chao, 2012) and that increasing ventilation rates over the minimum requirements can improve productivity, satisfaction and health (Wargocki, Wyon, Sundell, Clausen & Fanger, 2000; Fisk, 2000; Fang, Wyon, Clausen, & Fanger, 2004). Increased ventilation rates have also been linked to lower cases of respiratory illnesses and even increases in test scores by students and staff productivity through improving ventilation in schools (Smedje and Norbäck, 2000; Shaughnessy et-al., 2006; EPA, 2013; Schneider, 2002).

Bell and Franz (2008) emphasise that the ppm should vary depending on a building's use, density and pollutant levels. As schools accommodate a higher number of staff and students than office buildings, the ventilation rates will dramatically reduce bringing an immediate impact to performance. The impact can be amplified if traditional paints, finishes and other contributing materials continue to be used in these spaces. Children also breathe twice as much as adults, therefore heightening their exposure to the impacts of poor indoor environments (Blundell, 2012).

Improving natural ventilation in schools can also reduce the electricity required to power an HVAC, as well as improving the indoor environment, clearly demonstrating the co-benefits of understanding and managing carbon in schools. However, the Building Code of Australia (BCA) only requires five per cent of a school area to have openable windows (Blundell, 2012), which makes it difficult for schools to achieve natural ventilation, especially in existing facilities.

Lighting

Numerous studies have linked lighting levels and employee productivity (Abdou, 1997; Edwards & Torcellini, 2002), with particular attention given to the importance of natural daylight. The term 'ill-lighting syndrome' was coined in a study into artificial lighting in offices, which showed a lack of vitamins from natural daylighting can cause various health problems for workers (Begemann, van den Beld, & Tenner, 1997). Other studies have identified positive links between daylighting levels, mood and productivity (Edwards & Torcellini, 2002; Heerwagen, 1998). These findings are equally as applicable to school environments; harnessing and maximizing daylight has a direct impact on staff and student performance, whilst minimizing the need for artificial lighting, resulting in reduced electricity requirements.

A study conducted by the Heschong Mahone Group (1999) also documented correlations between natural daylight and the academic performance of students in a classroom. It found that the students who resided in a classroom with the most amount of daylight demonstrated a 20 to 26 per cent faster learning rate compared to the classrooms with the least amount of daylighting (Heschong Mahone Group, 1999).

Greenery, external views, and the physical and physiological benefits

Many school classrooms have limited accessibility and views of the outdoors. This can be addressed by providing indoor plants in the classroom, which bring the benefits of both improving the air quality and providing views to greenery that may not be possible otherwise. A study that tested 28 types of plants found that some had the ability to remove VOCs from indoor air (Yang & Pennisi, 2009). A Norwegian study by Bringslimark, Hartig and Patil (2007) also supported the link between indoor plants and sickness/productivity. An Australian study also found reductions in confusion, anxiety, fatigue, anger and depression through the use of indoor plants (Burchett, 2011). Selhub and Logan (2012) also found that contact with nature (or even pictures of nature) can lower stress reactions in the brain and body. Burchett (2011) also showed the potential for indoor plants to reduce air-conditioning loads, thus reducing the energy requirements of buildings.

Improved student and teacher retention and wellbeing

Research shows that teachers in green schools show overall improvements in their attitude towards their work and environment and have reduced stress levels (Edwards, 2004; Kats, 2006). A study by Turner Construction (2005), of over 100 of their clients in executive positions in schools, found that those who were involved with a "green" or sustainable K-12 education institution, reported the following findings when compared to a conventional school ("Green' Schools Are More Effective", 2005):

- 74 per cent reported an increase in ability to retain teachers
- 72 per cent reported reduced student absenteeism
- 71 per cent reported improved student performance

Financial Savings from High Performance Buildings

Schools that implement carbon reduction initiatives generally see a reduction in resource consumption, which usually correlates with financial savings on utility bills. In Victoria, for example, the ResourceSmart AuSSI Vic program, which has over 1022 schools participating in it, has documented over \$5.2 million in savings (ResourceSmart, 2013).

Such savings have also been seen in the South Fremantle Senior High Schools case, where the school has managed to accumulate a savings in excess of \$40 thousand a year on their utility bills.

Studies conducted by the United States Green Building Council (USGBC) found that green schools use an average of 33 per cent less energy than schools built with conventional building designs (Kats, 2006; EPA, 2013). A reduction in energy costs not only benefits the schools and departments of education directly, but also helps to reduce the strain on local energy systems. This is particularly important as energy usage is expected to increase over the next two decades (Western Australia. Department of Finance, 2012; WA Office of Energy, 2012) along with rising energy costs (Fleay, 2007; McHugh, 2012; WA Chamber of Commerce and Industry, 2007).

Considering government expenditure on schools in Australia is around \$40 billion per annum (Buckingham, 2014), there is significant opportunity to leverage greater performance from this expenditure, through the implementation of sustainability initiatives that address indoor environment factors and reduced carbon emissions, which saves costs.

Hands-On Learning

Hands-on learning, also referred to as “action learning”, “experiential learning” or “scientific learning”, is a teaching method where students combine theory with experience. It facilitates the process of creating meaning from an experience (Talwar, 2009; Wurdinger, 2005), making it a dynamic and interactive teaching method. Studies have shown that students who are taught with a hands-on learning approach rather than the traditional textbook and lecture method, have higher scores and a better understanding of the material, particularly for students with English as a second language (Riskowski, Todd, Wee, Dark & Harbor, 2009).

Studies have found that the involvement of students in the calculation of their ecological footprint, which included categories such as food, energy, and water usage, at both a personal and school-wide level, resulted in a high level of engagement of students and increased probability of actions around sustainability to be taken both on and off campus (Gottlieb, Vigoda-Gadot, Haim & Kissinger, 2012). This indicates that while education around sustainability, carbon and climate change, is crucial in the classroom on a textbook level, the connections are strengthened with the students when they have a hands-on involvement with reducing their personal and school-wide emissions.

The process of conducting a carbon footprint at a school, including implementing a range of carbon reduction initiatives, provides the opportunity for students to be engaged throughout multiple stages of the process and to learn experientially. Rather than learning about issues such as climate change, carbon, and sustainability from textbooks, students can be directly involved in it by calculating the footprint, identifying problems and finding solutions to help to decrease the resource consumption and carbon footprint of their school. As the carbon footprinting process is carried out each year, it provides a perfect opportunity to be embedded into the curriculum allowing students to be involved with the annual calculation of the carbon footprint, enabling them to see the effects of their individual, as well as group actions, on the carbon footprint of the school over time.

Schools as a Vehicle for Community Engagement

Various studies have identified beneficial links between schools and their communities. The GBCA (2013) highlights the important role Green schools play “in the development of greener, healthier, more vibrant communities, where people are encouraged to make more sustainable transport choices, to participate in sustainability initiatives and to adopt the sustainable practices learnt at school in their own homes” (p.20).

Other studies have linked the benefits between schools and engagement with the surrounding community, with positive impacts on student achievement and improved school academic performance, attendance and attitudes (Henderson & Mapp, 2002; Valli, Stefanski & Jacobson, 2013). These school-community partnerships help to unite the community to work towards common goals (Furnco, 2013) and empower students to become change-agents in their homes and elsewhere, with some schools reporting a higher level of engagement from the community after pursuing sustainability initiatives at their school (Salter, Venville & Longnecker, 2012).

As many school buildings provide joint-use facilities (e.g. swimming pools, gymnasiums, halls), this not only enables more advantageous and cost effective use of the school facilities, but it provides a unique opportunity to engage with the community. A school that has implemented sustainability initiatives or green design features can encourage the community to think and act more sustainably (GBCA, 2013; Kershaw & Simm, 2014). Furthermore, most Education Departments support greater use of schools buildings and facilities by the community, thereby providing an even greater potential to influence society. There are also several additional benefits of increasing the functional use of school facilities, including: reduced payback periods for retrofits; additional income to help to pay for retrofits; a reduced need for more buildings and facilities; and stronger community ties with schools.

Sustainability initiatives, such as school gardens, have shown that they can attract community interaction while promoting sustainability, and activate students and staff to further green the campus (Rilla, 2013). Larger whole-school sustainability initiatives have also demonstrated positive community impacts. Tilbury and Henderson (2004) suggest that such initiatives encourage greater partnerships, action and participation between schools and the outside community (including organisations, business and industry and governments), demonstrating “that whole-school approaches to sustainability have an important contribution to make in shifting our communities towards sustainability” (p.7).

It is clear that school-community partnerships are beneficial to both parties. Partnerships work best when teachers feel empowered to take action and are supported at the school and district administration level (Furnco, 2013), as well as from the community. South Fremantle Senior High School provides a great example of this, whereby a staff member was hired by an engaged Principal and proactive school administration, and through a supportive community network (which later formed the carbon neutral committee), achieved a positive outcome for both the school and the surrounding community. Such initiatives included the establishment of a local farmers market, which educates visitors on various aspects of sustainability, and a partnership with a local solar PV supplier, which led to 25 homes in the local community to install solar energy¹⁷, demonstrating exceptional community engagement and leadership.

Existing Carbon Footprint Frameworks and Methodologies

A carbon footprint is usually conducted in line with international protocols such as the Greenhouse Gas Protocol and ISO standards for greenhouse gas accounting (e.g. ISO 14064 series), as well as Australia’s own National Carbon Offset Standard’s (NCOS) Carbon Neutral Guidelines. These standards were developed for products or business organisations and, as such, are not specifically designed for schools. Currently, no universal GHG standards exist specifically for schools.

Nevertheless, the standards mentioned above provide an adequate framework and starting point from which to begin. The emission sources included under these frameworks are usually discussed in terms of scopes of emissions and include:

- Scope 1: Direct GHG emissions (sources owned or controlled by the enterprise - predominantly onsite fuel combustion).
- Scope 2: Indirect GHG emissions (generation of purchased electricity, steam, heating/cooling).
- Scope 3: Other indirect GHG emissions (emissions that are a consequence of the activities undertaken, but occur from sources not owned or controlled by the company).

Examples of these emissions are provided in Figure 8 below.

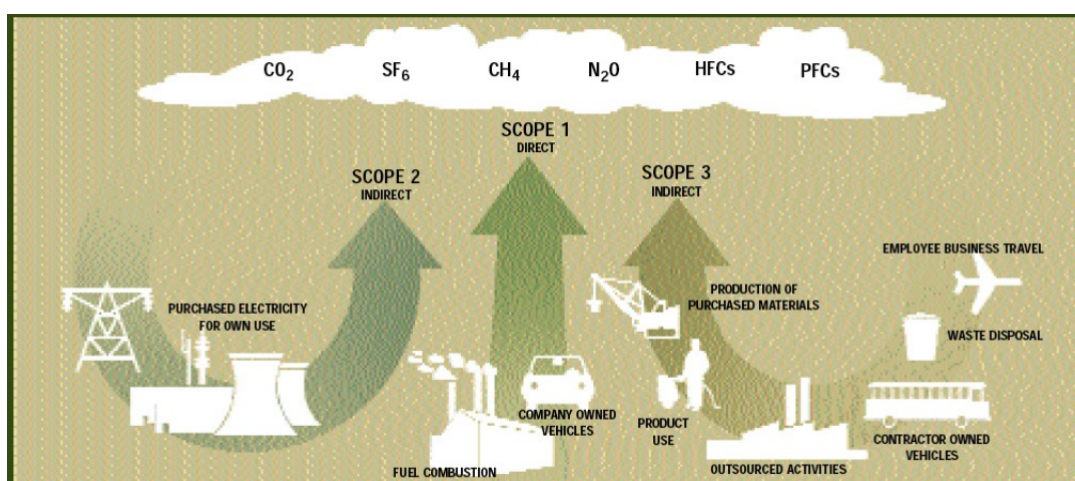


Figure 8: Overview of scopes and emissions across a value chain (WRI & WBCSD 2004, 26).

When applied to schools, the primary emission sources that should ideally be incorporated into a carbon footprint include fuels combusted onsite (e.g. gas, petrol and diesel), refrigerant leakage (e.g. from air-

¹⁷ The school directly influenced 25 members of the local community to invest in solar panels, which enable the supplier to donate a solar array to the school.

conditioners and fridges), purchased electricity, water and wastewater, waste to landfill, paper, school-related flights and travel (e.g. hired buses, taxis, staff cars). Additional Scope 3 (indirect) emissions could include student and staff commute to work and food provided by the canteen and used in Home Economics classes. Currently, these additional emissions are rarely included, however, they have potential to provide exceptional educational opportunities.

Looking abroad, a UK Carbon Footprint study of schools conducted by Global Action Plan, Stockholm Environment Institute and Eco-Logica (2006) outlined a methodology for carbon footprinting in schools in the UK and recommendations on the way forward. They identified the major carbon emissions associated with schools based on data collected from bottom-up surveys from schools, as well as top-down data from the education department, and included the emissions seen in Figure 8. The research identified a combination of both bottom-up and top-down data collection as an important aspect of a comprehensive carbon footprint, and recommended calculating emissions beyond a school's direct emissions (e.g. school fuel use) to include the full transport (e.g. student and staff commute) and embodied emissions (e.g. materials and food).

School Carbon Emission Sources
Direct Emissions
Electricity
School Transport
Other Transport
Chemicals
Furniture
Paper
Other Manufacturing
Mining and Quarrying
Others

Table 1: School Carbon Footprint Emission Sources (Adapted from Global Action Plan, SEI, Eco-logica, 2006).

Another UK study by the Department for Children, Schools and Family (2009) defines carbon footprinting emissions as those from:

- The use of energy in school buildings;
- Pupil, staff and school travel and transport;
- Supply chain activities of companies producing goods and services procured by schools, and;
- Waste management and minimisation by schools.

The UK carbon footprinting methodologies highlighted above are extremely comprehensive and could be rather complicated for schools wanting to undertake such a process on their own. The extensiveness of this approach is likely due to much stronger carbon emission reduction policies in place in the UK, than in Australia. It is likely that such a rigorous framework would be considered too difficult and burdensome to implement in the Australian context¹⁸, particularly in the absence of any meaningful national carbon policy.

The NCOS and GHG protocol guidelines may also be too stringent for schools. It is therefore important and recommended that schools collaboratively discuss and decide on which sources of emissions could realistically be included when creating a universal framework and methodology for carbon footprinting in schools.

Programs, Initiatives and Tools Targeting Schools

While many sustainability tools, initiatives and programs currently exist, this chapter highlights the primary ones targeting carbon within schools in Australia. The Australian Sustainable Schools Initiative (AuSSI) was included in this analysis despite the fact that it does not focus directly on carbon, as it is the only national sustainability program.¹⁹ The AuSSI sustainability framework also provides a good basic framework for a

¹⁸ In light of the repeal of the carbon price, there is less incentive or encouragement from the government to cut carbon emissions. This may reduce the willingness of organisations (including schools) to take voluntary action at such a detailed level.

¹⁹ Although a national initiative, the AuSSI is now only delivered at the State level.

carbon footprint, thus, providing significant potential for wider integration of carbon into the program in the future. Several past programs were also included to provide a more complete picture of how carbon has been targeted in schools to date. The authors distinguish between a tool and a program or initiative as follows:

- **Tool:** an application that allows schools to enter data to calculate a carbon footprint, or various aspects of a carbon footprint;
- **Program and/or Initiative:** may provide a framework, resources, information and advice and/or certification, but not necessarily the tools to calculate carbon.

This chapter begins by highlighting the federal initiatives before discussing how AuSSI has been delivered at the state level. Existing tools, programs and services offered by private consultancies specifically targeting carbon in schools are then examined. Past tools are highlighted before ending with a brief analysis of some of the benefits and limitations of the programs and tools.

National Initiatives

There is currently no national initiative or program in Australia that specifically targets carbon in schools. However, two broader national sustainability initiatives have indirectly targeted carbon. These include the National Solar Schools Program (NSSP)²⁰ and the Australian Sustainable Schools Initiative (AuSSI)²¹. The Building the Education Revolution Initiative (BER), which ran between 2008 and 2011, also had a small focus on energy efficiency and sustainable building measures. However, there were no regulations around this, nor any monitoring of the sustainability outcomes. In some cases, this led to perverse outcomes with increases in energy consumption (Kathy Anketell, pers comms, August 2014).

The NSSP ran from 2008 until 2013 and had a total of \$217 million in grants and funding for participating schools to install solar panels and other renewable systems, rainwater tanks as well as a number of other energy efficiency measures. While it didn't require any calculation of carbon emissions, some audits were conducted as part of the program and numerous initiatives were implemented, which would have contributed to the reduction of the carbon footprint of schools. Approximately 8,300 schools registered with the program, and 5,300 schools were awarded a grant with a total of 4,897 PV systems funded and an estimated 44,354 MWh of electricity generated per annum by the installed PV systems (Department of Resources, Energy and Tourism, 2013). A significant limitation to the program was the lack of follow-up upon completion of the program, leaving many schools with unanswered questions about their PV systems or the program as a whole (Department of Resources, Energy and Tourism, 2013).

The Australian Sustainable Schools Initiative (AuSSI) program is the only national sustainability initiative currently targeting schools in Australia. Having recognised the importance of sustainability, the Australian Government, in partnership with the state and territory governments and the catholic and independent school sectors, launched the program in 2004. This nation-wide initiative provides a broad overarching sustainability framework, covering four key areas: energy, water, waste and biodiversity. It promotes a whole-of-school approach and encourages engagement with the wider school community. The vision for the program is "for all Australian schools and their communities to be sustainable" (AGDEWH, n.d.).

While AuSSI has encouraged, facilitated and enabled countless schools across the country to adopt and implement a range of sustainability initiatives and actions that have resulted in a number of outcomes (e.g. reduced consumption of resources, minimised waste and increased biodiversity), the success or impact of the initiatives has largely been undocumented. Although the majority of initiatives would most likely have resulted in a reduction in carbon, this has never been calculated, as carbon hasn't featured as a key area within the program. As a result, few resources and tools currently exist to help schools to understand or measure their carbon footprint.

Despite the fact that AuSSI does not focus on carbon, it is the only ongoing national sustainability program and is therefore discussed further below.

Australian Sustainable Schools Initiative (AuSSI)

Initially funded by the Federal Government, individual states and territories are now responsible for funding and implementing the AuSSI program. The initiative provides only the broad framework (i.e. the four key areas), so each state or territory is free to implement the initiative in whichever format they like, developing their own strategies and specific foci. As such, some states chose to put greater emphasis on aspects such as

²⁰ For more information, see <http://www.industry.gov.au/ENERGY/ENERGYEFFICIENCY/GRANTS/FUNDING/SOLARSCHOOLS/PROGRAM/Pages/default.aspx>

²¹ See <http://www.environment.gov.au/topics/sustainable-communities/sustainability-education/aussi>

measuring and monitoring achievements (i.e. Victoria), while others used the initiative to advance the development of their state's EfS (ARTD, 2010). While schools have been encouraged to conduct School Environmental Management Plans (SEMP) or Sustainability Action Plans (SAP), which has led to some interesting and useful metrics being developed, none of these metrics have specifically targeted carbon emissions.

Interestingly, the techniques for collecting schools SEMP and SAP data vary considerably between states and territories and few systematically collate and publish it. An evaluation report of the AuSSI program in 2010 stated that, "since schools do not always collect resource-use data regularly or consistently, collation across individual states and territories or across the country may not be valid or reliable or even particularly useful" (ARTD 2010: 23). This lack of a systematic way of collecting, analysing and publishing the data prevents adequate benchmarks from being developed or comparisons to be made between schools.

In 2010, federal funding for the AuSSI program ceased, leaving states and territories to determine how, and to what extent, they would continue to support and promote AuSSI. Unfortunately, this signalled the end of the program in many states and territories.

The latest reported figures²² stated that over 3000 schools were participating in the AuSSI program Australia-wide (ARTD, 2010). While some states may have experienced an increase in the number of registered schools (i.e. those who continued financial support for the program), in states that did not continue funding, it is unclear how many schools are still participating or pursuing the program. As no funding exists at the federal level, this information is no longer being collected.

After federal funding ceased, Queensland, Northern Territory and Tasmania chose to discontinue their funding of the program, while the remaining states provided varying degrees of support. The programs now have various names and are managed by different agencies and departments. These are highlighted in Table 2.

In Western Australia, the Department of Education funds one staff member dedicated to supporting schools under the AuSSI program. However, there are a number of other organisations providing support such as the Canning River Eco Education Centre, CREEC.²³ In South Australia, the government department Natural Resources Management (NRM)²⁴ manages the AuSSI program in collaboration with the Department of Education and Child Development.²⁵ ACT and NSW have relatively well-established and supported AuSSI programs. It is unclear how many resources have been allocated to running these programs. ACT offers an accreditation scheme under their program.

Victoria was one of the first states to pilot AuSSI in 2003. When federal funding for AuSSI ceased in 2011, the Victorian Government committed \$8.305 million to build what has become the ResourceSmart AuSSI-Vic framework and program; the most well established of the AuSSI programs. For this reason, it is discussed in greater depth below.

State/Territory	Name of Program	Who manages it?
Victoria	ResourceSmart	Sustainability Victoria
New South Wales	Sustainable Schools NSW	Office of Environment and Heritage (OEH)
Australian Capital Territory	ACTSmart	ACT Environment and Sustainable Development Directorate (ESDD)
Western Australia	AuSSI-WA	WA Department of Education
South Australia	AuSSI-SA	Natural Resources Management (NRM) Department of Education and Child Development (DECD)
Queensland	N/A	N/A
Northern Territory	N/A	N/A
Tasmania	N/A	N/A

Table 2: AuSSI Initiatives across the States and Territories.

²² An evaluation report was produced in 2010.

²³ For more information, see <http://www.canning.wa.gov.au/General/welcome-to-the-canning-river-eco-education-centre.html>

²⁴ See <http://www.naturalresources.sa.gov.au/adelaidemtloftyranges/get-involved/education/for-educators>

²⁵ See <http://www.sustainableschools.sa.edu.au/pages/wholeschool/33565/?reFlag=1>

Case study: ResourceSmart AuSSI Vic

Sustainability Victoria currently delivers the Victorian ResourceSmart AuSSI program, through a partnership with Department of Education and Early Childhood Development (DEECD). As of 2014, they had over 1000 schools signed on to the program, representing more than 400,000 students (Sustainability Victoria, 2014). While it is important to note that the program currently does not provide a tool that specifically calculates the carbon footprint of schools, it does provide a comprehensive online platform and certification system that allows schools to measure and track their consumption of resources from energy, water and waste and how they are addressing biodiversity.

How it works

The online platform allows teachers and students to upload data from their schools utility bills (i.e. units of consumption and costs), and the system then automatically tracks and calculates the savings over time. Alongside the utility data, schools upload how they have met the various criteria in each of the 5 modules (Energy, Water, Waste, Biodiversity and Core). Based on their progress through the modules, they can achieve a



star rating, from one star to five (see Figure 8).

Each module contains three key areas that need to be addressed in specific relation to the module. These include:

1. Workplace and Operational;
2. Learning and Teaching, and;
3. Whole School Community Engagement.

In order to achieve a five star status, a school must demonstrate that is a sustainability leader in the community.

Integrating Carbon

Considering that the activity data needed to calculate a carbon footprint of a school (in terms of waste, energy and water) is already gathered through this online system, significant potential exists to extract and convert this existing data into carbon to calculate the carbon footprint.

Potential for collaboration with other states

As significant time, funds and experience has gone into creating and improving this tool, there is significant scope and potential for the tool/platform to be shared amongst other states and territories, particularly those without a program currently in place. Rather than reinventing the wheel and spending considerable funds in developing another tool, this well-established platform could relatively easily be modified and expanded to other states and territories, and used on a licencing basis. This would enable better comparisons between schools from different states and territories.

Figure 9: The 5 Levels of ResourceSmart AuSSI Vic Certification (Adapted from ResourceSmart 2014)

Existing Carbon Tools, Programs and Initiatives

A desktop review of current and past tools available targeting Australia schools that can help them to calculate their carbon footprint were analysed. Descriptions of these are provided in APPENDIX A – Australian School Programs, Initiatives and Tools Targeting Sustainability and Carbon, while Table 3 provides a comparison of these. The scope of this analysis was strictly limited to tools that were specifically targeting schools and focused on carbon. The analysis was also limited to Australia, as international tools cannot be easily applied to and used by Australian schools due to differences in electricity grids, emission factors and input methods. The section below provides a comparative analysis of the tools identified.

Comparative Analysis of Benefits and Limitations

Currently, very few tools, initiatives and programs exist that specifically target carbon within schools. Only two tools were identified that allow schools to actually calculate their carbon footprint: the Schools Environmental Tracking System (SETS) and the AuSSI-SA Carbon Tool. However, the AuSSI-SA tool only targets energy consumption, thus making it an incomplete carbon tool for the purposes of this report. The SETS tool was unable to undergo an advanced analysis due to the lack of publicly available information and access to the tool. While the websites suggests that carbon emissions for energy, water and waste are analysed, it is unclear whether transport is included. Furthermore, given that the data collected by SETS is currently not publicly available, there is little opportunity for comparisons to be made between schools on a broader scale.

Table 3 below provides a comparison of the tools, what sources of emissions they cover and their costs.

Program	Type	Emissions Targeted	Access to Carbon Calculator	Cost	About
SETS School Energy Tracking System	Tool/ Consultancy	Energy, Water, Waste	Yes	\$250/yr	<ul style="list-style-type: none"> An online tool originally commissioned by Sustainability Victoria that enabled schools to input energy usage and calculate their carbon footprint, monitor their energy usage over time and compare to other schools around the nation.
AuSSI-SA Carbon Footprint Spreadsheet	Tool	Energy, Transport	Yes	Free	<ul style="list-style-type: none"> A downloadable MS Excel-based carbon calculator with energy and transport inputs. Carbon footprint is translated into "fridges of CO₂".
Carbon Kids	Program	Energy, Transport,	No	Free	<ul style="list-style-type: none"> CSIRO's CarbonKids provides educational resources and assistance to schools that wish to reduce their carbon footprint.
Maia Maia	Initiative/ Consultancy	Energy, Water, Waste, Transport	No	Free	<ul style="list-style-type: none"> An innovative small program based in Western Australia that created a carbon emissions trading scheme for schools. As part of this, it conducted carbon footprints though it does not have an online calculator and is limited in its reach.
Carbon Planet	Consultancy	Unknown	No	Varies	<ul style="list-style-type: none"> Energy and carbon consultancy based in Victoria that focuses on schools.
Simply Carbon	Consultancy	Energy, Water, Waste, Transport	No	Varies	<ul style="list-style-type: none"> Energy and carbon consultancy based in Western Australia that focuses on schools. They conduct carbon footprints for schools but don't have an online tool.
Climate Clever Energy Savers	Past Initiative	Energy	No	Free	<ul style="list-style-type: none"> Past program that sought to education schools about energy use, carbon emissions and their effect on the climate.
Carbon Sinks Schools Program	Past Initiative	Unknown	No	Free	<ul style="list-style-type: none"> Past pilot program that helped schools in Victoria conduct a carbon footprint and educate students about carbon sinks.
EPA Victoria	Past Tool	Unknown	No	Free	<ul style="list-style-type: none"> Past carbon footprinting tool hosted on the EPA Victoria website that allowed schools to conduct their carbon footprint.

Table 3: Comparison of Australian Tools, Programs and Initiatives targeting Carbon.

As can be seen from the table above, the various tools, programs and initiatives targeting schools include a range of emissions within their scope. Thus, an overall limitation of all the tools is the inconsistency in the

scopes and boundaries of emissions that determine a school's carbon footprint. This makes it difficult to draw useful or accurate information in order to make valid comparisons or to enable the development of benchmarks and standards for schools across Australia.

Of the dozens of sustainability initiatives targeting schools in Australia²⁶, this research has identified only two tools that specifically target carbon and provide an approach for calculating the footprint. As mentioned in Chapter 3, a carbon footprint should ideally include the emissions associated with, as a minimum, energy, water, waste and transport. Based on this parameter, the research indicates that SETS is the only carbon footprinting tool in Australia that fully addressed these components.

The lack of tools provides unique and opportune window to develop a nationally consistent standard and approach to calculating emissions at the school level, before this sector becomes flooded with tools as has occurred in the commercial building sector. Ideally, if tools do emerge subsequently, they would all include the minimum scope of emission sources.

Currently, SETS, as well as the other carbon consultancies mentioned, charge to use their calculators or conduct a carbon footprint (apart from Maia Maia). This could potentially present a barrier for some schools, though it is unclear to what extent this would deter them. It was outside the scope of this report to determine what impact cost has on school decisions to undertake a carbon footprint.

Table 4 highlights the range of benefits and limitations associated with each of the tools, programs and initiatives analysed.

Program	Benefits	Limitations
SETS School Energy Tracking System	<ul style="list-style-type: none"> Only carbon footprinting tool in Australia for schools targeting multiple sources Enables comparisons between schools using the tool Includes multiple emission sources Web-based, which enables for better data capture and comparisons to be made Low-cost to use 	<ul style="list-style-type: none"> No results are publically accessible Schools need to pay annually for access Lack of transparency around how the emissions are calculated
AuSSI-SA Carbon Footprint Spreadsheet	<ul style="list-style-type: none"> A relatively comprehensive carbon audit of energy use at the school Easily accessible Free Translates carbon into a tangible analogy 	<ul style="list-style-type: none"> Limited solely to energy Only in a downloadable format with no ability to track or receive results, thus not allowing for benchmarks to be made Very simplistic
Carbon Kids	<ul style="list-style-type: none"> Available in all states Sharing of experiences/ideas on online wiki Helps schools develop a five year plan Operated under a credible research organisation Variety of carbon inputs 	<ul style="list-style-type: none"> Overall carbon footprint is not annually measured Unclear what sources are included in a carbon footprint No publicly accessible benchmark data Uncertainty around longevity of funding
Maia Maia	<ul style="list-style-type: none"> Innovative concept around carbon reduction and trading Documented and publicly available carbon reduction data Carbon footprint based on international standards 	<ul style="list-style-type: none"> Very limited reach Funded through private consultancy with no additional incoming funds therefore uncertainty around continuation Innovative concept may mean harder to grasp
Carbon Planet	<ul style="list-style-type: none"> One of the only carbon/energy consultancies that focus specifically on schools Provides supplementary resources for students and resources for teachers including workshops 	<ul style="list-style-type: none"> Unclear about whether the carbon footprint is carried out with the students participating Primarily based in Victoria Charges a fee (fee unknown)
Simply Carbon	<ul style="list-style-type: none"> Reputation – helped to certify the first even certified Carbon Neutral school in Australia Carbon consultancy that targets schools among other businesses Targets a range of emissions according to 	<ul style="list-style-type: none"> Limited reach (based in WA) No supplementary teaching resources Charges a fee (fee unknown) No publicly accessible benchmarking data

²⁶ The search was limited to those tools that were readily accessible through online Internet searches and from word of mouth by key stakeholders. It is by no means an exhaustive list of all tools in Australia.

	international standards	
Climate Clever Energy Savers	<ul style="list-style-type: none"> Reached a large number of schools Focus on cost helped to prevent resistance by teachers/staff who may have been adverse to the idea of anthropogenic climate change A large focus on student participation with program 	<ul style="list-style-type: none"> From available info, it only targeted energy Due to finish in 2014 due to end of funding Only targeted a limited grade range Uncertain whether the data (if collected) was used to benchmark schools (look up)
Carbon Sinks Schools Program	<ul style="list-style-type: none"> Educated about carbon sinks, offsetting and carbon neutrality Carbon footprints for schools however the methodology is unknown 	<ul style="list-style-type: none"> It never made it past the pilot phase Limited reach with schools Results not publicly available
EPA Victoria	<ul style="list-style-type: none"> Was previously widely known Web-based 	<ul style="list-style-type: none"> No longer in operation Uncertainty around carbon footprinting methodology

Table 4: Benefits and Limitations of Carbon Tools, Programs and Initiatives.

There was surprising little information available on many of the tools and programs, particularly in relation to their methodology for calculating carbon and how much they cost. This is likely due to several reasons: many of the tools are commercial and intellectual property may be an issue; several programs and initiatives were only run as pilots, which limits the information available since their completion, and; of the past programs, few were evaluated meaning potential lessons learnt have been lost.

Another current limitation with all tools analysed, is that they are not web-enabled and do not allow data collected by schools to be used for research or benchmarking purposes and accessed publicly (i.e. such a database could enable comparisons between schools. School names could be kept anonymous).

From discussions with ResourceSmart Victoria, there is interest and potentially an opportunity for integrating a new carbon component or tool into their existing online ResourceSmart platform. Schools participating in ResourceSmart currently upload their utility data including electricity, water, and waste, - data which is also needed for calculating the carbon footprint. This provides a unique opportunity to streamline the carbon footprinting process and integrate with existing programs and initiatives. From interviews with stakeholders, integration with existing programs was identified as a key success factor, as was the ability to embed initiatives into the national curriculum.

Low Carbon Resources

As sustainability becomes a greater focus in schools, countless resources (curriculum & practice) have been developed both in Australia and across the globe. While abundant resources are available on a variety of sustainability subjects, very few focus on climate change and/or carbon emissions, particularly in Australia. This research identified four organisations that provide climate and/or carbon specific resources. These include: Cool Australia, FutureCarbon, WithOnePlanet and Carbon Planet. A description of these is provided in Appendix D. There is the potential to collaborate with some or all of these organisations to develop specific low carbon curriculum materials.

Conclusion

This chapter has highlighted some of the key benefits of high performing, low carbon schools, which include health and productivity/performance benefits, financial savings and educational hands-on learning opportunities. As many of the sustainability and low carbon initiatives implemented in schools could also be applied at the household level, there is great opportunity for children to become teachers and educate their families and wider community on sustainability issues. Furthermore, as schools often share facilities (i.e. halls, swimming pools) with the community outside of school hours, this provides a range of additional opportunities to educate the wider community.

This chapter also described some of the current carbon accounting methodologies to determine what the boundaries, scopes and sources of emissions would/should be for schools undertaking a carbon footprint. It was noted that there is currently no universal carbon accounting framework specifically designed for schools. The current international standards were deemed to be too complicated for schools, though they provide a good starting point for developing school specific carbon accounting standards and minimum requirements. It was suggested that at the minimum, the emissions associated with energy (gas and electricity), waste, water and transport should be included.

Finally, the main programs, initiatives, tools and resources targeting carbon reduction in schools were analysed. Although nine were identified, only one was able to calculate a carbon footprint across a range of emission sources. This tool - the School Environmental Tracking System (SETS) – is from a Victorian-based consultancy Carbonetics. This demonstrates a clear lack of adequate tools for schools to conduct their carbon footprint. It also highlighted the lack of additional curriculum resources and to help embed practical initiatives into the curriculum.

Sustainability Victoria's ResourceSmart AuSSI Vic program, which includes a certification system and online platform, was identified as one of the leading programs in Australia. Although much of the utility data required to calculate a school's carbon footprint is captured within this platform, it currently does not provide the option to convert this data into emissions. Nevertheless, it provides a useful database, and great potential for developing this function in the future. From discussions with representatives from Sustainability Victoria, there was interest in pursuing this and in collaborating in the future. Discussions also took place in relation to the possibility of expanding the ResourceSmart platform into other states pending future conversations.

Thus, the focus now is how to best deliver high performance schools in terms of improvements to buildings and physical infrastructure, as well as academic performance due to the associated health and productivity benefits. These two factors are already closely linked, though will become increasingly so as students begin to learn about resource efficiency and building performance within their curriculum. This is the next agenda for low carbon, high performance buildings.

4. Methods

Introduction

Despite the numerous documented benefits associated with Low Carbon Schools, and the drivers for sustainability within the curriculum, few schools are actively reducing their carbon footprint. Chapter 3 identified some of the current limitations associated with existing tools designed to assist schools in this process. Considering the limited reach and uptake of the tools identified in Chapter 3, the authors decided to examine some of the barriers preventing schools from taking action. A variety of methods were used to identify and examine these barriers. These included a desktop review and workshops, surveys and interviews with teachers and key stakeholders. The methods are elaborated on below.

The workshops and surveys were also used to gauge interest in a potential future Low Carbon Schools pilot program.

Desktop Analysis

While a literature review was conducted throughout the research, Chapter 3 specifically reviewed and analysed frameworks for calculating a carbon footprint, and Chapters 4, 5 and 6, reviewed the current barriers, benefits and opportunities associated with reducing emissions in schools. A desktop review of carbon programs, initiatives and tools targeting schools (both existing and past) highlighted the tools that have been included in Chapter 7 - the Comparative Analysis described below. Additional tools, programs and initiatives were identified from interviews with key stakeholders.

The literature reviews drew on a variety of existing data sources including academic reports and journal articles, industry reports, programs websites, curriculum materials, government department websites, reports and guidelines, amongst others.

Workshops, Surveys and Interviews

Workshops

Two workshops with teachers and other key stakeholders were held in Fremantle, Western Australia on the 30th of July and 1st of August 2014. The workshops were approximately 3 hours in length and discussed a variety of topics including: the benefits of addressing carbon and sustainability in schools; how to achieve carbon neutrality; the main barriers facing schools attempting to reduce emissions; what initiatives schools are currently implementing, and; the opportunities available for pursuing carbon reduction. Discussions with the participants of the workshops also helped to inform information in the following sections.

The workshops were open to all schools in WA and publicised through a variety of networks and channels, including teachers and schools associations as well as personalised emails. In total, 35 teachers and stakeholders participated in the workshops over two days. The teachers all expressed interest in being involved in a second pilot phase of the project. Interest was also expressed from schools that couldn't attend the workshop, including those as far south as Esperance, as far north as Geraldton, and far east as Leonora.



Figure 10: Fremantle Workshop (Credit: Vanessa Rauland).

Surveys

Surveys were also conducted with teachers, as well with stakeholders from Government departments and agencies and coordinators of the AuSSI program in various states.

School-based survey

The school-based survey targeted teachers and associated stakeholders and were distributed both online and in paper format during the workshops. The online survey was distributed through the Catholic Schools Network of WA as well as the full list of schools registered with the AuSSI-WA program. Personalised emails were also sent to proactive individual schools within the AuSSI-WA list acquired from the website. Paper surveys were also distributed to attendees of the workshops. Due to the workshop being based in Western Australia, survey distribution was limited to teacher and school networks located in WA.

There were a total of 42 responses from this survey, which helped to inform all aspects of the analysis in this report. The full survey can be found in Appendix E.

Education Departmental-level survey

A total of five responses were received from a survey that aimed to analyse current practices around data collection at the State level within Education Departments. It was also used to gather information around the implementation of the AuSSI program in each state. As only a limited number of surveys were returned, additional information was collected via interviews and personal communication.

Where contacts were found, surveys were distributed to the key stakeholders within school budget/finance departments in each of the states and territories. Responses were not received from all states and territories. Where requested, names have been kept confidential. These surveys were administered through personal email in combination with phone interviews and conversations.

Interviews

Interviews were conducted with key personnel related to the various programs, initiatives and tools²⁷, as well as with key stakeholders within Education Departments, including state AuSSI coordinators and other relevant government departments and agencies.

Interviewees were chosen based on their position within the relevant departments or their association with the tools and programs that were chosen for inclusion in the analysis. Some of these chose to remain anonymous. Using the snowball sampling method, additional key stakeholders were identified from conversations with the interviewees.

The results from these interviews are primarily provided throughout Chapter 5, and information gathered from these have also been used to inform Chapter 3.

²⁷ Some program leaders or owners of carbon tools were unable to be contacted.

5. Barriers facing schools attempting to decarbonise

Introduction

While many schools around Australia have demonstrated some outstanding examples of successful sustainable and low carbon initiatives, they are far from being mainstream. Few schools are actively pursuing environmental upgrades to their buildings and facilities, despite the abundant social, environmental and financial benefits that low carbon, green schools offer. This is likely due to a range of barriers facing schools.

Little research has been conducted in the Australian context around barriers to implementation of carbon-focused sustainability initiatives and environmental upgrades in schools. A literature review was conducted to identify the overarching barriers schools experience when attempting to implement sustainability initiatives.

One study conducted by Evans, Whitehouse, and Gooch (2012) that focused on the implementation of EfS in schools, examined the barriers for implementing school-based sustainability faced by two primary schools in far North Queensland, and the ways by which these barriers were overcome. The researchers identified three major barriers, shown in Figure 11 and classified them into three categories:

- 1) Grassroots barriers
- 2) Administrative barriers
- 3) Conceptual barriers

Two workshops, an online survey and interviews with representatives from various Education Departments across the states and territories (including AuSSI reps, asset managers and financial managers) were conducted as part of this research. The majority of responses around barriers to schools pursuing carbon reduction initiatives closely corresponded with the three barriers categories outlined by Evans et al. (2012).

When asked what the key barriers preventing schools from taking action around carbon reduction in schools, Education Department stakeholders identified the following barriers:

- Competing priorities;
- Aging/inefficient infrastructure;
- Longevity of strategies implemented (initiatives often fall down after a champion leaves);
- Ownership of the issue/initiative (by teachers and students);
- Lack of knowledge and understanding by teachers and staff (particularly in primary schools), and;
- Financial constraints.

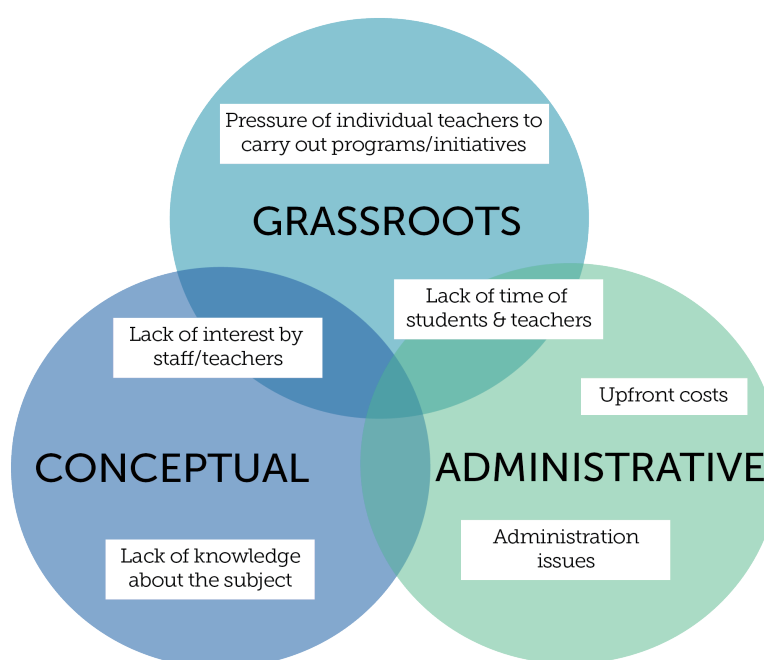


Figure 11: Categories of barriers

Survey respondents recognised financial barriers, time restraints, and lack of interest by teachers and staff as the major barriers to sustainability initiative uptake as highlighted in Figure 12.

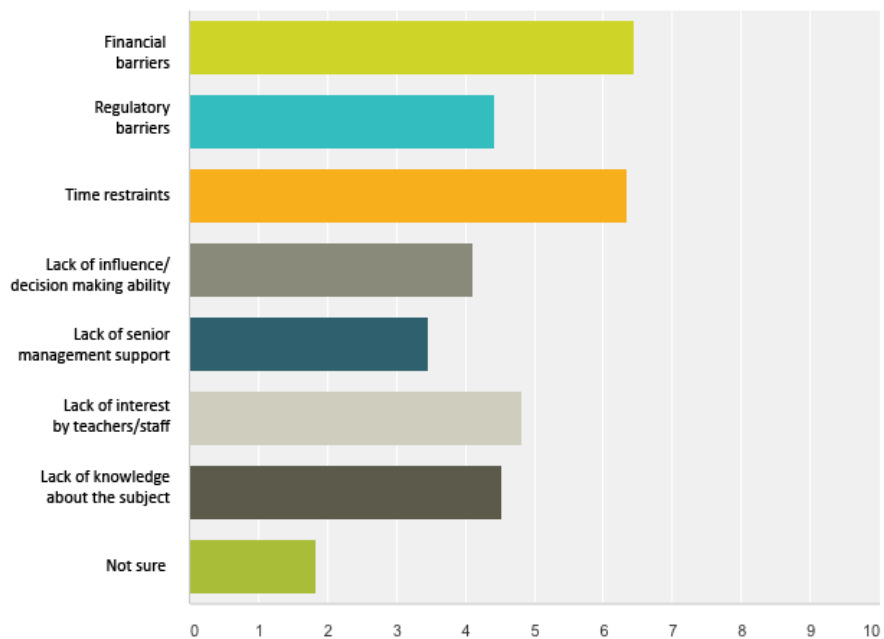


Figure 12: Barriers recognised by teachers

The sections below investigate in further detail some of main challenges and issues facing schools attempting to decarbonise and/or implement sustainability initiatives and summarise the barriers.

Grassroots Barriers

Grassroots barriers are defined as those that teachers face on a daily basis, and include lack of time, an increasingly busy or crowded curriculum, insufficient teacher knowledge and lack of professional training around sustainability (Evans, et al., 2012).

Workshop participants and survey respondents restated these barriers and specifically noted the lack of time, teacher or staff knowledge about the subject and lack of interest by other staff members or teachers as the most significant barriers to carbon reduction initiatives at their school. A lack of professional training around sustainability for teachers has also been identified as a large barrier to sustainability in schools with some findings indicating that while primary school teachers view environmental education as very important, they lack the skills and knowledge to successfully teach the content in that area (Cutter-Mackenzie & Smith, 2003).

Administrative Barriers

Another classification of the types of barriers that schools face are administrative barriers, which are barriers at the administrative level, often specifically relating to the principal or school board members. The lack of school funding for sustainability initiatives was identified as a large barrier by Evans et al. (2012) to principals or boards who wished to support sustainability initiatives in their schools. Workshop participants also noted that lack of funds was a significant barrier to their school. Schools generally rely on a motivated individual, often a teacher, to drive a sustainability initiative at their school and carrying out these initiatives often requires the contribution of unpaid hours outside of school hours. Most schools are unable or remunerate the teacher for their time, hence placing a heavy reliance on a passionate and driven individual. Strict Department of Education procurement policies also limit the decision-making ability of schools in many cases, providing additional administrative barriers for schools. However, this is likely to change with the push for greater school autonomy as previously discussed in Chapter 2.

Conceptual Barriers

The last barriers identified were classified as conceptual barriers, which were defined as “conflicts between sustainability education theory and school practices” (Evans, et al., 2012, p.124). While in many cases, there is desire within schools and by staff to teach about climate change and sustainability, the lack of knowledge and support around this, are key barriers. Other studies have found that some schools, while interested in

implemented sustainability initiatives in their school, are reluctant to take major actions and tread lightly for fear of being labelled a “greenie” (Whitehouse & Evans, 2010) or the initiative backfiring (Salter, Venville & Longnecker, 2012).

From the research conducted in this project, very few schools have conducted a carbon footprint of their school. Results from the survey indicate that fewer than 20 per cent have had a carbon footprint conducted at their school. This is due in part to some of the mentioned grassroots barriers around the lack of knowledge or information of schools about how to proceed with a carbon footprint, as well as the lack of knowledge and availability of programs, tools, and resources to help schools conduct their carbon footprint. The survey results combined with discussions at the workshops indicate that despite the range of programs available and the growing interest of schools in taking action on climate change, a lack of understanding about how to begin the process, particularly around how to calculate their carbon footprint and quantify their carbon reduction, is likely to be deterring many schools. The lack of integration between, and understanding of, the various programs and tools may also be adding to the confusion.

Summary

This chapter highlighted some of the main barriers currently facing schools trying to reduce their carbon emissions and increase their sustainability. The literature grouped barriers into three categories: grassroots, administration and conceptual. Results from surveys, workshops and interviews held by the researchers, revealed that the lack of funding, time, interest and knowledge of staff were the top barriers preventing schools from pursuing low carbon initiatives. This correlated with what representatives from Education Departments identified as key issues. This demonstrates the need for greater support to assist schools. Recommendations for overcoming some of the barriers are provided in the following chapter.

6. Conclusions and Recommendations

This research has examined the potential for increasing the number of low carbon, high performance schools in Australia. The definition of 'High Performance' in this research incorporates both the physical infrastructure within schools (i.e. their buildings), as well as students academic performance, which research has demonstrated improves with better buildings and facilities. Significant opportunities for sustainability education were also identified from low carbon, high performance schools, as students can learn about resource efficiency and improving building performance using their own facilities as living laboratories. These practical learning outcomes can easily be embedded in the curriculum, thereby addressing sustainability as one of the three cross curriculum priorities. This knowledge could also be passed on and shared with the wider community via various programs and community engagement initiatives.

Low carbon, high performance (LCHP) schools should be considered the next agenda for the education sector. However, despite the abundant benefits associated with LCHP schools, a range of barriers, limitations and gaps in research exist are currently preventing schools from pursuing this agenda. These will need to be addressed in order to encourage more schools to be actively involved in reducing their carbon footprint in the future.

An examination of various tools, programs and initiatives that could assist schools with this process was provided within this report, however, it revealed that very few can assist with quantifying the carbon footprint of schools or measuring carbon reduction associated with initiatives.

Based on the findings, a number of opportunities have been identified and recommended as further research. These are provided below.

1. A Low Carbon, High Performance Pilot Program

This research recommends the development of a Low Carbon, High Performance Schools Pilot Study. This study would assess both the carbon footprint of schools and measure various health and productivity factors to determine whether carbon can be used as a metric to assess High Performance schools within an Australia context. Key components of the pilot study include:

- The development of indicators to measure the effect of carbon reduction initiatives across a variety of sources;
- The development of suitable metrics to measure student and staff performance/productivity;
- The development of a national online carbon footprint calculator specifically for schools. This calculator either be embedded into a broader platform (discussed below) or could be integrated with existing initiatives (such as the ResourceSmart AuSSI Vic platform). It would collect, calculate and publish carbon-related school utility data, which can then be used to create benchmarks for the carbon performance of schools across Australia;
- The development of an online platform that allows schools across Australia to communicate with each other and share information and experiences. This could assist schools to identify the most appropriate solutions, those that didn't work, and those that offer the greatest carbon reduction for the least cost.
- The development of a basic cost-benefit carbon calculator that provides simple Return-On-Investment (ROI) calculations to determine rough feasibility for low carbon retrofit initiatives and upgrades. This can help to highlight the key opportunities and appropriate payback periods for school administrators;
- The development of new curriculum-based materials and resources (including lesson plans) that are tailored around low carbon initiatives (i.e. using the carbon footprinting calculator mentioned above, analysing the carbon reduction opportunities associated with various initiatives, energy and water efficiency, local food production, student commute to school etc.). This will help to ensure that initiatives do not become the responsibility of, and therefore rely solely on, individual champions within a school. It will also provide exceptional opportunities for embedding sustainability into the curriculum, which is a national priority;
- Conduct a review of high-performing, low carbon schools across Australia to identify the key factors that contributed to their success, including popular and effective initiatives, governance structures, procurement processes, and community and industry partnerships. This should be filmed as Star Performing Schools and made available to all schools to encourage and motivate them to participate.

2. National Framework, Methodology and Certification for Low Carbon Schools

The creation of a national carbon accounting framework and methodology for schools would increase the credibility and comparability of carbon claims made by schools. It would also help to streamline the process, which could provide greater potential for replicability by other schools. This would also increase the useability of the data collected by schools.

Such a framework would include the minimum emission sources required within a school's carbon footprint, as well as the process for how schools can achieve carbon neutrality, similar to how South Fremantle Senior High School did. This framework and process should be developed collaboratively with schools and key stakeholders to ensure that it is applicable and viable in a schools context. The online calculator discussed above would need to be based on this. Having a standardised framework would also mean that any future carbon calculators developed (i.e. by consultancies etc.), would be more consistent and able to feed data into the national database.

A certification process could be established through the CRC LCL for delivery through an accepted accrediting body. This would provide a mechanism to help motivate and incentivise schools on their journey, allowing them to celebrate their success in becoming a low carbon, high performance school.

3. Community Partnerships and Innovative Funding Models

Future research should explore further opportunities around innovative community and industry partnerships that can both ramp up the speed and cost-effectiveness of implementing low carbon and other sustainability initiatives in schools, whilst engaging wider with the community on such issues.

4. Sharing Resources

It is recommended that new opportunities be investigated for sharing resources between schools, including project officers/personnel that can assist with implementing carbon reduction initiatives. A network of people willing to assist in such sharing of knowledge could be created through this project.

It is also recommended that States and Territories consider sharing more of their resources, knowledge, and databases with each other. This can help to spread costs of developing new software or platforms between the states, particularly in relation to the AuSSI program.

Figure 13 below highlights the benefits, opportunities and resources required for encouraging greater uptake of Low Carbon, High Performance schools in Australia.

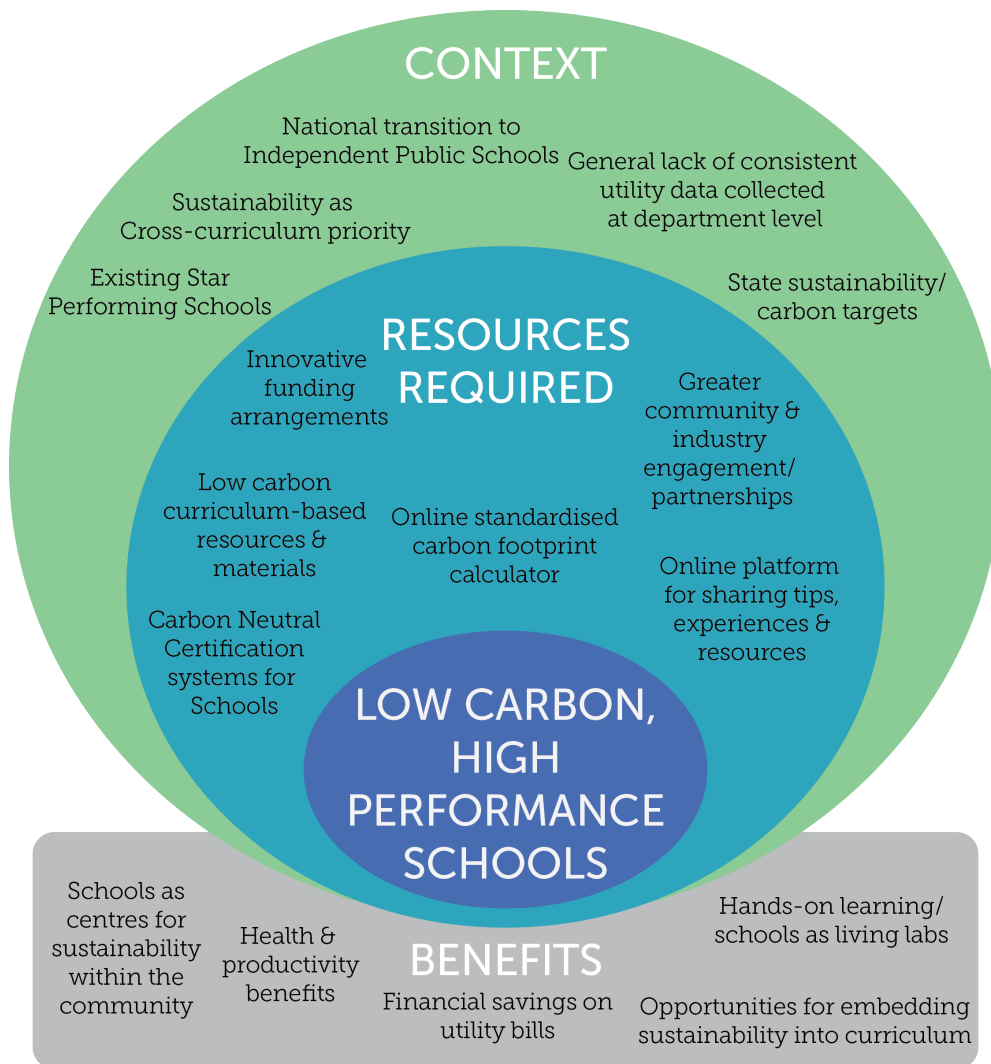


Figure 13: Benefits, Opportunities & Resources Required to Mainstream Low Carbon, High Performance Tools

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APPENDIX A – Australian School Programs, Initiatives and Tools Targeting Sustainability and Carbon

Carbon-Focused School Programs in Australia

H: High School
P: Primary School
E: Early learning

E: Energy T: Transport
W: Water F: Food
R: Waste C: Carbon

Name	Target Level	Country/State	Type	About	Emission Areas	Cost	Limitations
Carbon Planet	EL, P (P-10)	National	Carbon Consultancy	Provided free carbon footprints/energy audits to schools in 2011 as part of a corporate donation to the community.	Unknown	Varies	Not consistent for schools
Future Carbon	Not targeted	National	NFP Initiative	An initiative of Greening Australia that focuses on planting large areas of natural vegetation to sequester carbon	E, T	Free	Not targeted towards schools. Doesn't include very much detail.
Coolnation	P	National	FP Consultancy Program	An initiative of Carbon Planet that includes educational resource pack focused on climate change education	E, T, Ec	\$99	Cost to teachers and doesn't provide accurate resources for schools to conduct their own accurate carbon footprint
Carbon Kids	EL, P	National	NFP	Educational program developed by CSIRO (commonwealth scientific and industrial research).	E, T	Free	Lesson resources available on site and once registered schools receive educational resources, newsletters, school visits, workshops etc
Planet Savers	EL, P, H	VIC	Carbony/Energy Consultancy	A program specialising in energy audits of schools and communities. Provide a very rudimentary free "Energy Footprint" Calculator on their website.	E	Unknown	Only way for schools to get an in depth carbon energy footprint is to choose from one of their energy audit services for a fee.
Resourcesmart AUSSI Victoria	EL, P	Australia (Vic)	State Government Initiative	A program underneath AUSSI that has an online database where schools can enter data about energy consumption, transportation, and water use and compare their results against other schools.	E, T, W, R, Ec	Free	Doesn't include carbon
Cool Australia	P, H	National	NFP	Provide online curriculum-linked educational material and support to the teaching community.	E, W, R, Ec, T, P	Free	Lacks carbon footprinting curriculum resources
Climate Clever Energy Savers Program	P, H	NSW	State Government Initiative	A \$5 million program where student teams investigate energy use in their school	E	Free	Limited to a certain number of schools
WithOnePlanet	P	National	NFP	A program stemming from WithOneSeed that has developed curriculum resources and a learning portal for students to learn more about climate change and the effect that carbon has on the environment.	C, Ec	Free	

Carbon Footprint Calculators in Australia

H: High School
P: Primary School
EI: Early learning

E: Energy T: Transport
W: Water F: Food
R: Waste C: Carbon

School Carbon Footprint Calculators

Name of Calculator	Target Level	State/Country	About	Emission Areas	Limitations	Who Runs It
EPA Victoria	EL, P, S	Australia	Free Ecological Footprint Calculator	E, W, R, T, F	Calculator is no longer in operation.	NFP
SETS School Environment Tracking System programme and SolarSETS	EL, P, S	Australia (NT, VIC)	Tracking programme (1600 schools at present) quantifying savings across schools nationwide	E, W, R	Doesn't include all the emission sources. Hard to navigate.	Private
Atlas Schools	P, S	UK	Created a carbon toolkit to allow schools to identify the sources of their carbon emissions and take action to reduce them.	E, W, R, T		NFP, Government
Cool School Challenge	P, S	USA	National challenge to engage students and teachers in practical strategies to reduce CO2 and other greenhouse gas emissions school-wide.	E, R, T	Not applicable for Australian schools. Not very detailed and not very user friendly.	NFP
AUSISA	S	Australia (SA)	GHG emissions spreadsheet	E	Not very user-friendly. Not kid-friendly. Doesn't include all emission factors and only doesn't give opportunities for comparing against other schools.	State Government
Carbon Detectives		Europe	Carbon programme with tools/calculator and resources to reduce - now finished			

General Carbon Footprinting Tools

Name	Target Level	State/Country	About	Emission Areas	Limitations	Who Runs It
Clean Up Our Climate Carbon Offset Calculator	Not targeted	Australia (NSW)	Simple "Carbon Offset Calculator"	E, R, T	Extremely basic, not accurate and not targeted for schools	NFP
Eco'tude	EL, P, S	Australia	Simple online ecological footprint calculator that uses estimated data	E,	Very rudimentary and basic. Appears to no longer be updated	NFP
Carbon Cops	All	Australia	ABC TV program with a carbon calculator	E, T, R	Not accurate, with limited functionality	Private
Carbon Emissions Calculator	Not targeted	Australia	Basic household carbon footprint calculator on the Tasmania Climate Change website	E, T, R	Basic and not targeted towards schools	Government
Carbon Neutral	Not targeted	Australia	Free Ecological Footprint Calculator - not all inclusive. Aimed at providing a "snapshot".	All	Not detailed and not tailored for schools. Uses average data usage not actual figures.	Private

APPENDIX B – Review of State and Territory Climate and Carbon Reduction-Related Targets

State	Name of scheme	Climate/Carbon Reduction Target	Initiatives to Reduce Carbon
ACT	AP2 - Climate change strategy and action plan (2012, with independent reporting and assessment occurring in 2014)	In November 2010, the Legislative Assembly passed the <i>Climate Change and Greenhouse Gas Reduction Act 2010</i> which established ACT emissions reduction targets of: <ul style="list-style-type: none"> zero net greenhouse gas emissions by 2060 peaking per person greenhouse gas emissions by 2013 40% below 1990 levels by 2020 and 80% below 1990 levels by 2050 	Action 4: The ACT Government will publish by 2015 a Pathway to Zero Emissions Buildings policy informed by a regulatory impact assessment and stakeholder consultation to be undertaken from 2013 covering residential and non-residential building types. Action 8: The ACT Government will establish <i>ACTSmart Energy Advice</i> to provide up-to-date practical advice and support to small and medium sized businesses, community groups and representative organisations. Action 11: The ACT Government will implement the <i>ACT Waste Management Strategy 2011–2025</i> and achieve a carbon neutral waste sector by 2020
NSW	NSW Greenhouse gas plan (2005)	NSW became the first jurisdiction in Australia to map out a new agenda of big cuts over the next 20 to 45 years, reductions that will take a lot of planning and discipline to achieve: <ul style="list-style-type: none"> a 60 percent cut in greenhouse emissions by 2050; and cutting greenhouse emissions to year 2000 levels by 2025. NSW abatement opportunities identified in the cost curve equate to over 50 MtCO _{2e} per year (about one third of current estimated NSW emissions)	Applied principles of energy efficient design to Government buildings. The Government will develop measures to extend greenhouse gas emissions savings from new and existing commercial buildings, utilising existing measures such as the Building Code of Australia, the Building Sustainability Index (BASIX) and the Australian Building Greenhouse Rating scheme, to cover both design/construction and ongoing operational performance. Set minimum greenhouse emissions standards for new commercial buildings, and improve the performance of existing buildings. The Office assist with the design of a wide range of Government building projects such as the design of schools and TAFEs.
NT	NT Climate change Policy (2009)	Aspirational goal – reduce emissions by 60% by 2050 from 2007 levels	By 2010, establish a phase-out timetable for diesel powered electricity generation in regional and remote communities and replace with renewable and low emissions energy. Energy Smart Rebates (NRETAS); Rainwater Tank Rebates (NRETAS); NTG Solar Hot Water System Retrofit Rebate (PWC); Australian Government Solar Credits Program Travel smart workplaces programs
SA	Tackling Climate Change: South Australia's Greenhouse Strategy 2007-2020	Outlines the case for action, the wider international context and three essential strategy requirements, which are: <ul style="list-style-type: none"> the need to reduce our greenhouse gas emissions the need to adapt to climate change the need to innovate. 	At the national level, South Australia has been the first jurisdiction in Australia to set targets in legislation roll out solar panels for schools commit to feed-in laws to reward owners of solar panels trial micro wind turbines. School curriculum has been augmented with information on sustainable energy. Other education programs have addressed youth, energy efficiency and the development of Adelaide as a green city. By incorporating good design, resource efficiency and low-waste practices into their operations, community providers and hubs such as councils, schools and community centres can also exemplify a range of best practice greenhouse solutions that are accessible and affordable for all sections of the community. Priorities for government in encouraging travel behaviour change will be to: expand the TravelSmart
ACT	AP2 - Climate change strategy and action plan (2012, with independent reporting and assessment occurring in 2014)	In November 2010, the Legislative Assembly passed the <i>Climate Change and Greenhouse Gas Reduction Act 2010</i> which established ACT emissions reduction targets of: <ul style="list-style-type: none"> zero net greenhouse gas emissions by 2060 peaking per person greenhouse gas emissions by 2013 40% below 1990 levels by 2020 and 80% below 1990 levels by 2050 	Action 4: The ACT Government will publish by 2015 a Pathway to Zero Emissions Buildings policy informed by a regulatory impact assessment and stakeholder consultation to be undertaken from 2013 covering residential and non-residential building types. Action 8: The ACT Government will establish <i>ACTSmart Energy Advice</i> to provide up-to-date practical advice and support to small and medium sized businesses, community groups and representative organisations. Action 11: The ACT Government will implement the <i>ACT Waste Management Strategy 2011–2025</i> and achieve a carbon neutral waste sector by 2020
NSW	NSW Greenhouse gas plan (2005)	NSW became the first jurisdiction in Australia to map out a new agenda of big cuts over the next 20 to 45 years, reductions that will take a lot of planning and discipline to achieve: <ul style="list-style-type: none"> a 60 percent cut in greenhouse emissions by 2050; and cutting greenhouse emissions to year 2000 levels by 2025. NSW abatement opportunities identified in the cost curve equate to over 50 MtCO _{2e} per year (about one third of current estimated NSW emissions)	Applied principles of energy efficient design to Government buildings. The Government will develop measures to extend greenhouse gas emissions savings from new and existing commercial buildings, utilising existing measures such as the Building Code of Australia, the Building Sustainability Index (BASIX) and the Australian Building Greenhouse Rating scheme, to cover both design/construction and ongoing operational performance. Set minimum greenhouse emissions standards for new commercial buildings, and improve the performance of existing buildings. The Office assist with the design of a wide range of Government building projects such as the design of schools and TAFEs.
NT	NT Climate change Policy (2009)	Aspirational goal – reduce emissions by 60% by 2050 from 2007 levels	By 2010, establish a phase-out timetable for diesel powered electricity generation in regional and remote communities and replace with renewable and low emissions energy. Energy Smart Rebates (NRETAS); Rainwater Tank Rebates (NRETAS); NTG Solar Hot Water System Retrofit Rebate (PWC); Australian Government Solar Credits Program Travel smart workplaces programs
SA	Tackling Climate Change: South Australia's Greenhouse Strategy 2007-2020	Outlines the case for action, the wider international context and three essential strategy requirements, which are: <ul style="list-style-type: none"> the need to reduce our greenhouse gas emissions the need to adapt to climate change the need to innovate. 	At the national level, South Australia has been the first jurisdiction in Australia to set targets in legislation roll out solar panels for schools commit to feed-in laws to reward owners of solar panels trial micro wind turbines. School curriculum has been augmented with information on sustainable energy. Other education programs have addressed youth, energy efficiency and the development of Adelaide as a green city. By incorporating good design, resource efficiency and low-waste practices into their operations, community providers and hubs such as councils, schools and community centres can also exemplify a range of best practice greenhouse solutions that are accessible and affordable for all sections of the community. Priorities for government in encouraging travel behaviour change will be to: expand the TravelSmart

State	Name of scheme	Climate/Carbon Reduction Target	Initiatives to Reduce Carbon
ACT	AP2 - Climate change strategy and action plan (2012, with independent reporting and assessment occurring in 2014)	In November 2010, the Legislative Assembly passed the <i>Climate Change and Greenhouse Gas Reduction Act 2010</i> which established ACT emissions reduction targets of: <ul style="list-style-type: none"> • zero net greenhouse gas emissions by 2060 • peaking per person greenhouse gas emissions by 2013 • 40% below 1990 levels by 2020 and • 80% below 1990 levels by 2050 	Action 4: The ACT Government will publish by 2015 a Pathway to Zero Emissions Buildings policy informed by a regulatory impact assessment and stakeholder consultation to be undertaken from 2013 covering residential and non-residential building types. Action 8: The ACT Government will establish <i>ACTSmart Energy Advice</i> to provide up-to-date practical advice and support to small and medium sized businesses, community groups and representative organisations. Action 11: The ACT Government will implement the <i>ACT Waste Management Strategy 2011–2025</i> and achieve a carbon neutral waste sector by 2020
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NT	NT Climate change Policy (20090)	Aspirational goal – reduce emissions by 60% by 2050 from 2007 levels	By 2010, establish a phase-out timetable for diesel powered electricity generation in regional and remote communities and replace with renewable and low emissions energy. Energy Smart Rebates (NRETAS); Rainwater Tank Rebates (NRETAS); NTG Solar Hot Water System Retrofit Rebate (PWC); Australian Government Solar Credits Program Travel smart workplaces programs
SA	Tackling Climate Change: South Australia's Greenhouse Strategy 2007-2020	Outlines the case for action, the wider international context and three essential strategy requirements, which are: <ul style="list-style-type: none"> • the need to reduce our greenhouse gas emissions • the need to adapt to climate change • the need to innovate. 	At the national level, South Australia has been the first jurisdiction in Australia to: set targets in legislation roll out solar panels for schools commit to feed-in laws to reward owners of solar panels trial micro wind turbines. School curriculum has been augmented with information on sustainable energy. Other education programs have addressed youth, energy efficiency and the development of Adelaide as a green city. By incorporating good design, resource efficiency and low-waste practices into their operations, community providers and hubs such as councils, schools and community centres can also exemplify a range of best practice greenhouse solutions that are accessible and affordable for all sections of the community. Priorities for government in encouraging travel behaviour change will be to: expand the TravelSmart

APPENDIX C – Emission Reduction Measures by South Fremantle Senior High School

Carbon Neutral Actions SFSHS		
Location/Area	Action details	Date
BEHAVIOURAL CHANGES		
Whole school	Holiday switch off electric hot water system	2007
Whole school	Holiday switch off gas hot water system	2007
Whole school	Paper & cardboard recycling	2007
Whole school	'Turn off' signage on lights	2008
Whole school	Waterwise accreditation	2013
Whole school	PD sustainability event for ALL staff	2012
Whole school	Sustainable Purchasing policy introduced	2013
RETROFIT CHANGES		
A Block	1kW Solar Power system installed	2008
Canteen	Delamp canteen fridges	2007
Rec, D,E,Music	Waterless urinals	2007
Music, Admin	Timers on hot water boilers	2008
Canteen	Canteen Cool room self closing door	2009
Offices	Replace bar heaters with 200W or 420W thin panel heaters	2008
Toilets	Replace 9 single flush toilets with 4-star dual flush	2009
Library	Waterwise shade planting	2008
F Block	Waterwise shade planting	2009
Music Centre	A/C changed from 8am - 4pm to manual hour lesson timer	2009
Music Centre	Lighting retrofit - LED lights for Music Centre carpark	2008
External	Lighting retrofit - LED sensor flood lights	2009
Hall	Decommission 400l gas storage hot water system-replaced w/ instant gas	2010
Gardens	Reduce lawn areas - Kali & Vita Gardens	2008
Trade Training Centre	Waterwise local species garden replaces lawn	2012
Pool	Pool blanket donated by City of Fremantle	2014
Gardens	South side of pool (170 m ²) lawn removed, replaced with local Waterwise plants	2012
Woodwork H3	LED Trial	2010
Canteen	4.550kw Solar Power system installed	2010
Canteen	Solar Hot Water system installed	2010
Toilets D block	Push button timers for hand washing	2010
Whole school	Flow reducers on all taps and showers	2012
Canteen	Replace door seal on cool room	2010
Whole school	1 hour timers on classroom bar heaters	2011
Staff room, staff toilets,	Timers on electric hot water heaters 7.30 - 3.00 5 days a week	2009
English F4 & 5	LED's installed	2012
Computer labs x5	Shutdown timers which run for 6 hours	2013
Home Ec	15 m ² Lawn removed replaced with herb garden	2014
Gardens	Build Green Room propagation area - remove 120 m ² lawn	2008
Whole school	Paper and cardboard recycling	2009
Gardens	Green waste bin introduced	2011
Whole school	Carbon Neutral accreditation	2011
Whole school	Purchase 100% Green Power	2010
Whole School	Purchase Carbon Credits	2010

Whole school	Sustainability included in all subjects	2011
Whole school	Murdoch Uni Geo Thermal feasibility study	2011
Whole school	Murdoch Uni Bike Fountain prototype constructed	2012

APPENDIX D – Carbon Tools, Programs and Initiatives

School Energy Tracking System (SETS)

The School Energy Tracking System (SETS) online system was developed by carbon and energy management consultants Carbonetics for a commission by Sustainability Victoria in 2002 and was designed to allow school administration and teaching staff to measure their school's energy, water consumption and waste and see the changes over time. The platform keeps track of the data completed by each school and enables comparisons to be made between schools as a method of measuring progress and comparing results. In 2010, the system was optimised to be used as a certification tool to allow schools to complete the 5Star Sustainability Certification Process for receipt of the ResourceSmart AuSSI Vic Certificate of Achievement in the biodiversity, energy, waste, water and core modules. According to the SETS website, SETS has been used by over 1600 schools across the nation since its inception. In 2013, Sustainability Victoria ceased using SETS as their primary carbon and energy-tracking tool for schools due to issues around usability (pers comm) and switched to the ResourceSmart online module system that was developed in-house. Currently, the tool is still online and can still be used by schools, however the current uptake by schools is unknown.

A primary benefit of the SETS tool is that it is currently sits as the only comprehensive tool by which schools in Australia can calculate their carbon footprint without engaging a carbon auditing service. Its widespread use has allowed schools to compare results to one another and includes multiple sources of emissions such as energy, water, waste and transport (CHECK). A significant strength of the tool was its embedment into a larger state program, Sustainability Victoria's delivery of the AuSSI program, which gave schools access to additional supplementary resources. A potential barrier to schools of SETS is the cost, which is \$250/year plus GST. While this is a relatively low cost, some schools may struggle to meet this fee. The accuracy of the carbon accounting behind the tool is unknown and the it's cessation of embedment of a larger program may inhibit progress forward.

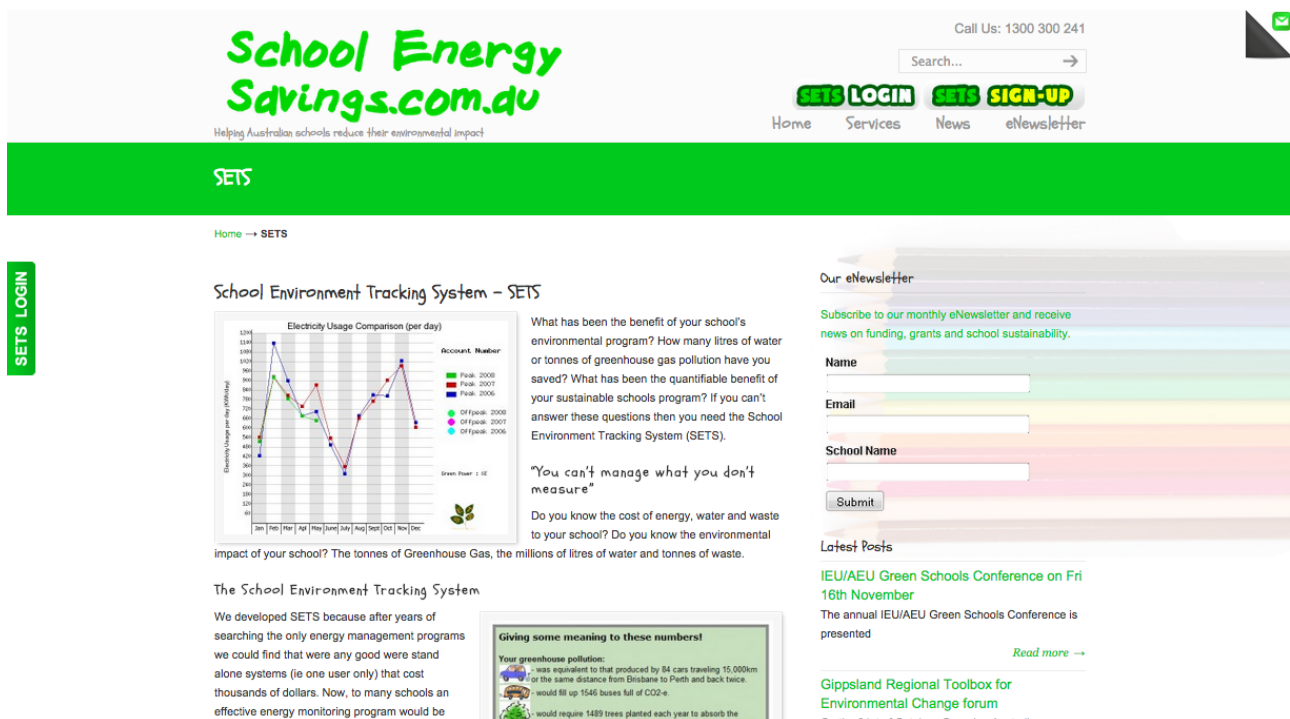


Figure 14: Screen shot of SETS Website.

AuSSI: South Australia

South Australia's delivery of AuSSI, is a collection of online resources with various supplementary educational activities designed to help teachers integrate climate change, energy, biodiversity, water, waste, transport and air quality modules into their curriculum. The climate change module, contains a MS Excel-based, downloadable greenhouse gas emissions calculator targeted at schools. The calculator includes the following inputs: lighting, heating, cooling, reverse cycle airconditioning/heating, and computers, and generates a total energy usage in kw/h, as well as the school's energy carbon footprint in kw/h. The kw/h is this translated into 'fridges of carbon' using the metric 1kw of energy = 1kg of carbon = 1 standard sized fridge (<http://www.sustainableschools.sa.edu.au/pages/assessteach/45150/#A40>).

While the spreadsheet allows for specific inputs, the data is not collected and thus does not allow for data to be compared between schools. The website also includes explanatory data for the carbon footprinting spreadsheet as well as other supplementary information. While the tool is free and specifically targeted at schools, it is not widely known or accessible, and does not allow comparisons to be made between schools. It translates carbon into a tangible analogy however; it is not designed in a user-friendly manner and does not include metrics important for a carbon footprint such as water, waste, and transport.

	A	B	C	D	E	F	G
1	Calculating your school's energy greenhouse gas emissions						
2	This calculation is for a single 24 hour period. Therefore generally speaking, when considering heating/ cooling, only type being used will be calculated.						
3	To calculate a schools carbon energy footprint for a year, work out how many days per year require heating, and how many days per year require cooling. Then times the daily energy by the number of days the school is open for.						
6	Lighting						
7		9w Magnetic Ballast Fluorescent Lights	4 w low loss ballast fluorescent lights	Incandescent lights (wattage type A)	Incandescent lights (wattage type B)	Incandescent lights (wattage type C)	Security Lights outdoor
8	Quantity						
9	Energy usage (w)		9	4			
10	Daily hour usage (hours)						
12	Total Energy Usage (w/h)		0	0	0	0	0
13	Total Energy usage (kw/h)		0	0	0	0	0
15	Total of Lighting Energy (kw/h) usage per day		0				
17	Heating*						
19		Central heating (boiler system)	Furnace system (gas)	Hydronic heating system	Gas Wall furnace	Radiant Gas Heaters	Portable Heaters
20	Quantity						
21	Megajoules (MJ) for gas appliances only						

Figure 15: Screen shot of AuSSI SA Carbon Calculator.

CarbonKids (CSIRO)

CarbonKids started in 2009 and is jointly funded by Bayer and Global Carbon Capture Institute (GCC) and operates under CSIRO. The focus of CarbonKids is to provide educational resources, activities and assistance to schools that are interested in tackling climate change. The program started with 25 schools in 2009 and now reaches 315 schools across the country, with a large portion of the schools located in Western Australia and South Australia. The program assists schools in developing a five year sustainability action plan and gives them access to resources such as a carbon tree calculator that converts energy into number of trees needed to absorb the CO₂ as well as an online wiki, where participating schools can go to exchange ideas and share experiences with their carbon reduction and sustainability initiatives. CarbonKids only works with schools whose principals are on board with taking action around sustainability at the schools, rather than one teacher or group heading the initiative, which is a crucial element of the success of the program (N. Mackey, personal communication, August 14, 2014).

CarbonKids is currently the only active national initiative in Australia that has a specific focus on carbon emission education and reduction. Operating under CSIRO gives CarbonKids credibility with the science behind their lessons. Their online wiki provides a crucial element of community engagement with other

schools, however it is unknown whether schools can compare results such as their carbon footprint. It is unclear how the carbon footprints are calculated and currently there is no publicly accessible data from CarbonKids

Maia Maia

Maia Maia is a community-run emissions reduction currency system whose mission is to educate children about climate change. They developed a currency called Boya, which is given to students when their school has decreased their carbon emissions. The students can then use the Boya to 'buy' things or services at a discounted price, at other participating schools and some participating businesses in Perth. Using an "upsidedown" thermometer, Maia Maia schools keep track of their school carbon emissions and how it contributes to global warming as a whole.

Planet Savers

Planet Savers is an environmental consultancy based in Victoria that specialises in energy audits and carbon footprinting of schools. Planet Savers conducts an energy and/or carbon audit and then help schools identify long term management of energy resources as well as offer professional development workshops for teachers and staff. Planet Savers has conducted energy audits or carbon footprints for over 700 schools and also available to schools are curriculum resources around energy and climate change such as lesson plans, worksheets and activities. The outputs the school is given upon completion of the energy audit include total energy consumption and CO₂ emissions, cost of energy, CO₂ emissions and energy consumption as well as m² and per student (www.planetsavers.com.au). Planet Savers is primarily based in Victoria and does charge a fee for their services, which may make the service unattainable for some schools.

Along with being just one of a handful of carbon/energy consultancies that focus specifically on schools, Planet Savers also provides a number of supplementary resources for students and teachers once Planet Savers is engaged, such as workshops and student activities. Planet Savers is primarily based in Victoria, which limits their reach and it is unclear whether schools can compare data to one another.

SimplyCarbon

SimplyCarbon is a boutique sustainability consultancy that specialises in assisting organisations and schools to measure, monitor, reduce and offset their carbon emissions. In 2012, they assisted South Fremantle Senior High School to become the first NCOS certified Carbon Neutral school in Australia, an achievement that was celebrated with the Prime Minister. Their carbon footprint audits are conducted in line with international protocols and fulfil the NCOS requirements. The carbon footprint is provided as a report to the school, and highlights the total emissions for the school as well as per student carbon footprint. Energy and water audits and staff workshops are also offered. SimplyCarbon is based in Perth, Western Australia, and their services are currently focusing in this region.

Carbon Planet – Coolenation

Carbon Planet, a carbon consultancy founded in 2000, has developed a resource pack for teachers that was designed to engage primary school children with information and fun activities about what can and is being done about climate change. As part of the initial resource packs, Carbon Planet offered free or discounted carbon footprinting and auditing services for the schools wishing to be involved (anonymous, personal communication). The resource pack is still available online for purchase on the Coolenation website, however, uptake is unknown.

EPA Victoria (Past Tool)

Up until early 2014, the EPA Victoria hosted a free online carbon footprint calculator on their website that had a targeted "schools" component. The calculator was taken down as it became outdated and EPA Victoria didn't have the resources to maintain the calculator as they shifted their focus towards other initiatives ().

It was a widely known tool and was online and easily accessible. However, little information could be gathered about this tool after its discontinuation.

Carbon Sink Schools Program (Past Tool)

The Carbon Sink Schools program was a program run in conjunction with CERES, the Victorian Government and Planet Savers. It was a one-year pilot program that assisted schools in calculating their carbon footprint with a focus on offsetting those emissions. The program ran in 2007 and was limited to Victoria with little

further information is publicly available on this program. It is believed that this program was later re-written to become the basis for the CSIRO CarbonKids program (pers comms).

This program specifically focused on carbon, and educated children about carbon sinks, offsetting and carbon neutrality, and enabled schools to conduct a carbon footprint. The initiative never made it past the pilot phase and was limited to a handful of schools with no publicly available data upon its conclusion. It is unknown why this program was not carried out past the pilot phase and the accuracy of the carbon footprinting process is also uncertain.

Climate Clever Energy Savers (Past Tool)

An initiative by the NSW Government, the Climate Clever Energy Savers program was a \$5 million dollar program that was part of a larger NSW Energy Efficiency Initiative that ran from 2010 to 2014 and reached nearly 700 schools across the state. The program sought to provide professional learning opportunities for educators and raise awareness with students in years 3 to 10, about sustainability, specifically greenhouse gas reduction and energy efficiency. The findings of the program pointed to a strong benefit of “concrete outcomes” such as students making an active contribution towards reducing their energy use and carbon emissions and seeing the changes over time (Buckanan, Schuck & Aubusson, 2014). An emphasis on the cost savings of carbon reduction and energy efficiency measures as to not alienate those who were adverse to the idea of anthropogenic climate change, thus resulting in a more positive outcome for the program.

The program was able to reach 104 schools in New South Wales and was thoroughly evaluated for its effectiveness. From available information, only energy was consistently measured and translated into carbon throughout the program. The program was well evaluated with publicly available reports available for reference and held a strong focus on student participation.

Low Carbon Curriculum Resources

Cool Australia

Started in 2008 by Jason Kimberley, Cool Australia is a not-for-profit that provides free curriculum resources for teachers to use in classrooms from Foundation to Year 10. The resources are relatively widely known around Australia, with teachers using the resources to teach about a variety of sustainability topics. The curriculum resources are crafted to fit within the learning objectives of the Australian Sustainable Schools Initiative (AuSSI), and focus on eight sustainability topics: energy, water, biodiversity, climate change, resource consumption, waste and Arctic & Antarctica. Over 4,200 schools have used Cool Australia resources, which has reached over 185,000 students in 2013 ("About Us", n.d.). Cool Australia also offers curriculum development services to help schools and organisations (i.e. GreenPeace) to create targeted curriculum resources that fit within the Australian Curriculum, Principles of Learning and Teaching (PoLT), E5 and Performance and Development Culture²⁸ ("Curriculum Writing Team", n.d.).

FutureCarbon

Future Carbon is a website and online carbon footprint calculator that was developed in 2013 by Greening Australia and RACV. The calculator conducts emissions and is targeted at homeowners and community, however it was intended to have a schools component in the coming years (J. Duddles, personal communication, August 18, 2014). The focus of the initiative is to promote carbon sequestration through the planting of trees and increasing biodiversity. Currently the data is not being collected from the calculator as it has yet to be actively marketed, providing very little usable data thus far. Correspondence with key stakeholders within Greening Australia also point to the possibility for collaboration on a carbon footprint calculator specific to schools in the future (anonymous, pers comm).

WithOnePlanet

The WithOnePlanet program is an e-learning portal that is an initiative of the xpand Foundation²⁹ and will act as a repository for the already established WithOneSeed program, which is a social enterprise committed to taking action on climate change through reforestation and agroforestry projects in Timor Leste. The WithOnePlanet learning portal, which is scheduled for realase in February 2015, features resources for Years F to 10 under 3 themes: environment, culture and citizenship. The resources are designed to cohere with the Australian National Curriculum and the program seeks to give students practical knowledge about the environment, the carbon cycle, energy consumption, their culture and citizenship responsibilities ("WithOneSeed progress report", 2014).

²⁸ Principles of Learning and Teaching (PoLT), E5 and Performance and Development Culture are all instructional models for teaching.

²⁹ "The xpand Foundation creates and supports social enterprises that encourage social inclusion of disadvantaged people to build their social and economic participation in a society committed to a green future in the digital age," (www.xpand.net.au/about).

APPENDIX E – Survey and Workshop Questions and Results

SURVEY RESULTS

	Question	Answer Choices	Results
Q1	Please list the state your school is located in.	<ul style="list-style-type: none"> NSW, QLD, VIC, SA, TAS, WA, NT, ACT 	<ul style="list-style-type: none"> WA - 100 per cent
Q2	School type	<ul style="list-style-type: none"> Pre Primary/Primary School Secondary/Senior High School Both 	<ul style="list-style-type: none"> Pre Primary/Primary School - 69.05 per cent Secondary/Senior High School - 14.29 per cent Both - 16.67 per cent
Q3	School classification	<ul style="list-style-type: none"> Public Independent Public Private Catholic Christian Other (please specify) 	<ul style="list-style-type: none"> Public - 35.71 per cent Independent Public - 40.48 per cent Private - 9.52 per cent Catholic - 9.52 per cent Christian - 0.00 per cent Other - 4.76 per cent
Q4	Has your school ever had a carbon footprint or carbon audit conducted?	<ul style="list-style-type: none"> Yes No Not sure 	<ul style="list-style-type: none"> Yes – 7.14 per cent No - 73.81 per cent Not sure – 19.05 per cent
Q5	Is your school participating in any sustainability programs and/or have they implemented any carbon reduction initiatives?	<ul style="list-style-type: none"> No Not sure Yes (please specify) 	<ul style="list-style-type: none"> No – 7.32 per cent Not sure – 12.20 per cent Yes – 80.49 per cent
Q6	If there was a cost associated with any of the above programs or initiatives, how were they funded?	<ul style="list-style-type: none"> N/A – no cost involved Self funded (i.e. school allocated funds internally) Self-funded (i.e. school fundraising) Department of Education assistance External Grant Philanthropy Other (please specify) 	<ul style="list-style-type: none"> N/A - 40.00 per cent Self-funded internally - 57.14 per cent Self-funded externally - 20.00 per cent DoE assistance - 14.29 per cent External grant - 65.71 per cent Philanthropy - 5.71 per cent Other - 11.43 per cent
Q7	Are you aware of any other tools, programs or incentives that could assist reducing emissions in your school?	<ul style="list-style-type: none"> No Yes (please list) 	<ul style="list-style-type: none"> No – 62.16 per cent Yes – 37.84 per cent
Q8	Please rank what you receive to be the greatest barriers to carbon reduction initiatives in schools (1=greatest, 8=least. Rank only those that apply).	<ul style="list-style-type: none"> Financial barriers Regulatory barriers Time restraints Lac of influence/decision making ability Lack of senior management support Lack of interest by teachers and/or staff Lack of education or knowledge on the subject Not sure 	<ul style="list-style-type: none">
Q9	What measures do you think could help to overcome current barriers?	<ul style="list-style-type: none"> (open response) 	See Chapter 5.

Table 5: Online & Paper Survey Questions

WORKSHOP RESULTS

Discussion Topic	Workshop respondent responses	
School Sustainability Initiatives	<ul style="list-style-type: none"> • Waste Wise program • Waterwise program • Vegetable garden • Energy efficiency measures 	<ul style="list-style-type: none"> • Solar panels • Plant nursery • Worm farm • Rainwater tanks
Barriers to implementing low carbon initiatives	<ul style="list-style-type: none"> • Administration issues • Lack of interest by teachers/staff • Time of students/teachers • Lack of knowledge about the subject 	<ul style="list-style-type: none"> • Instability of grant programs • Difficulty convincing other teachers to integrate sustainability in their lessons • Pressure of individual teachers to carry out programs/initiatives
Resources needed	<ul style="list-style-type: none"> • Know what low hanging fruit is • Committee/groups for support • To get people on board • Innovative funding options for initiatives 	<ul style="list-style-type: none"> • Checklists & ready-made teacher resources • Online tool for kids that is simple to use • More sharing and contacts between schools & resources • Online system with resources

Table 6: Results from participant discussions at workshop