



**Survey of Education,  
Training and Continuing  
Professional  
Development  
in Energy Efficiency and  
Greenhouse-related  
issues**

*available to Australian building  
industry practitioners*

*Prepared by*

**Institute for Sustainable Futures**

*For*



University of Technology, Sydney

*Institute for Sustainable Futures*

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# **Survey of Education, Training and Continuing Professional Development in Energy Efficiency and Greenhouse- related issues**

*available to Australian building industry practitioners*

Final Report

*For The Australian Building Energy Council*

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## **ACKNOWLEDGEMENTS**

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Recipient databases for the surveys and input to survey development was provided by ABEC and AGO. ABEC and AGO were also responsible for organising and hosting an Industry Workshop to discuss survey findings and identify the way forward.



## EXECUTIVE SUMMARY

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Amidst global concern about the greenhouse effect and its implications for global warming and climate change, Australia has undertaken to limit its greenhouse gas emissions to an 8% increase on 1990 levels under the Kyoto Protocol. The Australian building sector is recognised as being responsible for 27.6% of Australia's energy-related greenhouse gas emissions, and as such can play a significant part in achieving Australia's greenhouse gas emission reduction target.

Formal education, training and continuing professional development (CPD) have an important role in promoting the capacity of the Australian building and construction industry to address the issues of energy efficiency and greenhouse gas abatement. This baseline study investigates the role education is currently playing and identifies where the greatest opportunities for improvement exist.

The intent of the study, in keeping with ABEC and AGO requirements, is to provide an indication of the extent to which the major providers are currently addressing these issues both generally and with respect to specific topics. Industry and Professional Associations, Universities and TAFE Institutes across Australia have been surveyed to assess the level of energy efficiency and greenhouse related education being offered to building industry practitioners (including both future graduates and those currently practicing). It is important to note that the information comes from self-assessments made by education providers, not the learners. The availability of educational materials is just the first step. Focus groups enabling assessment from the learners' perspective as to the quality and relevance of currently available education and training materials should be incorporated into later stages of this project.

The results of the survey show that, although reasonable greenhouse-related training opportunities currently exist for building and construction industry practitioners in Australia, there is much room for improvement. Significant opportunities exist to extend the reach of energy efficiency and greenhouse related issues in all educational sectors, perhaps most notably the TAFE sector. The survey found that students enrolled in almost half of the university departments surveyed, and over two thirds of the TAFE departments surveyed, will not necessarily be exposed to energy efficiency and greenhouse related issues in their training. The survey also found that, despite considerable interest in these issues from Industry and Professional Associations, few associations give significant coverage to the related topics in the training they provide to members.

As a way forward, focus groups and a 'snowballing' technique are recommended to add value to the findings of this report. It is also recommended that competency standards are reviewed and developed across all industry practitioner groups to improve greenhouse-related performance.

In the industry workshop set up to discuss the findings of this project, it was generally agreed that the greatest opportunities for short-term improvement exist in the TAFE sector. However, this is not to suggest that attention should be diverted from the other educational sectors. A recurring theme of the discussion was the need for a 'whole of industry' strategy to enable shared responsibility for holistic delivery of greenhouse related knowledge and skills. This strategy should target all practitioner groups, at both 'entry level' and more advanced stages of professional development.

It was agreed that as well as improvements in formal education, training packages across all practitioner groups to strengthen 'on the job' skills are necessary. These packages could be the result of partnership arrangements between training providers and industry players wanting to showcase 'best practice' developments through training. Any training packages developed must not present

energy efficiency and greenhouse related issues as 'add-ons' but rather as guiding principles which permeate all of the material.



# TABLE OF CONTENTS

---

<b>INTRODUCTION.....</b>	<b>1</b>
THE PROJECT.....	1
THIS REPORT.....	1
<b>BACKGROUND .....</b>	<b>2</b>
WHY THIS PROJECT IS IMPORTANT .....	2
CURRENT IMPACT OF THE AUSTRALIAN BUILDING SECTOR ON GREENHOUSE GAS EMISSIONS .....	2
EXISTING BARRIERS TO CHANGE WITHIN THE AUSTRALIAN BUILDING SECTOR .....	3
HOW THIS PROJECT RELATES TO EXISTING GOVERNMENT INITIATIVES.....	3
<b>OBJECTIVES OF THE RESEARCH .....</b>	<b>4</b>
<b>METHODOLOGY.....</b>	<b>5</b>
SURVEY DESIGN .....	5
LIMITATIONS IMPOSED BY THE SURVEY DISTRIBUTION.....	5
LIMITATIONS IMPOSED BY THE TIMING OF THE SURVEY.....	6
LIMITATIONS IMPOSED BY THE PROJECT SCOPE .....	6
<b>RESULTS.....</b>	<b>8</b>
RESPONSE RATES .....	8
SURVEY FINDINGS- NATIONAL INDUSTRY & PROFESSIONAL ASSOCIATIONS.....	12
<i>Formal ESD Policy.....</i>	<i>12</i>
<i>Competency Standards .....</i>	<i>12</i>
<i>Member Surveys.....</i>	<i>12</i>
<i>Training and CPD .....</i>	<i>12</i>
<i>Published Material .....</i>	<i>13</i>
<i>Conclusions and Recommendations .....</i>	<i>14</i>
SURVEY FINDINGS- UNIVERSITIES.....	16
<i>Formal ESD Policy.....</i>	<i>16</i>
<i>Programs.....</i>	<i>17</i>
<i>Subjects.....</i>	<i>19</i>
<i>Conclusions and Recommendations .....</i>	<i>21</i>
SURVEY FINDINGS- TAFE.....	22
<i>Formal ESD Policy.....</i>	<i>22</i>

<i>Programs</i> .....	23
<i>Subjects</i> .....	25
<i>Conclusions and Recommendations</i> .....	26
ALL EDUCATIONAL SECTORS.....	27
<i>Comparison of Programs by Sector</i> .....	27
<i>Influence of ESD Policy on Subject Content</i> .....	29
<b>IN SUMMARY</b> .....	<b>30</b>
WHAT NEXT? .....	31

## APPENDICES

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INDUSTRY AND PROFESSIONAL ASSOCIATIONS SURVEY  
 UNIVERSITIES SURVEY  
 TAFE INSTITUTES SURVEY  
 COLLATED COMMENTS FROM SURVEY

## LIST OF FIGURES

---

FIGURE 1 STRUCTURE OF THE SURVEYS .....	5
FIGURE 2: ASSOCIATION RESPONSES .....	8
FIGURE 3: UNIVERSITY RESPONSES.....	8
FIGURE 4: UNIVERSITY SURVEY COMPOSITION BY STATE/ TERRITORY .....	8
FIGURE 5: UNIVERSITY SURVEY COMPOSITION BY DISCIPLINE .....	9
FIGURE 6: UNIVERSITY RESPONDENTS AND RECIPIENTS BY DISCIPLINE.....	10
FIGURE 7: TAFE RESPONDENTS .....	10
FIGURE 8: TAFE SURVEY COMPOSITION BY STATE .....	11
FIGURE 9: TAFE SURVEY RESPONDENTS BY DISCIPLINE .....	11
FIGURE 10: TOPICS COVERED IN TRAINING/ CPD BY ASSOCIATIONS .....	13
FIGURE 11: TOPICS COVERED IN MATERIALS PUBLISHED BY ASSOCIATIONS.....	14
FIGURE 12: UNIVERSITY DEPARTMENTS WITH FORMAL ESD POLICIES BY STATE .....	16
FIGURE 13: UNIVERSITY DEPARTMENTS WITH FORMAL ESD POLICIES BY DISCIPLINE.....	16
FIGURE 14: STATES IN WHICH UNIVERSITY DEPARTMENTS ARE TEACHING PROGRAMS WITH SIGNIFICANT GREENHOUSE- RELATED CONTENT .....	17
FIGURE 15: DISCIPLINES IN WHICH UNIVERSITY DEPARTMENTS ARE TEACHING PROGRAMS WITH SIGNIFICANT GREENHOUSE-RELATED CONTENT .....	18
FIGURE 16: TOPICS COVERED BY PROGRAMS AT RESPONDING UNIVERSITIES .....	19
FIGURE 17: UNIVERSITY DEPARTMENTS TEACHING GREENHOUSE-RELATED SUBJECTS BY STATE.....	20
FIGURE 18: UNIVERSITY DEPARTMENTS TEACHING GREENHOUSE- RELATED SUBJECTS BY DISCIPLINE .....	20

FIGURE 19: LEVELS AT WHICH GREENHOUSE –RELATED SUBJECTS ARE TAUGHT ..... 20

FIGURE 20: DEGREE TO WHICH GREENHOUSE-RELATED SUBJECTS ARE COMPULSORY AT UNIVERSITIES..... 21

FIGURE 21: TAFE DEPARTMENTS WITH FORMAL ESD POLICIES BY STATE ..... 22

FIGURE 22: TAFE DEPARTMENTS WITH FORMAL ESD POLICIES BY DISCIPLINE ..... 22

FIGURE 23: TAFE DEPARTMENTS TEACHING PROGRAMS WITH SIGNIFICANT GREENHOUSE-RELATED CONTENT BY STATE ..... 23

FIGURE 24: TAFE DEPARTMENTS TEACHING PROGRAMS WITH SIGNIFICANT GREENHOUSE- RELATED CONTENT BY DISCIPLINE ..... 23

FIGURE 25: TOPICS COVERED BY THE RESPONDING TAFE DEPARTMENTS..... 24

FIGURE 26: TAFE DEPARTMENTS TEACHING GREENHOUSE-RELATED SUBJECTS BY STATE ..... 25

FIGURE 27: TAFE DEPARTMENTS TEACHING GREENHOUSE-RELATED SUBJECTS BY DISCIPLINE ..... 25

FIGURE 28: DEGREE TO WHICH GREENHOUSE-RELATED SUBJECTS ARE COMPULSORY AT TAFE..... 25

FIGURE 29: EDUCATION PROVIDERS CURRENTLY COVERING TOPICS ..... 27

FIGURE 30: EDUCATION PROVIDERS CURRENTLY GIVING *SIGNIFICANT* COVERAGE TO TOPICS..... 27

FIGURE 31: EDUCATION PROVIDERS CURRENTLY DEVELOPING MATERIAL ON TOPICS ..... 28

FIGURE 32: UNIVERSITIES: IMPACT OF FORMAL ESD POLICY ON SUBJECT CONTENT ..... 29

FIGURE 33: TAFE INSTITUTES: IMPACT OF FORMAL ESD POLICY ON SUBJECT CONTENT ..... 29

## **ABBREVIATIONS**

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ABEC	Australian Building Energy Council
ACIF	Australian Construction Industry Forum
AGO	Australian Greenhouse Office
CPD	Continuing Professional Development
ESD	Ecologically sustainable development
ISF	The Institute for Sustainable Futures, UTS
RCVET	The Research Centre for Vocational Education and Training, UTS
TAFE	Technical and further education
UTS	University of Technology Sydney

## INTRODUCTION

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This research project was proposed by the Australian Building Energy Council (ABEC) and is funded by the Australian Greenhouse Office (AGO). ABEC and the AGO are committed to ensuring that formal education, training and Continuing Professional Development (CPD) comprehensively include, and play an effective part in, promoting energy efficiency and the capacity to address greenhouse issues in the Australian building and construction industry.

### The Project

**The research project is divided into two stages. Stage One, of which this report is part, is now complete.**

**Stage One** is an investigation of the ability of the Australian Building Sector to respond to energy efficiency and greenhouse related issues, and the level of education and training available to support this. The investigation is divided into 3 main parts:

- Investigation of the various groupings within the Australian Building and Construction Industry and their respective influences on, and current responsiveness to, energy efficiency and the application of greenhouse principles.
- Investigation of the knowledge and skills needed by each of these groups in order to put those principles into practice.
- Assessment of how effectively the required knowledge and skills are currently being met by formal education, training and continuing professional development.

**Stage Two** involves the development of education and training strategies, and pilot training packages. It is divided into 3 main parts:

- The identification of a prioritised set of training needs which fill the gaps identified in Stage One and address the potential for each participant grouping to contribute to greenhouse gas abatement
- The development of strategies to ensure that the education and training system responds to the identified priorities.
- The development and costing of a limited number of pilot training packages for the areas identified as 'high priority' within the industry.

### This report

**This report documents a baseline study of the formal education, training and CPD currently available to support practitioners in the Australian Building Sector to respond to energy efficiency and greenhouse related issues.**

As such, this report forms the third part of Stage One, described in the project outline above as an 'assessment of how effectively the required knowledge and skills are currently being met by formal education, training and continuing professional development'. The first and second parts of Stage One have been separately documented by ABEC. This report presents the findings of a survey sent to Universities, TAFE Institutes, and Industry & Professional Associations in order to assess the extent of energy efficiency and greenhouse-related issues covered in the education and training they provide.

## BACKGROUND

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### Why this project is important

Global concern about the greenhouse effect and its implications for global warming and climate change is at an all time high. Australia has undertaken to limit its greenhouse gas emissions to an 8% increase on 1990 levels by the 2008-2012 commitment period under the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

This is a substantial task requiring significant reform across a broad range of industries to succeed. The energy reform agenda within the Australian building industry is rapidly gathering momentum. It is driven by government regulation and incentives, by industry competition and by consumer demand. In other words, it is becoming mainstream.

Historically, rapid change or growth in a sector of the industry has created a shortage of knowledge and skills. As energy reform occurs across all sectors, we can expect acute deficits in the knowledge and skills required to implement it. This is already becoming evident in some sectors. The current proliferation of professional development seminars and workplace training is providing a partial short-term solution but a planned, coordinated strategy is required as a matter of urgency.

This study will address that requirement. When both stages are complete, opportunities for improvement in education will be identified and a future focus will be created for the development and provision of specific training programs. This is essential to promote the culture of change necessary to achieve Australia's greenhouse gas emission targets.

A sound base of knowledge and skills across the industry will facilitate a smooth and cost effective transition from current practice to energy efficient best practice in accordance with the ABEC Voluntary Code of Best Practice. Additionally, it will facilitate compliance with the Building Code of Australia Minimum Energy Performance Code.

### Current Impact of the Australian Building Sector on Greenhouse Gas Emissions

In 1999, The Australian building sector was responsible for 27.6 per cent, or 80.9 Mt per annum of Australia's energy-related greenhouse gas emissions<sup>1</sup>, and as such can potentially play a very significant part in achieving Australia's greenhouse gas emission reduction target. This contribution becomes even more significant when projected increases to 2010 under Business As Usual (BAU) conditions are considered. Residential sector emissions are predicted to rise by 17% and non-residential by a staggering 94%<sup>1</sup>.

The contribution of a building to energy-related greenhouse gas emissions can be broadly categorised as either embodied energy (*i.e.* the energy necessary to mine, process, manufacture, and transport the materials used to construct or maintain the building itself) or operational energy (*i.e.* the energy required to operate the building over the duration of the building's use). This is a critical distinction because the operational energy can be far greater in the long term than the embodied energy. The energy required to operate the building is constrained by decisions made at the design stage. European studies have shown that opportunities to implement innovative, sustainable solutions diminish exponentially throughout the design phases with up to 90% lost by tender stage. Thus, the design professions have a critical role in change creation.

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<sup>1</sup> Commonwealth of Australia, 1999, Scoping Study of Minimum Energy Performance Requirements for Incorporation into the Building Code of Australia

Encouragingly, the *Building and Construction Industries Action Agenda*<sup>2</sup> highlights the environment as an important area for the building and construction industries, noting that the drive towards ecological sustainability continues to encourage changes to design and construction processes. Consideration of greenhouse and broader environmental issues in all stages of building and construction is essential to ensure industry evolves in a manner that responds to client and community needs.

### Existing barriers to change within the Australian Building Sector

Key barriers to 'mainstreaming' ecologically sustainable development (ESD) in the Australian building sector include a widespread lack of industry awareness and the lack of a skilled, dedicated workforce. The New South Wales Sustainability Advisory Council has recently identified the following major barriers:

- Insufficient sharing of intellectual property within the market, partly due to the diversity of the industry and its competitive nature, inhibiting cooperative training arrangements
- Conservative attitudes to new ideas
- Lack of skills base among decision-makers
- Lack of thinking in life cycle cost terms
- Widespread perception that sustainable building design/ technology is more expensive, less reliable and not marketable
- Project Manager and Contractor perceptions of impracticality or additional work
- Uncertainty regarding measures required- from architects through to legislators

A further significant barrier relates to traditional procurement methodologies, which continue to separate design and construction from ownership and operation.

Education, training and continuing professional development provide, in conjunction with other strategies, useful means through which these issues can be addressed.

### How this project relates to existing Government Initiatives

In March 1999, following wide consultation, the Federal Government and the building industry, represented by ABEC, reached a landmark agreement on a comprehensive strategy aimed at making Australian buildings more energy efficient. The strategy comprises:

**ABEC Voluntary Code of Best Practice:** involves Commonwealth Government and Building Industry support for a suite of voluntary measures that encourage and facilitate best practices in building design, construction, operation and disposal.

**BCA Minimum Energy Performance Code:** will eliminate worst energy performance practices by incorporating a single standard for minimum energy performance requirements into the Building Code of Australia.

The introduction of these codes of practice presents a major challenge to the building and construction industry. Provision of appropriate training and education on energy efficiency and greenhouse issues is essential to assist industry in meeting these challenges.

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<sup>2</sup> Commonwealth of Australia, 1999, *Building for Growth - Key initiatives of the Building and Construction Industries Action Agenda*

**The National Greenhouse Strategy:**<sup>3</sup> Measure 2.12 states that relevant training resources related to vocational education and training will be reviewed, either separately or as part of ongoing curricular examination, and opportunities identified to augment existing course structures and material so as to:

- Enhance the consideration of greenhouse implications of various activities;
- Exploit opportunities for new avenues of activity/work relating to greenhouse.

**Other studies** are currently examining issues that bear on the nature of the industry and the required change for improved performance. For instance, the Australian Construction Industry Forum (ACIF) is examining innovation, improved documentation, and activity forecasting. Beneficial synergies exist between this report and outcomes of those separate studies, particularly the Construction Industry Innovation Study.

## OBJECTIVES OF THE RESEARCH

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**The objective of the overall project** is to encourage the reduction of greenhouse gas emissions in the Australian building and construction industry, by identifying appropriate strategies for education and training in order to fill the current gaps in knowledge and skills.

As previously explained, these gaps have been identified by industry and government representatives of the NSW Sustainability Advisory Council as a key constraint to 'mainstreaming' sustainability (including greenhouse gas abatement) within the Australian Building Sector.

**The objective of Stage One** of the project is to investigate firstly the current ability of the Australian Building Sector to respond to energy efficiency and greenhouse issues, and secondly the level of education and training currently available to support this. An understanding of this is necessary in order to inform the development of appropriate strategies for education and training which will support the ability of practitioners to contribute to the reduction of greenhouse gas emissions.

Identification of the training needs of the different industry sectors will facilitate the provision of more targeted and cooperative training, which addresses whole of industry requirements.

The research outcomes will guide all of those responsible for education and training for the building and construction industry in formulating future directions for education and training which reflect the growing importance of energy efficiency and greenhouse issues.

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<sup>3</sup> Commonwealth of Australia, 1999, *Building and Construction Industries Action Agenda*



## METHODOLOGY

ABEC and AGO requested a broad baseline study. The study was conducted as a simple quantitative survey sent by mail to the relevant educational institutions and industry & professional associations. Most answers only required the respondent to tick a box. The sole intent of the survey, in keeping with AGO and ABEC requirements, was to identify existing and planned educational offerings from the various institutions and associations. The survey does not assess the appropriateness of the educational material or its effectiveness as delivered.

### Survey Design

Separate surveys were designed for each of Industry & Professional Associations, Universities and TAFEs. Where relevant, common questions were asked to facilitate comparison. The databases used to identify the relevant associations and institutions were provided to ISF by either ABEC or AGO.

Each of the surveys underwent a rigorous three step development and review process. Firstly, draft surveys were developed by ISF in consultation with ABEC and in collaboration with the Research Centre for Vocational Education and Training (RCVET) at the University of Technology, Sydney (UTS). Secondly, ABEC and AGO provided feedback on these drafts. Thirdly, the modified surveys were piloted with representatives from either university, TAFE, or industry and professional association groupings. The final surveys incorporated feedback from the pilot survey programmes.

The surveys were designed to make responses both simple and readily comparable across sectors. An outline of the structure of the questions asked in each survey is set out in Figure 1.

**Figure 1 Structure of the surveys**

Question Kind	Associations	Universities	TAFE
Identifying information	X	X	X
ESD Policy influencing training	X	X	X
Competency standards	X		
Membership survey	X		
Relevant publications	X		
Levels of relevant training		X	X
Topics covered by training	X	X	X

### Limitations Imposed by the Survey Distribution

Surveys were distributed by mail directly to the Associations. In the case of Universities, the supplied list identified relevant schools or departments and, hence, separate surveys were sent to each. For TAFE, information was not available on what relevant departments operated in each Institute and in this case, multiple copies of the survey were forwarded to each Institute Director with a request to forward these to the relevant Department Heads.

The distinction between the available information in the University and TAFE databases is important because it defines the limit of our control over survey distribution, and hence our ability to interpret the representativeness of the survey responses. This point is further elaborated in the Results section.

There is a further limitation that needs to be pointed out here. The sample set and the response set for all groups is quite small in number. This problem is particularly acute for the professional associations group, where although the response rate is impressive (58%), the number of responses is small (14 in all). A single association in this response set represents 7% of the sample. Caution is therefore necessary in interpreting the data.

### **Limitations Imposed by the Timing of the Survey**

The timeframe of the major project dictated that the surveys be conducted during February/March 2002. Unfortunately, this is an extremely busy time for educational institutions since it represents the period of enrolments and the first few weeks of the teaching year. Despite this difficulty, quite high response rates (details in Results sections) were achieved.

### **Limitations Imposed by the Project Scope**

The survey was intended to provide a baseline against which future developments could be assessed. It does not, of course, provide a comprehensive description of all education, training and CPD currently provided in or to the sector. Rather it provides a guide to the types of training available and an indication of the extent to which the major providers are currently addressing the issue both generally and in respect of specific topics.

It is important to note that this is a provider evaluation, not an end-user evaluation. That is, the information has been collated from surveys filled out by education providers, not learners. The scope of the project constrained our methodology to focusing on inputs, rather than outputs. That is, it assessed the content and extent of the courses, and did not attempt to assess the effectiveness of the courses as delivered, or the potential for the courses to enable appropriate practice in the industry itself.

In addition, the scope of the project meant that firstly, we asked education providers to assess their own current offerings and strategies for future offerings, and secondly, that we were unable to provide a clear benchmark or to check respondents' understandings. The danger here is that self-assessment is liable to be highly variable. Educational researchers have demonstrated an inverse relationship between an individual's knowledge of a subject and that same individual's assessment of their understanding in that subject. In other words, those who know less about a subject are likely to rate their understanding more generously than those who actually know more. For example, in the components of Stage One undertaken by ABEC, those who nominated themselves as ESD consultants identified that they required more training.

In addition, individuals will interpret the same question in different ways, leading to ambiguous survey results. For example, in the industry and professional associations survey, state branches of some associations returned significantly different responses to national associations. Also, in each survey respondents were asked to indicate how well their programs covered various topics, but it appears that some respondents may have answered this question in relation to subjects, rather than programs.

To overcome these limitations, we recommend that Stage 2 of the project includes a process for verifying the quality of the responses. For example, a combination of a qualitative survey of end-users of a number of courses identified as having a high proportion of energy efficiency and greenhouse related content and the technique known as 'snowballing' could be used to verify the calibre of particular educational and training offerings, and their capacity to change practices on the ground in the industry. Focus groups within industry and professional associations could also add value to this verification process.

# RESULTS

## Response Rates

### Industry & Professional Associations

The Industry & Professional Association sample encompassed 24 national associations seen by ABEC as having a key role in the Australian Building and Construction industry. Of the 24 surveyed, 14 responses were received (a response rate of 58%)

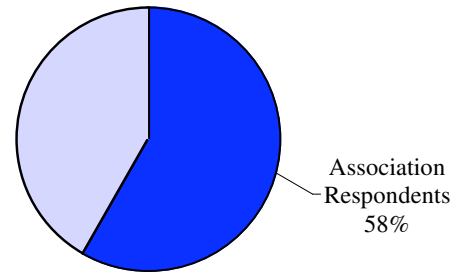


Figure 2: Association Responses

### Universities

The University sample encompassed Australian Universities providing education within the relevant sector. The database for this was provided by the AGO. A total of 162 different departments or schools were surveyed within 32 Australian Universities. Of these departments and schools, 50 responded to the survey (a response rate of 31%)

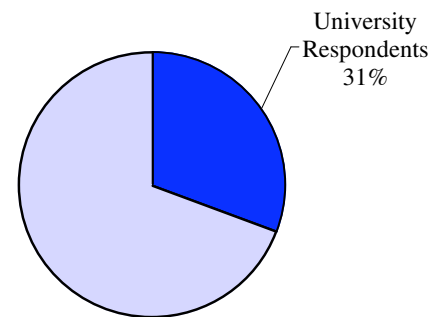


Figure 3: University Responses

In order to ensure that the responses are broadly representative, we have analysed the University recipients and responses geographically (Figure 4) and by discipline (Figure 5).

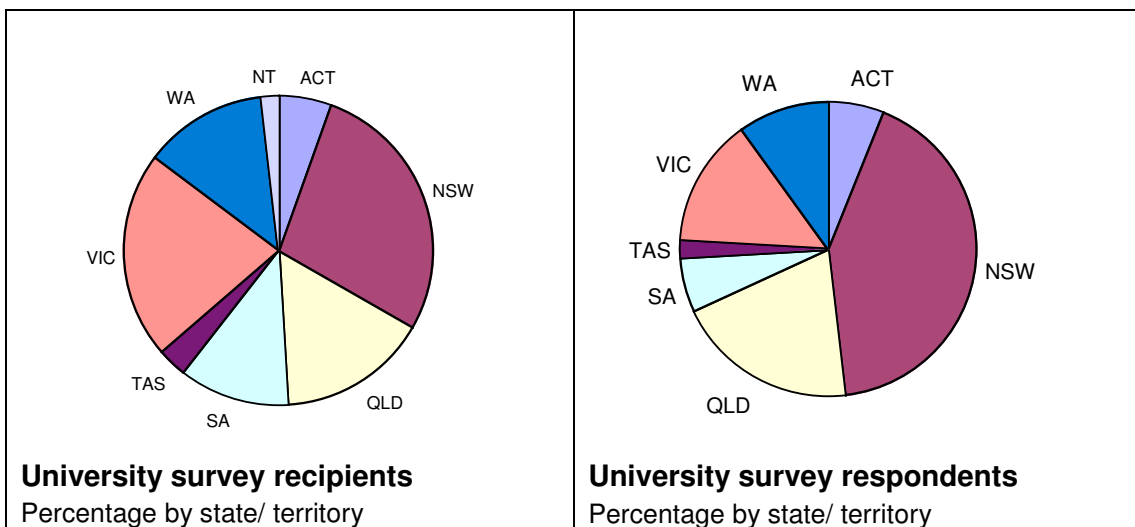


Figure 4: University survey composition by state/ territory

Figure 4 shows the representation of ACT and Queensland in the respondents and the recipients is similar. New South Wales representation in the respondents has increased by 50% relative to its representation in the recipients. The remaining states all have significantly smaller representation in the respondents than in the recipients: Western Australia has approximately 75%; Tasmania and Victoria have approximately 65%, and South Australia has 50%.

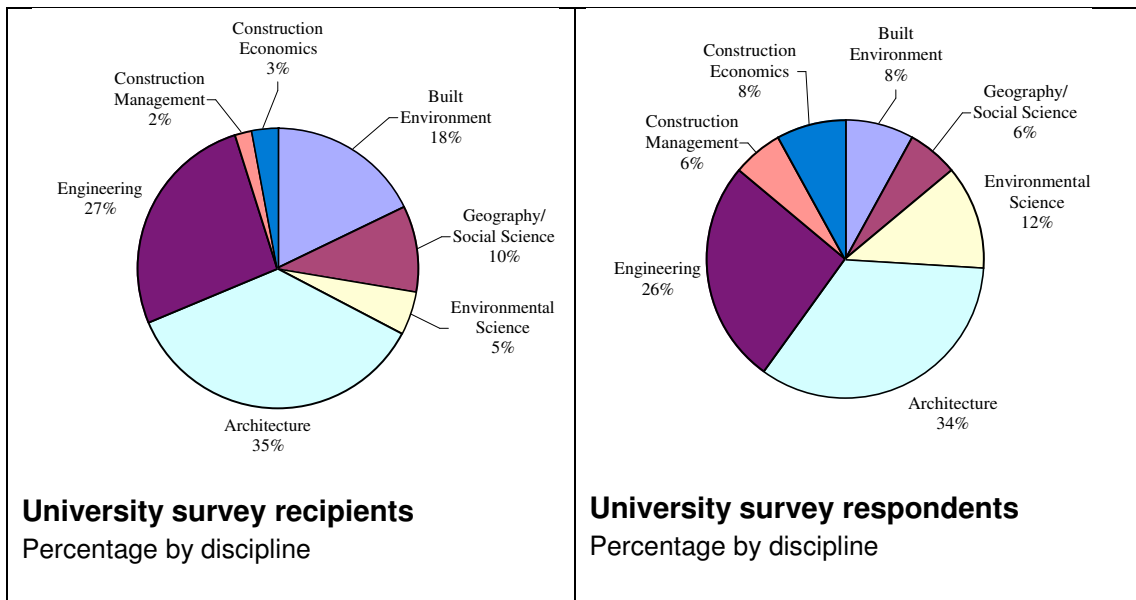
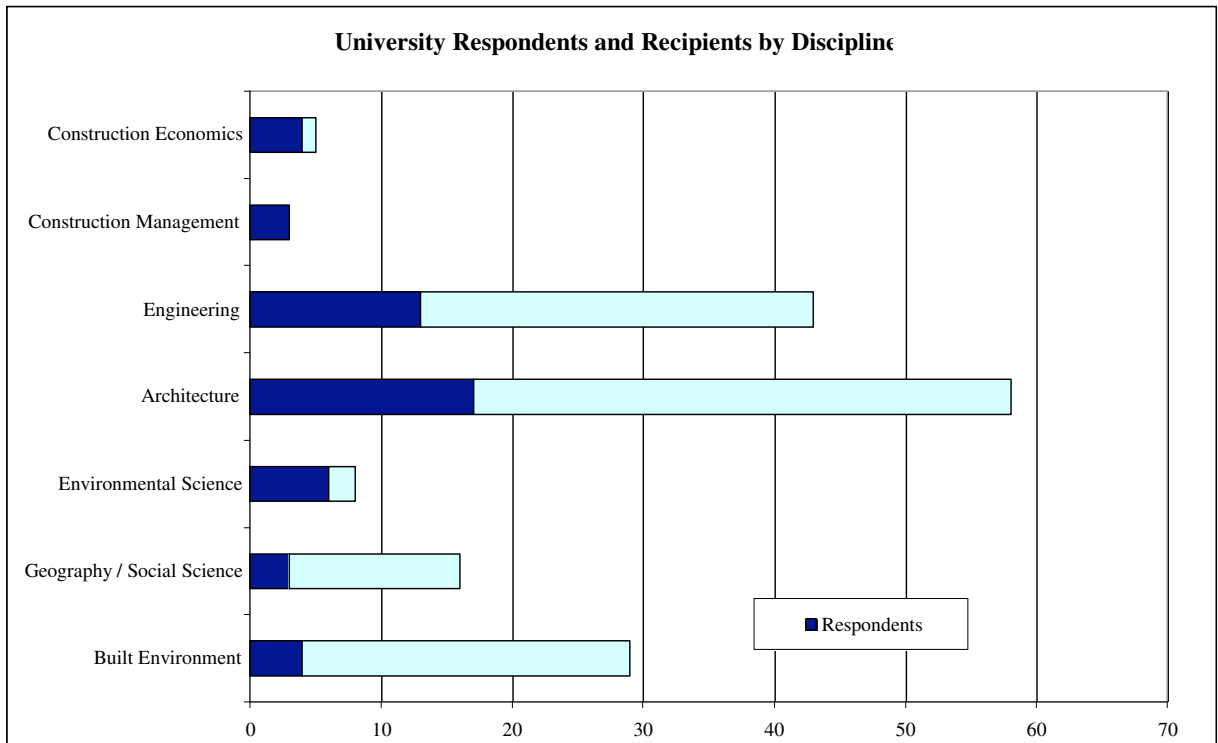


Figure 5: University survey composition by discipline

Figure 5 shows the relationship between University sector respondents and recipients by discipline. The two largest groups, engineering and architecture, maintain similar representation in recipients and respondents. The three smallest groups in the recipients, environmental science, construction economics, and construction management, all increase their respondent representation substantially (240%, 260%, and 300% respectively) over recipient representation. This happens at the expense of representation in the respondents from the mid-ranking groups: built environment and geography/social sciences.

Figure 6 shows these results in more detail and demonstrates the relationship between these results and response rates. Here, the number of recipients and respondents is shown according to discipline. The best response rates were achieved by the groups with the smallest number of recipients: construction economics, construction management, and environmental science. The poorest response rates were demonstrated by the mid-ranked groups in terms of numbers of recipients: geography/social science and built environment. Engineering and architecture each had response rates of just under 30%, consistent with the overall response rate for universities of 31%. In both cases, the two largest groups, engineering and architecture, together account for at least 60% of the sample. This is important, because it means the core of representation in the respondents is consistent with the recipients, and therefore should be consistent with the mix of courses on offer at universities. However, construction economics, construction management, and environmental science courses are over-represented in the respondents, whilst geography/social sciences and built environment programs are under-represented.



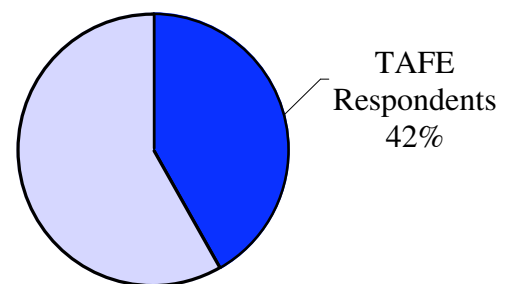
**Figure 6: University respondents and recipients by discipline**

There are three other disciplines not classified above either because they were small in number, or because they were taught in a wide variety of departments. These are:

1. Planning- taught by six respondents; three classified as architecture, one as engineering, one as construction economics, and one as geography/social science.
2. Interior design- taught by one of the architecture respondents.
3. Landscape design- taught by one of the architecture respondents.

**TAFE Institutes**

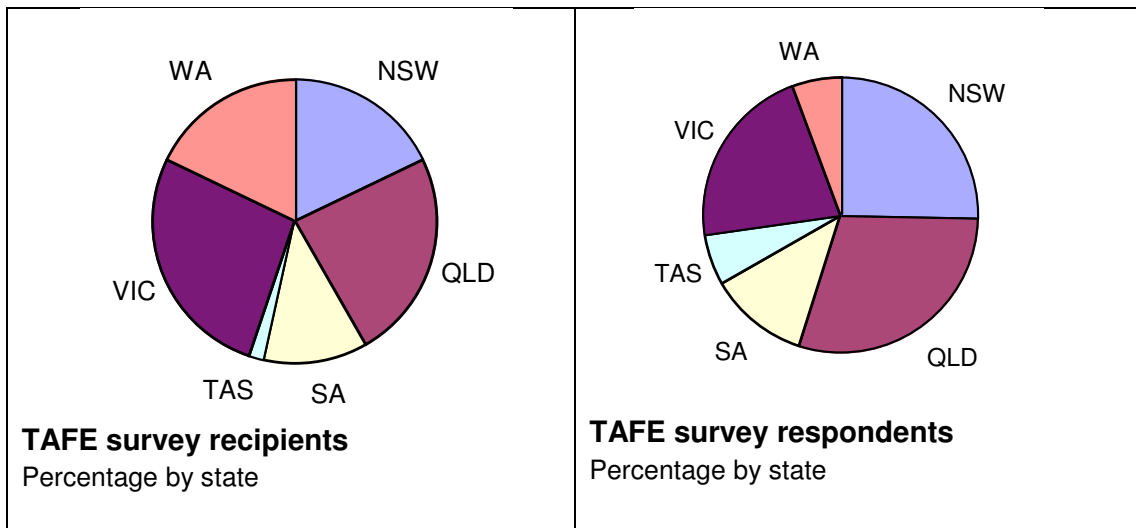
The TAFE sample encompassed Australian TAFE Institutes providing training within the building and construction sector. The database for this was provided by ABEC. A total of 68 Institutes were surveyed. Of these, 28 responded to the survey (a response rate of 41%). Multiple responses were received by many of the TAFEs who had more than one relevant program area. A total of 51 completed surveys were received.



**Figure 7: TAFE Respondents**

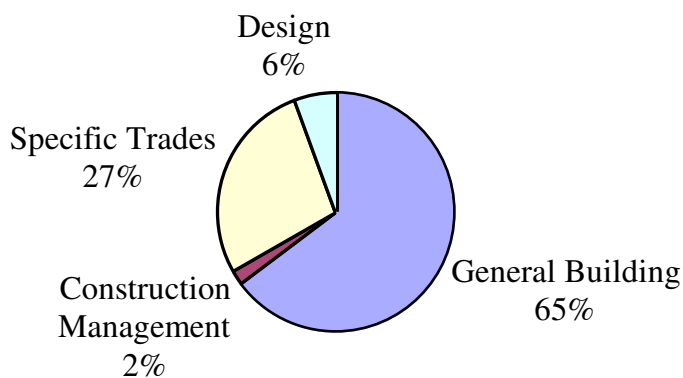
Because the TAFE contact database supplied by ABEC contained information about Institutes, but not about individual courses, programs, or departments, we are not able to interpret the representativeness on a geographical or discipline basis of the survey respondents. In the absence of any other information, we assume that the spread of representation in the respondents mirrors the

spread of representation in the relevant courses, programs, and departments. Figure 8 shows a breakdown of the respondents by state. Figure 9 shows a breakdown of the respondents by discipline.



**Figure 8: TAFE survey composition by state**

33 respondents (65%) fall into the 'general building' category (ie. those teaching 'building & construction', 'building studies' or 'building technology' rather than material related to one specific trade). Of these, one respondent teaches housing-specific material.



14 respondents (27%) fall into the 'specific trades' category (ie. those teaching one specific trade). Of these, 5 respondents teach painting, 3 teach carpentry, 3 teach plumbing, 2 teach bricklaying and 1 teaches electrical trades.

3 respondents (6%) fall into the 'design' category and one (2%) into 'construction management'.

**Figure 9: TAFE survey respondents by discipline**

## **SURVEY FINDINGS- NATIONAL INDUSTRY & PROFESSIONAL ASSOCIATIONS**

Of the 24 National Industry & Professional Associations surveyed, 14 returned responses (a response rate of 58%).

### **Formal ESD Policy**

Out of those 14 associations who responded, half (7) said they had a formal policy on ESD.

Five of these associations with a formal ESD policy represented members primarily involved in the design phase of buildings (including costing). The other two associations with a formal ESD policy represented i) members involved primarily in building construction, and ii) contractors of building services and equipment.

Between them, these 7 associations cover both professions and trades at all stages of the building life cycle in their memberships, although the design professions were the most heavily represented. (The category 'design professions' refers to groups such as planners, engineers, architects, building designers, quantity surveyors, and landscape architects). One of the associations had what could be considered a very broad membership (covering developers, project managers, design professionals, building contractors, tradespeople and facilities managers). A further 2 covered at least 3 of these groups.

### **Competency Standards**

Three of the 14 associations who responded said that they currently have competency standards for members *that include energy efficiency or greenhouse gas abatement*. (Two of these were among those who said they had a formal ESD Policy- see above). One of the associations represents a fairly broad industry group including developers, project managers, design professionals, building contractors, commissioning agents, facilities managers, and air conditioning/ refrigeration tradespeople. The other associations represent design professionals and insulation manufacturers respectively.

### **Member Surveys**

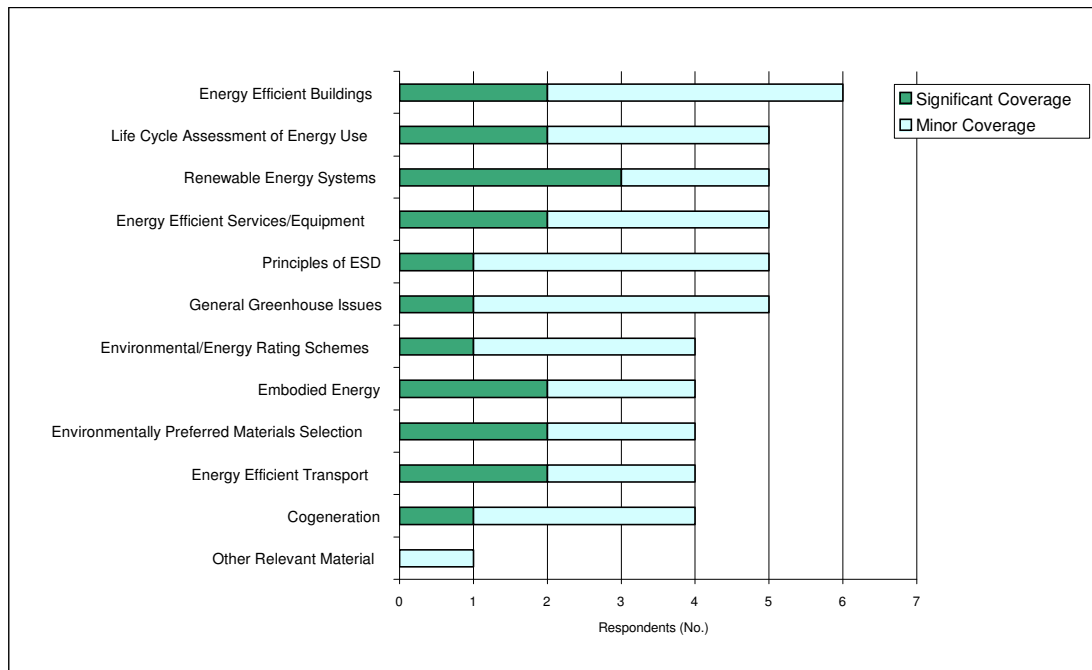
Six of the 14 associations who responded said they have conducted a survey of members concerning energy efficiency or greenhouse gas abatement in the last 3 years.

### **Training and CPD**

Eleven of the 14 associations who responded said they currently provide specific training or CPD activities for members (short courses, seminars, conferences etc). A further 2 are in the process of developing training or CPD activities.



Nine of the 11 associations providing training/ CPD said they currently provide training or CPD activities covering energy efficiency and greenhouse related topics. Figure 10 shows how many associations provide training or CPD activities for members on each of the following topics. The darker bars indicate the number of associations giving the topic significant coverage in their training or CPD. For example, 2 associations give the topic energy efficient buildings significant coverage, and a further 4 give this topic minor coverage.

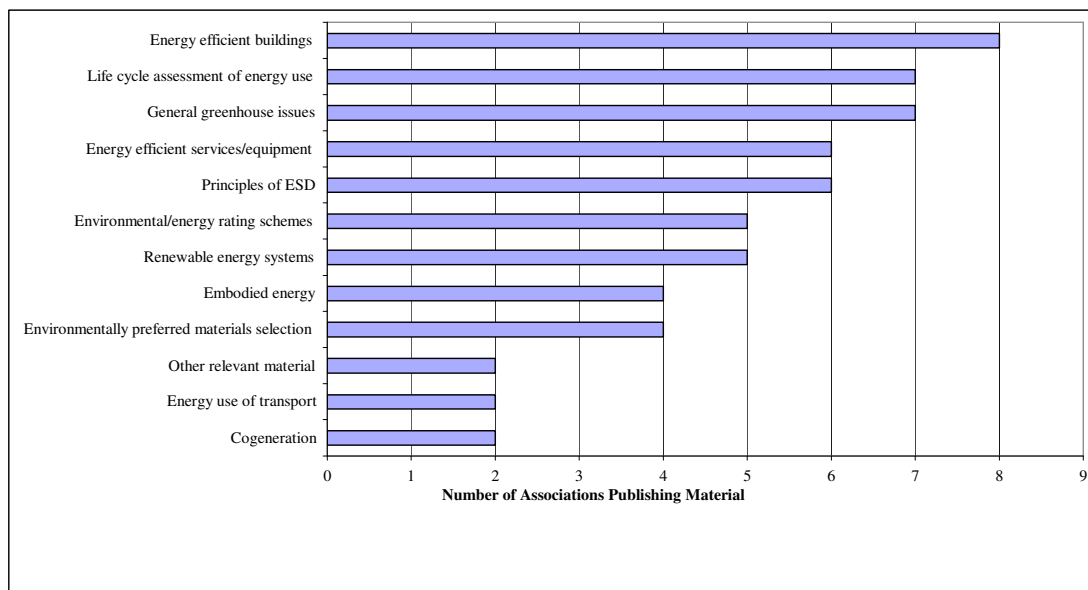


**Figure 10: Topics covered in training/ CPD by Associations**

Four of the associations said they covered at least half (6) of the topics. Two associations said they gave significant coverage to at least half of the topics. Again, the design professions are well represented in these groups.

**Published Material**

Nine out of the 14 associations who responded have published material for their members in the last 3 years on at least 1 topic related to energy efficiency/ greenhouse gas reduction. Figure 11 shows the number of associations publishing information on each of the following topics.



**Figure 11: Topics covered in materials published by Associations**

Two of the associations, whose members are design professionals, cover all the topics in their published material. A further 3 associations cover at least half of the topics in their published material. These associations have broader memberships across the industry. As well as design professionals, these associations represent developers, project managers, building contractors, facilities managers and commissioning agents. In addition, some manufacturers and trades are represented.

## Conclusions and Recommendations

Half the associations have a formal policy on ESD, but only two of these have translated such a policy into competency standards. There is considerable interest in energy efficiency and greenhouse gas abatement in the industry, as evidenced by the following:

- that these issues have been the subject of member surveys for almost half of the organisations;
- that three-quarters of the associations are currently providing some form of training or CPD related to these issues;
- that three-quarters of the associations have published in the last 3 years some kind of material related to these topics.

However, each topic was only given significant coverage by one or two associations in their training or CPD activities. These results indicate that there has been some movement already, but there is still a significant training and continuing professional development gap.

It is important to bear in mind that the availability of publications and training opportunities is just the first step. In order for change to happen in the industry, these materials must be broadly disseminated and acted upon. Our survey has identified three significant follow-up tasks: firstly, the quality of the existing materials, secondly, the degree of dissemination and uptake of publications and training opportunities, and thirdly, the usefulness of existing resources in facilitating change in industry practices.

Follow up activities for Stage 2:

- Collect, collate, and review existing training materials and publications

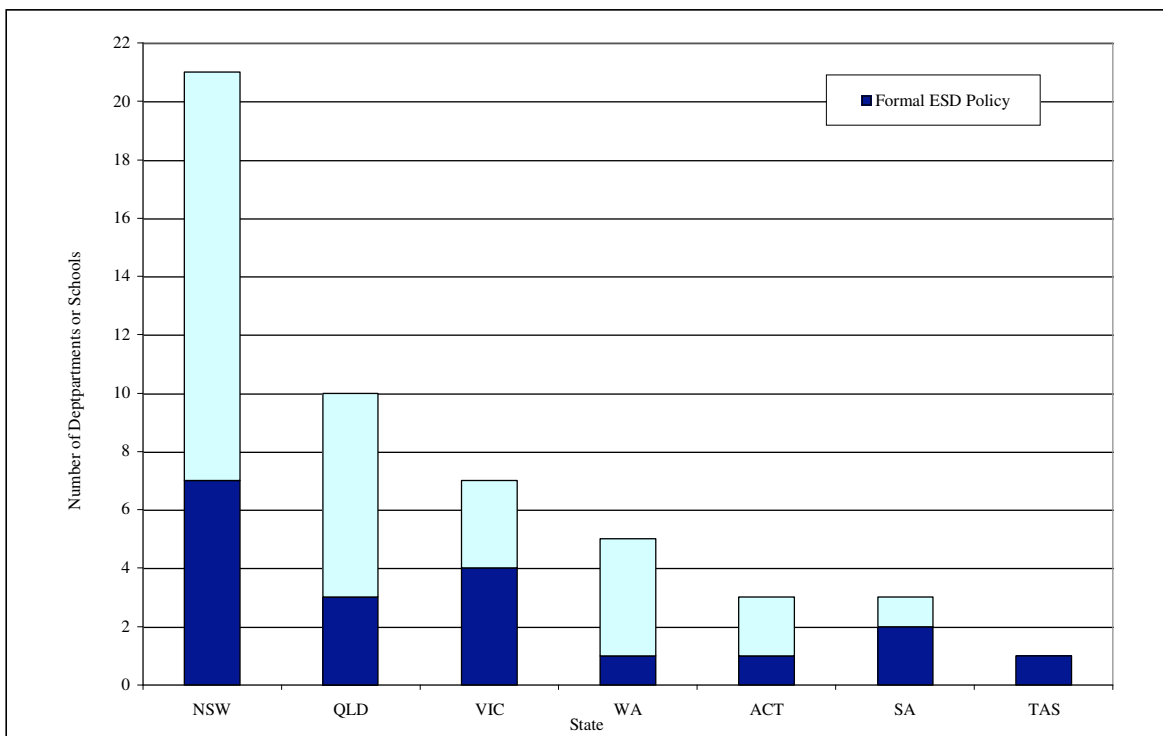
- Determine dissemination and uptake of existing publications and materials
- Conduct a snowballing exercise to ascertain the degree to which particular publications and training opportunities have enabled changes in practice, and what additional resources are necessary
- Conduct focus groups to determine the extent and quality of current CPD opportunities

## SURVEY FINDINGS- UNIVERSITIES

163 departments or schools within 32 Australian universities were surveyed. Of these, 50 responses were received from departments or schools, giving an overall response rate of 31%. These departments and schools represented 25 different universities, giving an excellent institutional response rate of 78%, and indicating broad geographical coverage.

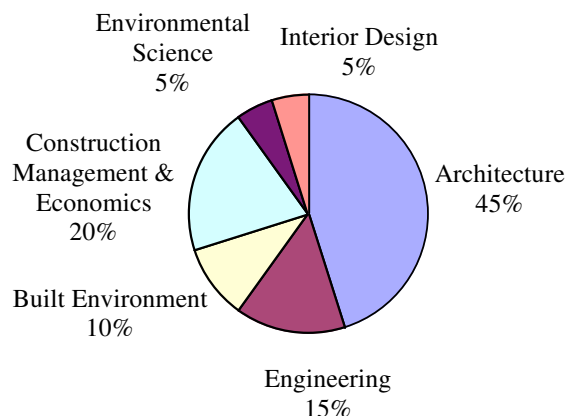
### Formal ESD Policy

Of the departments or schools surveyed, 19 (38%) said they have a formal ESD policy. Figure 12 shows the number of respondents from each state, and how many of them said they have a formal ESD policy.



**Figure 12: University schools/ departments with formal ESD policies by state**

The schools or departments who said they had a formal ESD policy fell into the categories shown in Figure 13. Comparing this figure with the discipline spread of all university respondents, it seems that architecture and construction management and economics schools are more likely to have formal ESD policies than engineering or environmental science schools. However, the number of respondents is small - 19 in total, so one response to this question is equivalent to 5% in this figure.



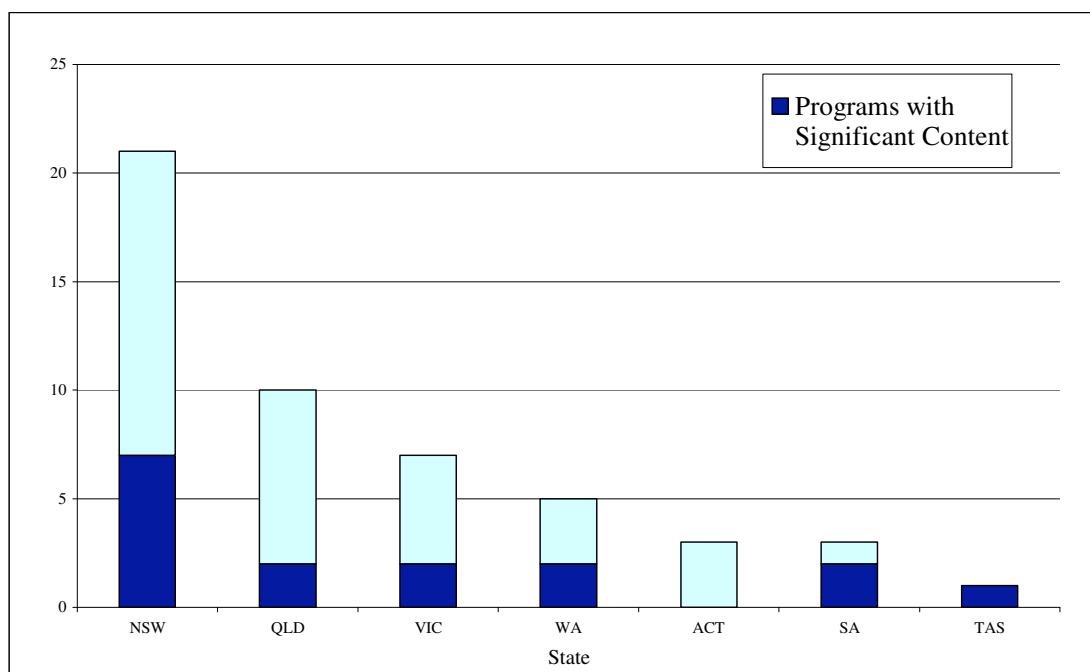
**Figure 13: University schools/ departments with formal ESD policies by discipline**

## Programs

Survey recipients were asked whether their institution offered specific programs in building and construction with a significant content focused on issues relating to energy efficiency, renewable energy sources/ applications or greenhouse gas abatement. To guide the interpretation of this question, 'significant content' was defined in the question as greater than a third of the curriculum.

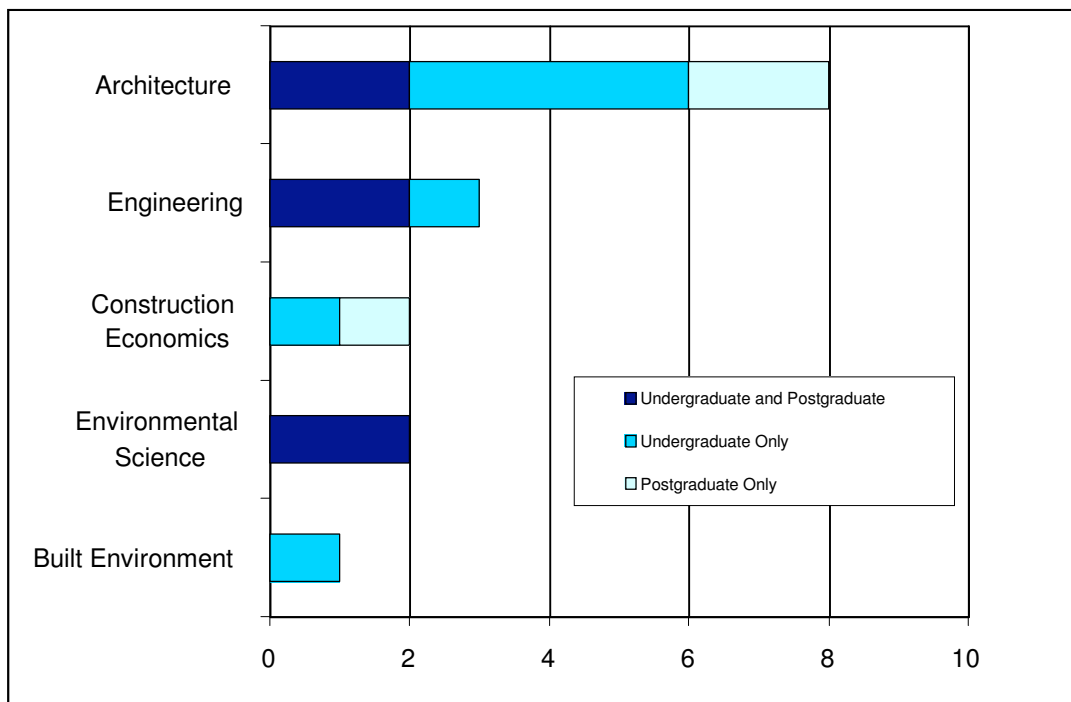
16 (32%) of the schools or departments who responded categorised their programs as meeting this definition of 'significant content' related to energy efficiency, renewable energy or greenhouse gas abatement.

Figure 14 shows the geographical distribution of these schools. The columns show the total number of respondents from each state, and the number identifying their programs as having significant content.



**Figure 14: States in which university departments/ schools are teaching programs with significant Greenhouse- related content**

Figure 15 shows the discipline-based distribution of the schools or departments who said they teach programs in building and construction with a significant content (over a third of curriculum) focused on issues related to energy efficiency, renewable energy sources/ applications or greenhouse gas abatement. Once again, comparing this figure with the overall university respondents discipline distribution (Figure 13), architecture has a significantly higher representation than might be expected, and engineering has a lower representation. That is, architecture programs are more likely to have significant content, and engineering programs less likely to have significant content. The representation of other disciplines who identified their programs as having significant content (construction economics, environmental science, and built environment) is consistent with overall representation of those disciplines.



**Figure 15: Disciplines in which university departments/ schools are teaching programs with significant Greenhouse-related content**

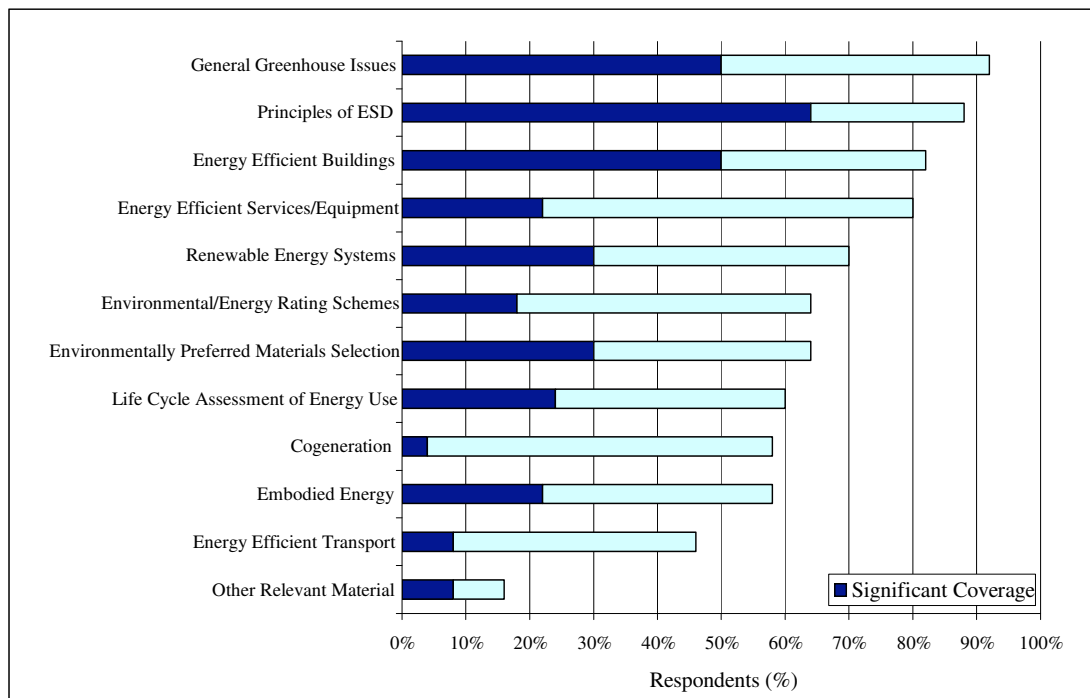
Figure 15 above also delineates between the level of these specific programs. Of the 16 respondents, 3 schools or departments said that their programs were postgraduate only. Six schools or departments said that their programs were postgraduate and undergraduate. The remaining 7 schools or departments said their programs were undergraduate only. The distinction between postgraduate and undergraduate programs is significant because postgraduate courses are likely to have far fewer students than undergraduate programs. In other words, although postgraduate programs could be more targeted, their coverage is smaller. The impact of programs offering 'significant content' in these areas is a function of both the number of students involved in the program, and the ability of the program to enable the students-as-practitioners to do things differently.

Survey recipients were also asked to provide some details about the topics covered in their program. The number of responses to this question was very high, which indicates that this question has been interpreted in different ways. Respondents have indicated topics covered and the extent of that coverage, but not whether the coverage is within a subject, course, program or module.

Two background topics were listed (causes, effects and solutions to the greenhouse problem; principles of ecologically sustainable development) along with nine so-called 'specialist topics' (see Figure 16 for details). Respondents could also add other relevant topics not listed. Respondents were asked to indicate the extent to which these topics were covered in existing programs. These responses were framed as either 'not covered', 'under development', 'currently minor coverage', or 'currently significant coverage'. Significant coverage was not separately defined here. The most likely interpretation of this term is therefore an extension of the definition provided earlier in the survey: more than a third of a subject or course, module or program. 'Minor coverage' could then be interpreted as less than this level of coverage.

Figure 16 shows the percentage of the 50 schools or departments responding who said their programs covered the topics listed. The total length of each bar indicates the percentage whose programs cover

the topic. The darker section of the bars shows the percentage whose programs gave the topic significant coverage. Approximately 90% of the respondents are at least covering the background topics of general greenhouse issues and principles of ecologically sustainable development to some degree. Two-thirds of respondents are giving ESD principles significant coverage, and half are giving general greenhouse issues and energy efficient buildings significant coverage. All of the listed topics are receiving at least minor coverage from at least half of all respondents. These are certainly encouraging results.

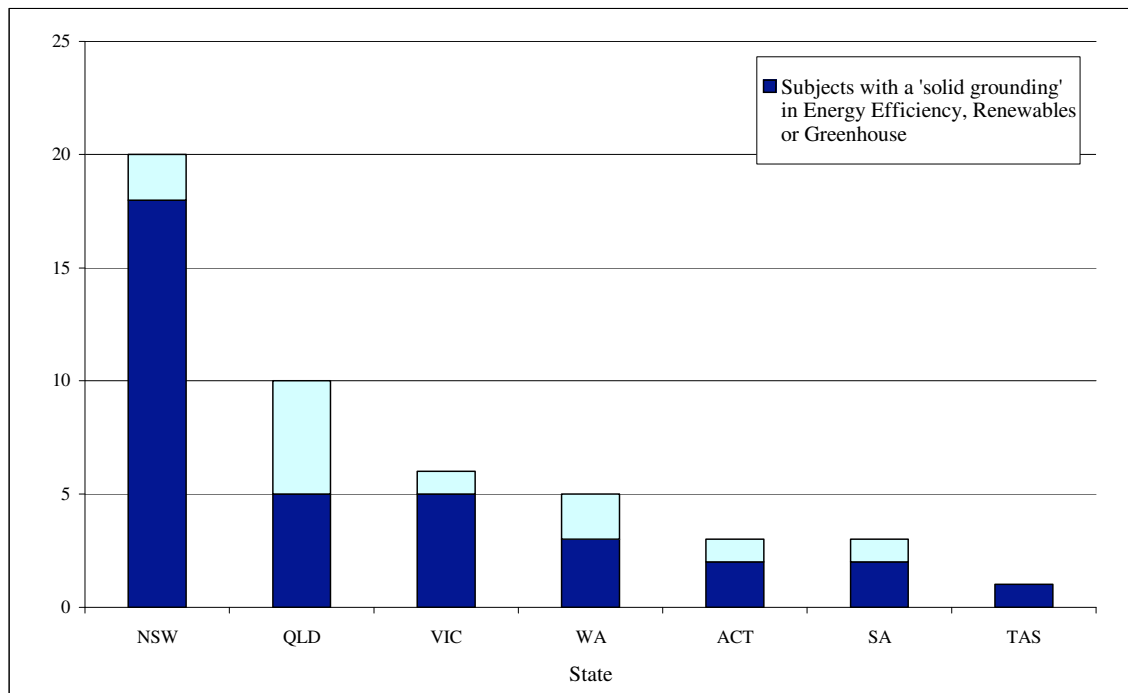


**Figure 16: Topics covered by programs at responding Universities**

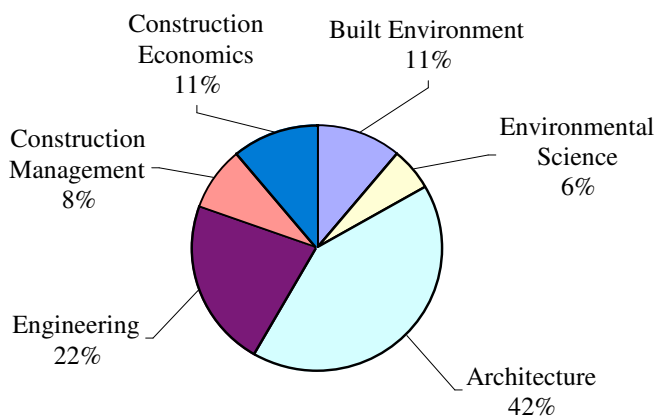
**Subjects**

Thirty-six (72%) out of the 50 schools or departments who responded said that they offered specific subjects for building and construction students including a 'solid grounding' in energy efficiency, renewable energy sources/ applications or greenhouse gas abatement.

Figure 17 shows the number of respondents from each state, and how many of these offer specific subjects as described above. The figure shows that most of those who are offering subjects in these topics are giving a solid grounding, rather than something more superficial.

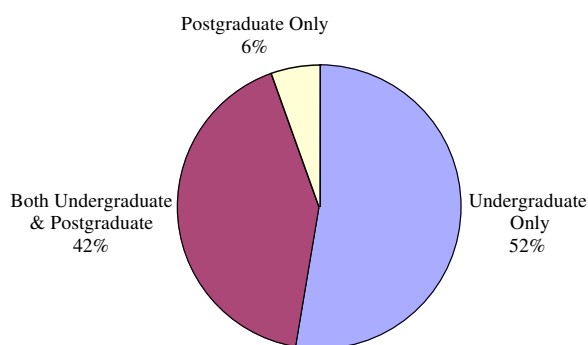


**Figure 17: University departments/ schools teaching Greenhouse-related subjects by state**



Of the 36 schools or departments offering greenhouse related subjects, 4 were classified as built environment, 15 as architecture, 8 as engineering, 3 as construction management, 4 as construction economics, and 2 as environmental science (see Figure 18).

**Figure 18: University departments/ schools teaching Greenhouse-related subjects by discipline**

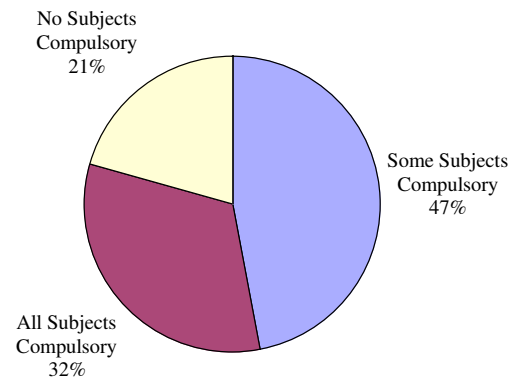


Of the 36 schools or departments offering greenhouse related subjects, 2 said these subjects were postgraduate only. 15 said these subjects were both postgraduate and undergraduate. 19 said these subjects were undergraduate only. In terms of proportions, this means the abundance of postgraduate subjects relative to all subjects is significantly less than the abundance of postgraduate programs relative to all programs.

**Figure 19: Levels at which Greenhouse – related subjects are taught**



Of the 34 schools or departments offering *undergraduate* subjects for building and construction students with a solid grounding in energy efficiency, renewable energy sources/ applications or greenhouse gas abatement, a third said that *all* the subjects are compulsory, and about half said that *at least some* of the subjects are compulsory (ie. some are compulsory, others are electives). Only 20% said that no subjects are compulsory. This is good news because it means that in most cases, the subjects are actually being delivered.



**Figure 20: Degree to which Greenhouse-related subjects are compulsory at Universities**

## Conclusions and Recommendations

Of the 50 departments and schools who responded to our survey, only two in every five have a formal ESD policy in place. This is somewhat surprising, since tertiary institutions might be expected to be leading the way with regard to ESD policy. It is not clear whether policies existed at program, departmental, faculty or university levels. Analysing this result further, we see that architecture and construction management and economics are much more likely than engineering or environmental science to have such a policy. It is difficult to interpret these discipline distinctions. However, on a broad basis, this result is similar to that for the professional and industry associations. Whilst it is tempting to suggest a link between the existence of ESD policies in professional associations and congruent policies in appropriate university schools and departments, the case of engineering would be the exception that breaks that rule. The Institution of Engineers, Australia, first ratified its sustainability policy in 1994. However, this survey has shown that engineering schools and departments are less likely to have an ESD policy than some other schools. In addition, engineering schools and departments appear less likely to offer 'significant' coverage of energy efficiency and greenhouse gas abatement issues than other disciplines.

It is most encouraging to see that almost 70% of university survey respondents are offering undergraduate subjects with a solid grounding in energy efficiency, renewable energy sources/applications or greenhouse gas abatement. Of these, about 80% stated that at least some of the subjects are compulsory. So, we can conclude that the students enrolled in a little more than half of the building and construction schools/ departments represented by university survey respondents are currently being exposed to these ideas. Of course, that means that almost half of the schools/ departments are not offering compulsory subjects in these areas. This situation must be addressed.

## SURVEY FINDINGS- TAFE

A total of 68 Institutes were surveyed. Of these Institutes, 28 responded to the survey (an institutional response rate of 41%). Multiple responses were received by many of the TAFEs who had more than one relevant program area. A total of 51 completed surveys were received from TAFE departments. It is not possible to report a response rate for this because the database supplied to us gave no indication of the total number of relevant programs offered in the TAFE sector. For the same reason, it is also not possible to report on discipline responses relative to recipients. This is unfortunate, because it limits the interpretation of the results. However, those who responded to the survey did provide details of the courses and programs they offered, so we are able to categorise the responses on the basis of discipline.

### Formal ESD Policy

Seven (14%) of the 51 TAFE departments who responded said they have a formal ESD policy. Figure 21 shows the number of respondents by state and how many said they have a formal ESD policy. Once again, the level at which the policy operates (eg. departmental or institutional) is not clear.

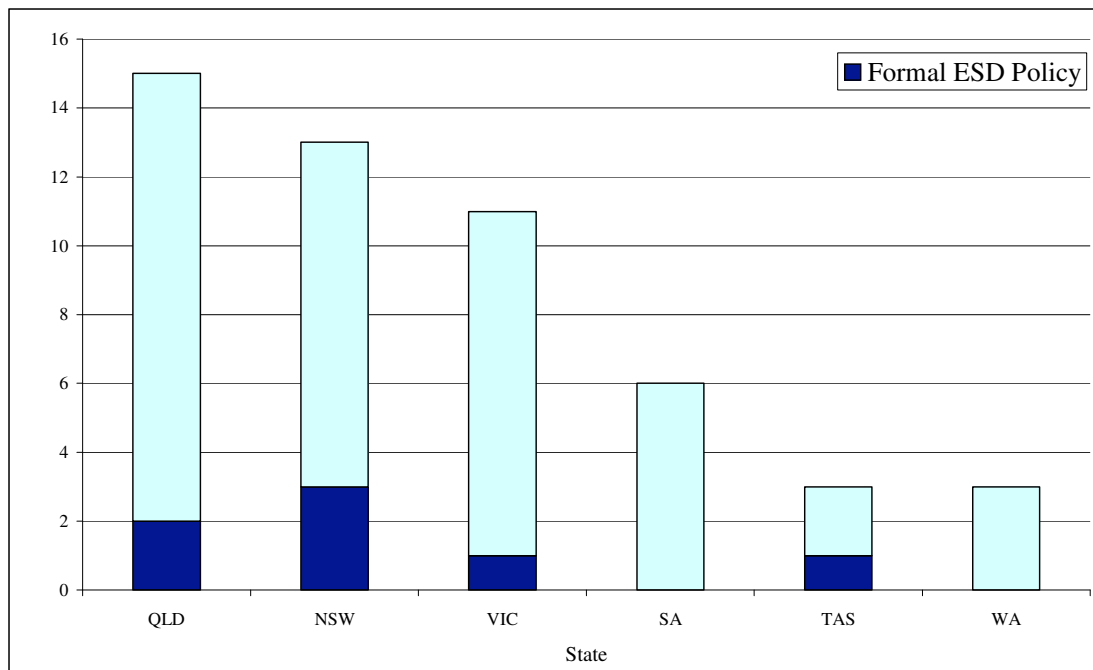


Figure 21: TAFE departments with formal ESD policies by state

The 7 departments who said they had a formal ESD policy fell into two main categories as shown. 4 fell into the category of general building and construction, and 3 into the category of specific trades. Of these, 1 taught carpentry, 1 taught bricklaying and 1 taught painting. None of the departments teaching 'design' or 'construction management' said they had a formal ESD policy.

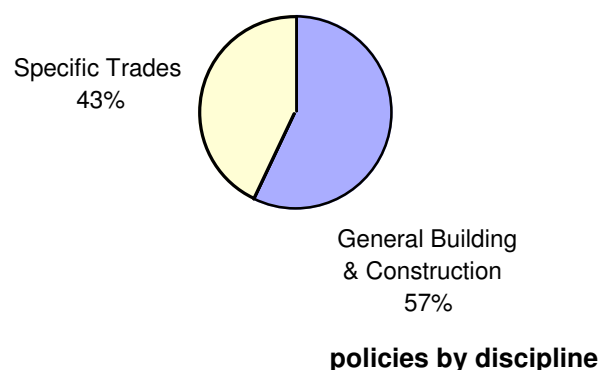
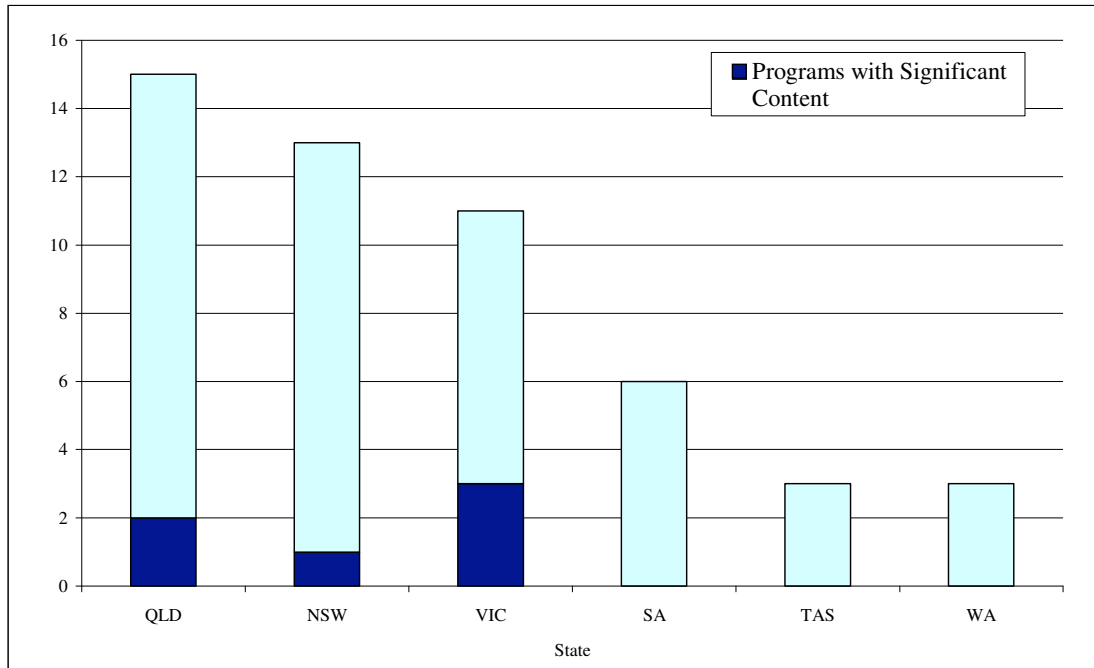


Figure 22: TAFE departments with formal ESD policies by discipline

## Programs

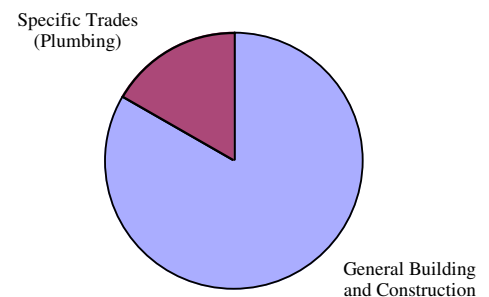
TAFEs were asked the same question as universities with regard to curriculum content. That is, the same definition of ‘significant content’ was used. For TAFE respondents, just six (12%) of the departments said they teach programs in building and construction with a significant content (over a third of curriculum) focused on issues related to energy efficiency, renewable energy sources/ applications or greenhouse gas abatement



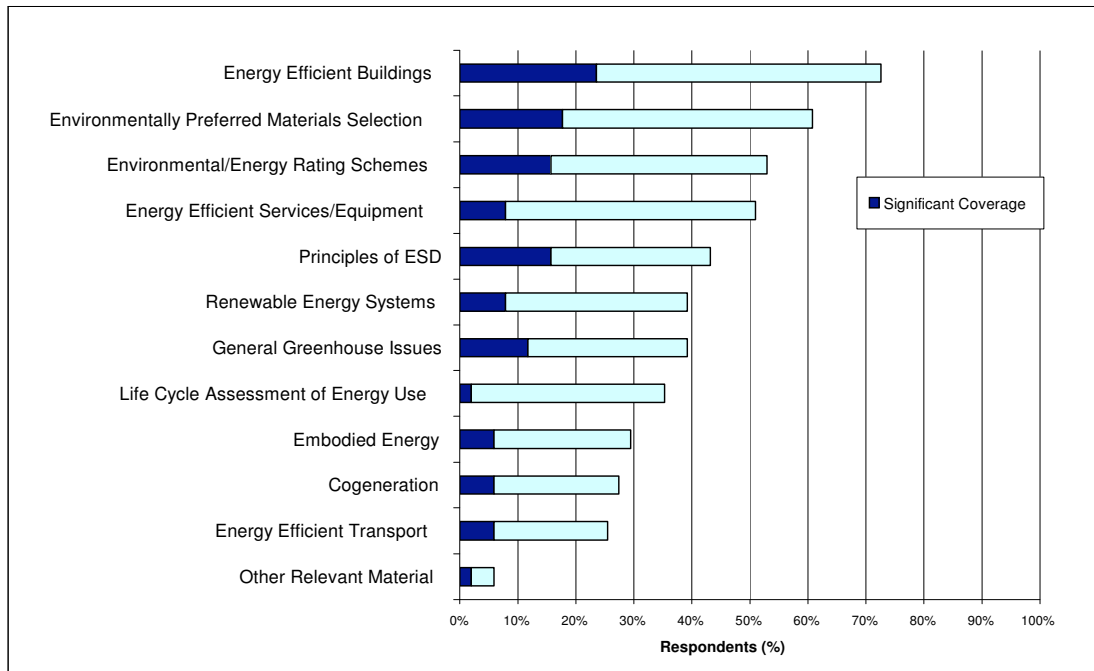
**Figure 23: TAFE departments teaching programs with significant Greenhouse-related content by state**

Figure 23 shows the number of respondents from each state, and how many in each state said they teach programs in building and construction with significant content as described above.

The 6 departments who said they said they teach programs in building and construction with a significant content (over a third of curriculum) focused on issues related to energy efficiency, renewable energy sources/ applications or greenhouse gas abatement fell into 2 main categories. Five fell into the category of general building and construction, while 1 (a plumbing course) fell into the category of specific trades.



**Figure 24: TAFE departments teaching programs with significant Greenhouse-related content by discipline**



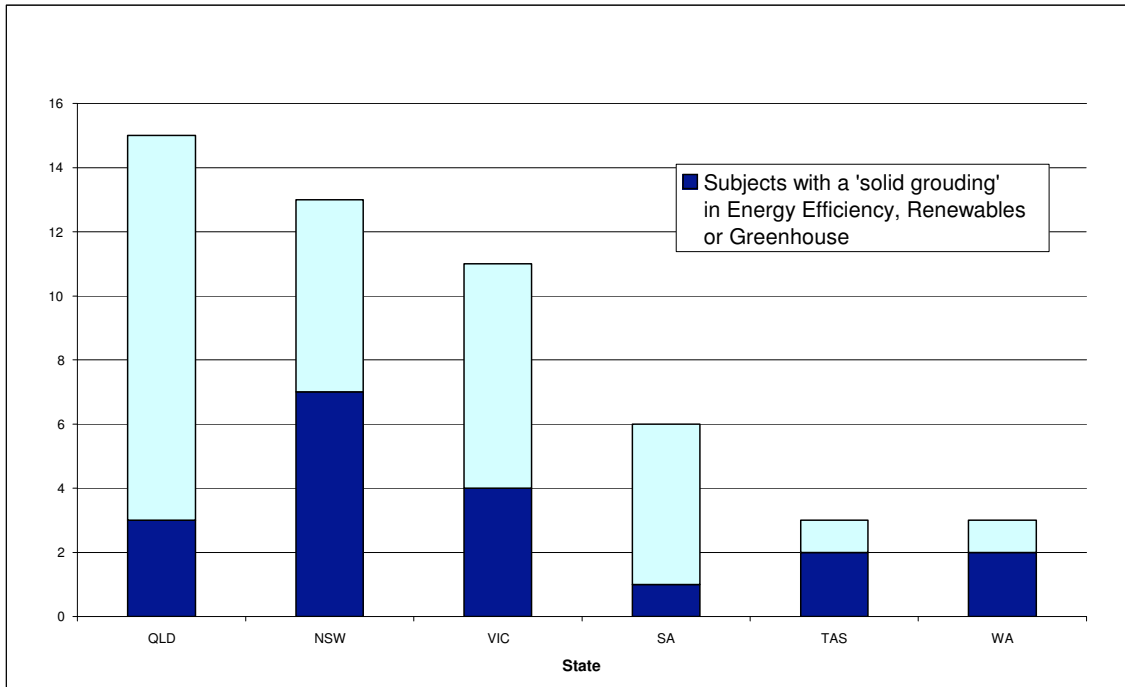
**Figure 25: Topics Covered by the Responding TAFE Departments**

Figure 25 shows the percentage of the 51 departments responding who said they covered the following topics. Once again, although this question referred to programs, the number of responses indicates that it has been filled out in relation to programs, modules, units and subjects. The total length of each bar indicates the percentage who cover the topic. The darker section of the bars shows the percentage who give the topic *significant* coverage.

Approximately 40% of the respondents indicated at least minor coverage of the basic topics (general greenhouse issues and principles of ESD). Of these, only 10-15% of respondents indicate significant coverage of these topics. However, more than 70% indicate coverage to some degree of energy efficient buildings, and 60% indicate coverage of environmentally preferred materials selection. Significant coverage of these two topics was indicated by around just 20% of respondents. One possible interpretation of this information is that TAFE's vocational nature translates more directly to applications of ESD principles, in examples like energy efficient building and environmentally preferred materials selection, rather than discussion of the principles themselves. A discussion of the pros and cons of such an approach is beyond the scope of this report, but this interpretation should be investigated and clarified in Stage 2 of this project.

## Subjects

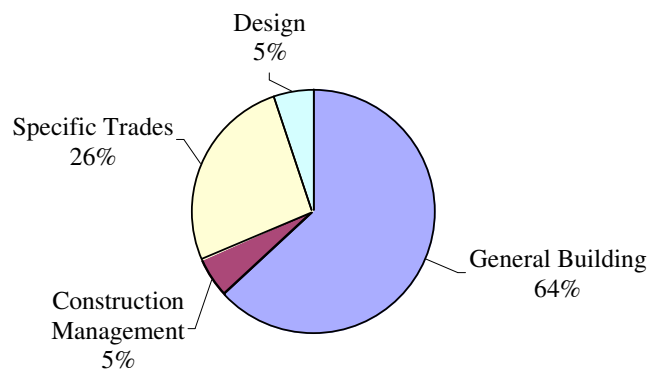
19 (37%) out of the 51 departments who responded said that they offered specific subjects for building and construction students including a solid grounding in energy efficiency, renewable energy sources/ applications or greenhouse gas abatement.



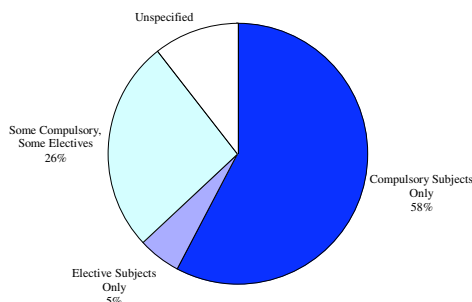
**Figure 26: TAFE Departments Teaching Greenhouse-related subjects by state**

Figure 26 shows the number of respondents from each state, and how many in each state said they teach specific subjects as described above.

Figure 27 shows the disciplines that the 19 respondents fell into. 12 fell into the category of general building & construction, 5 into specific trades, 1 into construction management and 1 into design.



**Figure 27: TAFE Departments teaching greenhouse-related subjects by discipline**



**Figure 28: Degree to which Greenhouse-related subjects are compulsory at TAFE**

Figure 28 shows the breakdown of these subjects in terms of whether they are compulsory or not. Of the 19 departments, 1 said the subjects they referred to were all electives, and 11 said the subjects they referred to were all compulsory. Five departments said some were compulsory and others were electives, and two departments did not specify.

## **Conclusions and Recommendations**

Overall, the results for TAFE indicate that significant opportunity exists to extend the reach of ESD principles. The number of TAFE departments responding who have ESD policies is low – just one in seven. Only one in eight departments offer programs they describe as having significant content in terms of energy efficiency, greenhouse gas abatement, or renewable energy. Less than 40% offer specific subjects incorporating a solid grounding in these categories. However, as much as 84% of these are compulsory. Nonetheless, this means students enrolled in less than one in three TAFE programs are likely to have been exposed to these ideas.

## ALL EDUCATIONAL SECTORS

### Comparison of Programs by Sector

Figures 29-31 show how the three educational sectors compare in terms of their current programs. Figure 29 shows the percentage of respondents (by educational sector) who indicated that their programs currently include coverage of the topics listed, that is, those who are providing either minor or significant coverage.

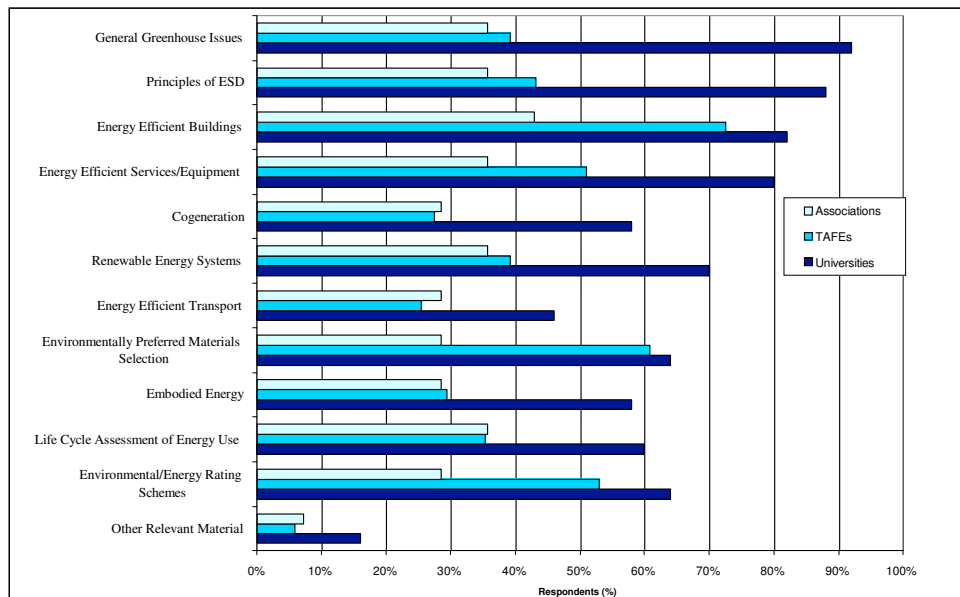


Figure 29: Education providers currently covering topics

Figure 30 shows the percentage of respondents who indicated that their programs currently include *significant* coverage of the topics listed.

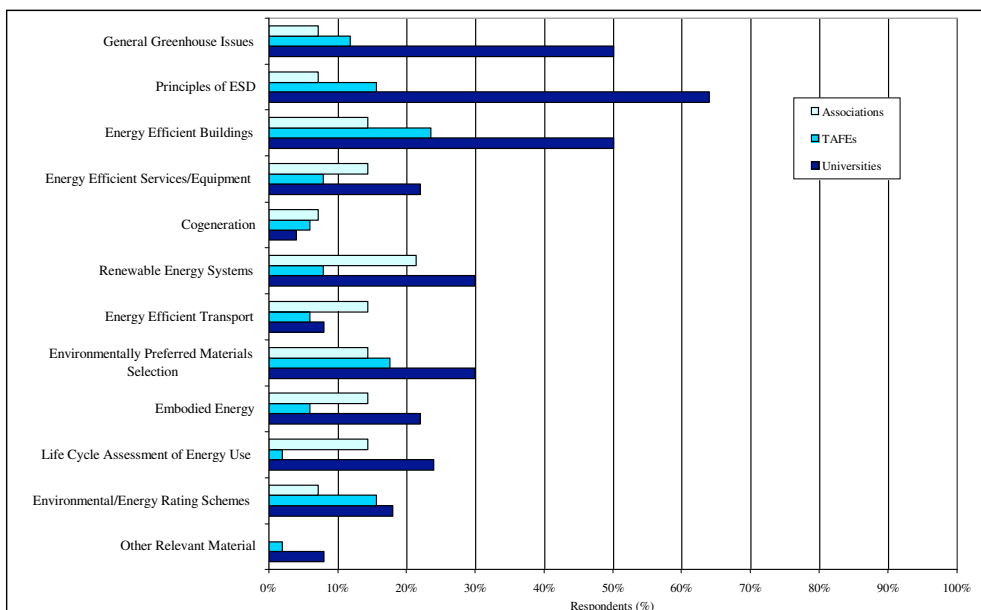
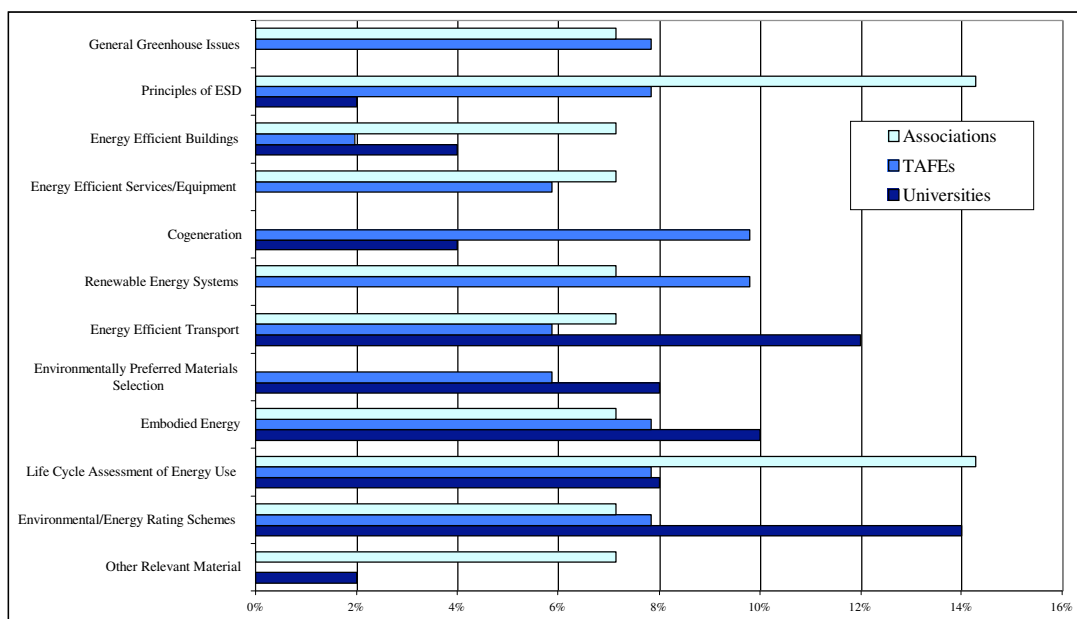


Figure 30: Education providers currently giving significant coverage to topics



**Figure 31: Education providers currently developing material on topics**

To assist in interpreting Figures 29-31, it is important to remember the effect of the numbers of respondents for each group: for the Industry and Professional Associations, 1 response is equivalent to about 7% whereas for Universities and TAFEs, 1 response is about 2%.

If the topics listed in Figures 29 and 30 are significant educational and training issues for these three groups, then there is a significant gap in current offerings which provide detailed coverage of these.

The first of these two figures demonstrates that universities are providing the broadest coverage in general. Far fewer TAFEs and industry and professional associations are providing coverage of these issues. TAFEs and associations are similar in their responses. The picture changes when we consider who identifies their programs as providing significant coverage of specific topics. Here, universities are still providing proportionally more programs in most topics, but the gap between universities and TAFEs and associations is smaller. Also, there is no pattern to the responses from TAFEs and associations. That is, for certain topics, association responses are significantly ahead of TAFEs, and vice versa for other topic areas.

Figure 31 shows 12 topics are under development by Associations, 32 by Universities, and 40 by TAFEs. This is again consistent with the results reported earlier for current coverage – that is, Universities are currently providing greater coverage, so one might expect slightly fewer topics under development relative to TAFE. Figure 31 also shows that Universities are now focusing on developing more specific materials, whilst TAFEs are more likely to be developing material on the principles of sustainable development and greenhouse. In these topics under development, Associations are most interested in life cycle analysis and ESD; Universities in rating schemes, transport, and embodied energy; and TAFEs in cogeneration, renewables, and principles of ESD and greenhouse. These results are consistent with the current coverage reported earlier for the two sectors.



### Influence of ESD Policy on Subject Content

Interestingly, having a formal ESD policy does not appear to have a significant impact on subject content in the TAFE sector, but in the University sector there is a definite correlation.

Figure 32 shows that 19 out of 50 of the University departments or schools who responded said they had a formal ESD policy, and that 18 of these 19 departments (around 95%) taught specific subjects offering a solid grounding in energy efficiency, greenhouse gas abatement or renewable energy sources/ applications.

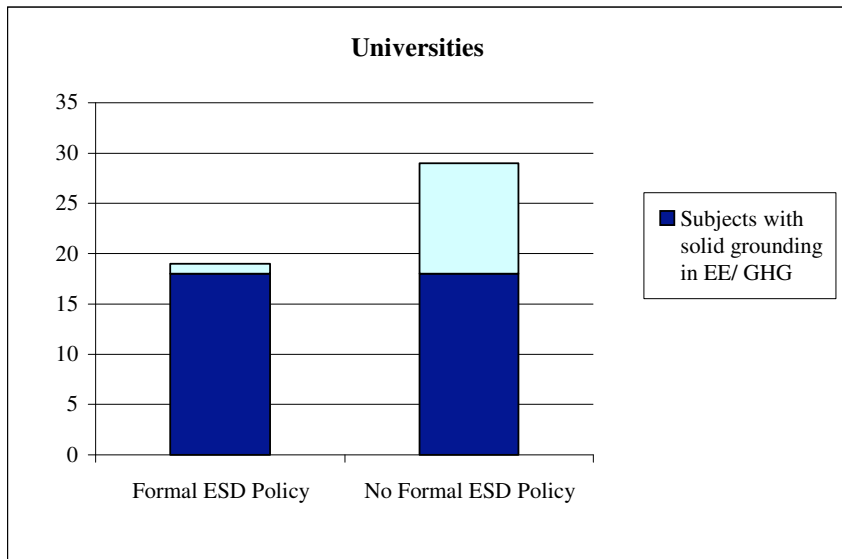


Figure 32: Universities: Impact of formal ESD policy on subject content

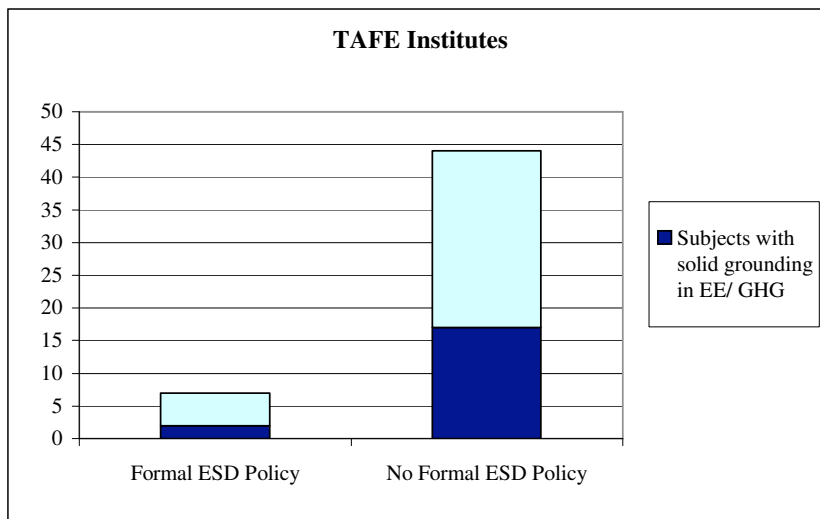


Figure 33: TAFE Institutes: Impact of formal ESD policy on subject content

Figure 33 shows that 7 out of the 51 TAFE departments who responded said they had a formal ESD policy, and only 2 of these 7 (29%) taught specific subjects offering a solid grounding in energy efficiency, greenhouse gas abatement or renewable energy sources/ applications. In total, 19 TAFE departments taught specific subjects as described above, which means that most of those teaching the subjects (89%) did not claim to have a formal ESD policy.

## IN SUMMARY

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Despite considerable interest in Energy Efficiency and Greenhouse issues, each related topic is given significant coverage by very few (1-3) of the surveyed Industry & Professional Associations in the training they provide to members.

Within the University sector a theoretical focus was observed in terms of teaching content, with *general greenhouse issues* and *principles of ESD* being the best-covered topics, covered by 92% and 88% of all respondents respectively. Over 60% of university respondents said they give *significant* coverage to *principles of ESD*. This focus on theory or underpinning principles is probably to be expected from Universities, since their focus should be at the level of principles – the ‘why’ of learning. However, it is clear that knowing ‘how’ is equally important. Future course or program development needs to focus on the practical implementation of these theoretical principles, and this seems to be indicated by the topics under development.

Almost 70% of University respondents offer undergraduate subjects with a ‘solid grounding’ in energy efficiency, renewable energy sources/ applications or greenhouse gas abatement. However, somewhere between 32-79% of the greenhouse related subjects taught by University respondents are compulsory. This means that students enrolled in almost half of the University departments surveyed will not necessarily be exposed to Energy Efficiency and Greenhouse-related issues in their learning.

Within the TAFE sector a practical focus was observed in terms of teaching content, with *energy efficient buildings* and *environmentally preferred materials selection* being the best covered topics, covered by 73% and 61% of all respondents respectively. In contrast, *general greenhouse issues* and *principles of ESD* were covered by less than 45% of TAFE respondents. This focus on practical applications is consistent with the role of the TAFE sector in focusing on ‘how’ principles are implemented. This should be the focus of teaching in TAFE, but improved coverage of ‘why’ (ie. the principles behind the practice) will contribute towards the culture of change necessary to improve the greenhouse related performance of the building and construction industry.

Less than 40% of the TAFE respondents offer subjects with a ‘solid grounding’ in energy efficiency, renewable energy sources/ applications or greenhouse gas abatement. As somewhere between 58-84% of the greenhouse related subjects taught by TAFE are compulsory, students enrolled in over two thirds of the TAFE departments surveyed will not necessarily be exposed to Energy Efficiency and Greenhouse-related issues in their learning.

In short, reasonable opportunities for education, training and CPD in energy efficiency and greenhouse related issues exist now in the building and construction industry. Significant opportunities exist to extend the reach of Energy Efficiency and Greenhouse-related issues in all educational sectors, perhaps most notably in the TAFE sector.

## What next?

Focus groups and a 'snowballing' technique would be a useful way to verify responses and add value to the information presented in this report.

This would enable:

- limitations due to self assessment of knowledge and the subjective interpretation of survey questions to be minimised
- assessment of the learning opportunities from the learner's perspective as well as from the education provider's perspective
- assessment of how effectively the available teaching translates to practice

An Industry workshop was conducted as part of the project, to examine the findings and discuss the way forward. It was agreed that focus groups and the 'snowballing' technique suggested above would be a useful way of adding value to the findings.

It was also agreed that a focus on the review and development of competency standards across all practitioner groups is vital to the improvement of industry's greenhouse related performance. This will capture performance 'on the ground', where up to 67% of tradespeople have not participated in any formal training.

The need for strategic planning, partnerships and improved integration within the industry was a key theme of the discussion. As well as improvements in formal education, a mechanism for strengthening 'on the job' skills is seen as necessary. Partnerships between training providers and industry were suggested as a way of enabling shared responsibility for holistic delivery of greenhouse related knowledge and skills. One model suggested was the use of 'best practice' building developments as the basis for training across a spectrum of practitioner groups, enabling greater liaison between industry players and training providers. This process would need to be coordinated by a peak body. Formal accreditation has been shown to improve participation rates in such training opportunities.

Another issue raised was the current need for greater competence in the installation, commissioning, and maintenance of imported 'green technology'. This may require the facilitation of new business model by changes to government policy, as well as appropriate training opportunities.

It was agreed that training packages should be developed in such a way that energy efficiency and greenhouse related issues are not perceived as teaching 'add-ons' but rather, must permeate existing teaching material. This requires a degree of cultural change in the way education is developed.

Although the design professions, as specifiers, have a major influence on the greenhouse related performance of industry, it was generally agreed that the most significant opportunities for short-term improvement exist in the TAFE sector. At present there are 33, 000 TAFE students involved in apprentice programs within the building and construction industry. Improved energy efficiency and greenhouse related training for these students could have a relatively immediate impact. Specifically, housing industry tradespeople were suggested as an effective target for a greenhouse related skills and training package.

This is not to suggest that attention should be diverted from the other educational sectors. A recurring theme of the discussion was the need for a whole of industry approach to improved training. This requires attention to be given to all practitioner groups, and to both 'entry level' training and continuing professional development. This will ensure support for improved greenhouse related practices and performance across all professions and levels of experience.

## **APPENDICES**

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**Industry and Professional Associations Survey**

**Universities Survey**

**TAFE Institutes Survey**

**Collated written comments from surveys**