

Communication

# Energy Efficiency Education and Training: Australian Lessons on What Employers Want—Or Need

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**Abstract:** This paper explores current approaches and future directions for energy efficiency education and training in the tertiary sector. Energy efficiency is a significant element in many jobs across the economy, with potential for substantial growth. It crosses disciplinary boundaries, as the range of skills and knowledge required by practitioners is broad, reflecting the diversity and expanding range of work roles that require energy efficiency skills and knowledge. Limitations of education and training contribute to a situation where business and consumer decision-making often involves little or no consideration of energy, so outcomes are often sub-optimal. This increases costs, environmental and social impacts and undermines productivity improvement. As the significance of energy efficiency skills and knowledge in workplaces increases, more flexible and varied education and training models are needed to allow workers to upskill, gain new skills and integrate energy efficiency into business models. The paper discusses the barriers to adoption of more comprehensive energy efficiency content in programs and presents options for inclusion. The paper concludes that, in order to capture the potential of energy efficiency to contribute to a productive, sustainable economy, appropriate teaching resources and certification must be developed and introduced across most disciplines, while employers and recruitment consultants must be informed of the benefits, so they value energy efficiency skills and qualifications.

**Keywords:** energy; efficiency; education; training; cross-disciplinary; employment; employers; productivity

## 1. Introduction

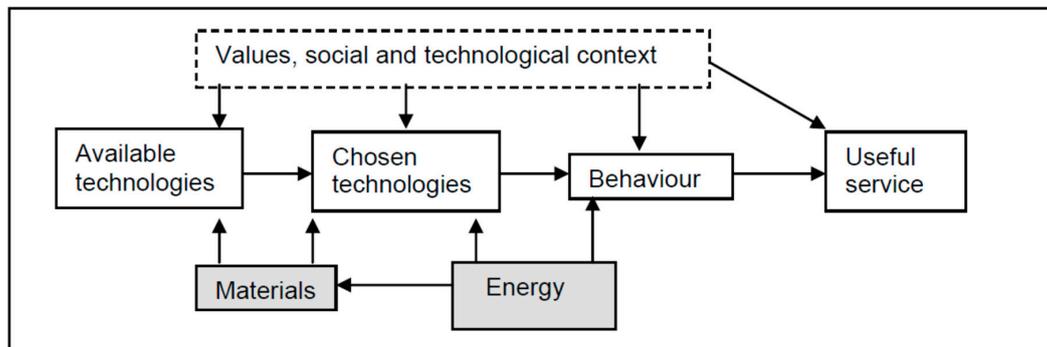
Energy efficiency is a broad field. This paper focuses on the role of tertiary educators across all disciplines in preparing their graduates to play appropriate and effective roles in improving energy efficiency during their working lives. It considers not just graduates who may specialise in energy issues, but also those in many professions where their decisions and practices will influence energy outcomes.

Energy efficiency is fundamentally different from energy supply. It is enmeshed in society and industry, innovation and diverse markets for buildings, appliances, materials and human behaviour. In contrast, energy supply is an input to the provision of useful services, and a major industry sector whose boundaries can be readily defined.

The emergence of ‘behind the meter’ electricity generation, energy storage, demand management and demand response is blurring the boundaries between traditional energy supply and consumers. These emerging options are more like energy efficiency measures than traditional utility energy supply. Indeed, they generally appear as changes in level and timing of demand at the meter. They typically involve investment by energy consumers, supported by a variety of new business models and financing mechanisms, who make decisions based on many factors beyond energy implications; indeed, energy aspects may be ignored. Tertiary educators across all disciplines need to consider this complexity

and rapid change when developing and delivering courses and developing their educational strategy and pedagogy.

In principle, energy consumers do not want energy for its own sake, they want services that they value. While some energy is usually required to deliver those services, the amount, type and timing of energy requirements depend on many factors, as shown in Figure 1.



**Figure 1.** High level model of factors contributing to ‘useful services’ for which energy is one input [1].

The International Energy Agency (IEA) describes energy efficiency as ‘the first fuel’, because of its powerful impact on energy use and climate impacts [2]. Indeed, IEA’s 2018 least cost Paris scenario for global energy suggests energy efficiency could deliver 37% of energy-related emission reduction by 2040, slightly more than renewable energy [3].

In Australia, energy efficiency has been ‘the forgotten fuel’, as funding and policy has focused on renewable energy and supply-side energy issues, particularly related to electricity. The policy focus on demand-side issues in energy markets has been mostly limited to demand response (short term demand management) to help manage in periods of peak demand or critical shortages, while ignoring the much greater potential of avoiding the need to use energy through improved efficiency. For example, the 2017 review of Australia’s National Electricity Market [4] (p. 26) framed energy efficiency as an important area, but one to be driven by governments, not through energy markets. In broader energy policy, the limited focus on energy efficiency has relied on under-funded public education and weak regulation, such as building codes that have not been effectively enforced, limited appliance mandatory standards and state level energy retailer obligation schemes with unambitious targets.

Australia’s situation is not atypical. Global action on energy efficiency, as measured by reduction in energy intensity, is lagging behind optimal cost-effective levels. IEA Executive Director Fatih Birol, in his foreword to its 2019 update on energy efficiency, commented: ‘In 2018, global primary energy intensity improved by only 1.2%, the slowest rate since the start of the decade and the third consecutive year that energy intensity improvements have weakened. This trend is worrying in a world where there is a growing disconnect between political statements and global energy-related greenhouse gas emissions, which, in 2018, grew at their fastest rate since 2013’ [5] (p. 3).

Energy efficiency improvement is a key element that should be part of graduating student toolkits in all disciplines, not just engineering and science, to achieve outcomes such as:

- Reduction of climate impacts;
- Reduction in energy bills;
- Reduction in capital investment costs for both energy suppliers and consumers;
- Reduced dependence on high reliability energy from often fragile and complex energy supply and storage infrastructure;
- Increased awareness of the relevance of energy efficiency for all stakeholders from the CEO to the plant manager, the engineer to the user;
- A range of ‘multiple benefits’ (see [6]) such as equity, health and well-being, productivity improvement, reduction in capital and operating costs.

This diverse range of benefits and impacts means energy efficiency crosses traditional educational, business, policy and decision-making boundaries, and its implications flow across the whole economy, as well as energy supply and demand systems. For example, decisions made by a building designer, builder, operator and maintenance contractor, as well as by appliance and equipment designers, specifiers, installers and users, affect the ongoing energy consumption and demand profile of a building for decades. The reality is that, at present, many decision-makers do not adequately incorporate consideration of energy-related factors into their work, which highlights the need for greater emphasis across all educational disciplines.

## 2. How Many Jobs in Energy Efficiency?

The justification for a stronger focus on energy efficiency within education and training should be based on its potential contribution to society, environment, the economy and potential employment value for graduates. As noted earlier, it plays a key role in least cost climate response, while delivering many broader economic, social and environmental benefits.

At a more pragmatic level, educators must consider how many students might be attracted to courses they offer. This depends on the number, quality and types of jobs and student perceptions of how attractive these jobs and long-term career paths might be. These perceptions are shaped by many factors such as potential income, status, compatibility with their values and so on.

The Environmental and Energy Study Institute (EESI) [7] found that there were over 3 million energy efficiency jobs in the United States in 2018, over two-thirds of which were in the building, appliance, lighting and HVAC sectors. The EESI fact sheet also noted that around 4.7 million US jobs were in retailing of energy efficient products and services. These figures compare with EESI's estimate of 555,000 US jobs in renewable energy.

Based on a comprehensive analysis of employer data collected in the fourth quarter of 2018, the 2019 US Energy and Employment Report [8] found that the Traditional Energy and Energy Efficiency sectors in 2018 employed approximately 6.7 million Americans or 4.6 percent of a workforce of roughly 147 million, of which energy efficiency contributed part or all of 2.35 million jobs (p. 3). The study also found that 72% or more employers had difficulties employing suitably skilled energy efficiency staff (p. 132).

The authors [8] also concluded that, in 2018, the majority (nearly 56 percent) of energy efficiency employees worked at construction firms, installing or servicing energy efficiency goods or performing energy efficiency-related services. Approximately one in five workers in the energy efficiency sector worked in professional and business services.

There have been few recent Australian studies of employment potential in energy efficiency. One study by Green Energy Markets [9] adjusted US data to estimate that at least 59,000 jobs were associated with home and business energy efficiency, though up to 236,000 jobs involved some level of energy management. In late 2019, the Australian workforce numbered 12.9 million [10]. Growth of Australia's energy efficiency activity has been relatively slow compared with many other countries, as illustrated by relatively low rankings in international comparisons such as the ACEEE scorecard [11] and International Energy Agency [5] studies. So there may well be greater potential for growth in Australia than in some other countries.

A spot check of a prominent Australian employment web site in January 2020 listed 531 energy efficiency jobs with annual salaries between \$40,000 and \$200,000 listed within the past 30 days [12].

## 3. What Kinds of Jobs and Skills?

The above studies suggest that construction, retailing, installing or servicing energy efficient products and services dominate employment in energy efficiency. But this is a narrow perspective.

In practice, energy efficiency is often a key element in a wide range of jobs across the whole economy. For example, investment analysts increasingly factor in energy efficiency as an element of their consideration of fiduciary risk related to climate change (see [13]). Social welfare agencies must consider factors such as energy costs and adequacy of housing thermal performance. So the above

estimates are conservative. One Australian study [14] expands discussion of the benefits of improving thermal performance of housing beyond financial savings on energy to include health, safety and other factors. Consideration of these factors broadens engagement from energy policy to social and environmental policy, and has implications for the work of a much broader range of workers.

An understanding of energy efficiency, or energy productivity as some now describe it, is increasingly important for senior managers and board members (see work of groups such as the Australian Alliance for Energy Productivity [15–17]), as energy costs increase and fiduciary pressures to manage climate impacts build [13]. Indeed, it could be argued that most employees will need to address aspects of energy efficiency, regardless of their main role, and that broad education on energy efficiency is useful for everyday living.

Clearly the spectrum of jobs in energy efficiency is very broad. Many of these jobs do not require high level expertise in engineering and science, but workers should have sufficient understanding and competence in energy efficiency to incorporate it into their core work and decision-making. Further, technical and scientific experts in energy efficiency would benefit from increased capacity to engage with co-workers and managers from a wide range of disciplines. Of course traditional engineering knowledge and skills, including thermodynamics, system design, monitoring and analysis and knowledge of technologies are important for energy efficiency specialists, and more basic knowledge of these areas would also benefit many other workers in the energy efficiency field.

In the following sections of the paper, I review several examples of how energy efficiency skills are combined with other skills within individual jobs, teams or organisations.

The extent to which energy efficiency will be part of one job or a specialist job within a broader context often evolves over time, and the maturity of institutional understanding of its influence in business and social outcomes. This highlights the importance of short courses, professional development, post-graduate programs and other options, so that workers from varied backgrounds can build competence in energy efficiency and integrate it into their core roles. Employers and recruitment consultants must be encouraged to factor energy efficiency knowledge, skills and qualifications into staff selection and career development.

### *3.1. Managing Energy in Local Government: A Manual Illustrating Integration of Energy Efficiency and Management into an Organisation*

This manual [18] was developed to support local governments as they pursued carbon emission reductions in the Cities for Climate Protection program in Australia, run by the International Council for Local Environmental Initiatives (<https://www.iclei.org/>) through its Australian branch (<https://www.icleioceania.org/>) over a decade from 1997. Of relevance to this paper are the sections that provide task sheets for council operational groups, and strategy sheets.

The ‘Council sheets’ separately address 15 different functional groups in councils and, for example include:

- For financial managers, preparation and supervision of relevant clauses in leases, contracts and purchasing guidelines and development and implementation of appropriate financial policies;
- For parks and gardens staff, equipment selection and operation, energy management in their buildings and facilities, management of green and other organic wastes and office energy use;
- For planning and building approvals staff, policy input on energy efficient building design and specification, advice to applicants on energy efficiency features and measures and consideration of relevant factors in approval processes.

This example highlights the need for all functional units within organisations to take responsibility for energy efficiency action related to their roles. Many measures involve energy efficiency improvement in supply chains, contractors, clients and customers, as well as their own operations.

Tertiary education programs across all disciplines need to incorporate content that provides graduates with basic understanding of energy efficiency, and how their work impacts on energy

(and broader sustainability) outcomes for their employer and customers. These should complement comprehensive components for disciplines likely to play leadership or specialist roles related to energy efficiency. Further research is needed to develop an understanding of these complex interactions.

### 3.2. Energy Efficiency and Environmental Professionals

At present, many potential employers see energy efficiency as predominantly an environmental role, so it is relevant to consider the range of skills typically required by people working in this space. Thomas [19] conducted an electronic survey of Australian environmental professionals, and found that the skills shown in Table 1 were important:

**Table 1.** Generic skills of importance for environmental professionals [19].

Generic Skills That Are Important for ... (Skills Are Listed in Alphabetical Order)	Current Job Count	Current Job%	Sector Skills Count	Sector Skills%	Difference Current Job%- Sector Skills%
Communication—Customer Service	50	3.2	99	8	<b>−4.8</b>
Communication—Spoken/Verbal	125	7.9	29	3	<b>4.9</b>
Communication—Written	149	9.5	95	8	1.5
Computer Skills	55	3.5	98	8	<b>−4.5</b>
Critical Thinking	156	9.9	28	3	<b>6.9</b>
Equipment maintenance	7	0.4	90	7	<b>−6.6</b>
Honesty	31	2	5	0.4	1.6
Identifying complex problems	42	2.7	29	3	−0.3
Initiative and enterprise	56	3.6	52	4	−0.4
Interpersonal Skills	112	7.1	113	9	−1.9
Judgment and Decision-Making	95	6	52	4	2
Learning Skills	26	1.7	42	3	−1.3
Mathematical literacy and abilities	19	1.2	9	1	0.2
Negotiation/Persuasion/Build Argument	47	3	35	3	0
Operation and control of equipment/systems	7	0.4	6	0.5	−0.1
Operation monitoring and analysis	16	1	14	1	0
Practical skills (e.g., installation of equipment/systems)	26	1.7	33	3	−1.3
Project Management	140	8.9	103	8	0.9
Resource Management Skills—Financial Resources	6	0.4	5	0.4	0
Resource Management Skills—Long term planning and organising	38	2.4	12	1	1.4
Resource Management Skills—Management of self	38	2.4	14	1	1.4
Resource Management Skills—Material Resources	7	0.4	6	0.5	−0.1
Resource Management Skills—Personnel	10	0.6	7	1	−0.4
Scientific Approach and Application	94	6	61	5	1
Solution Development	22	1.4	24	2	−0.6
Teamwork—Coordination	73	4.6	44	4	0.6
Teamwork—Instructing	15	1	7	1	0
Technology Design	6	0.4	2	0.2	0.2
Timeliness	23	1.5	10	1	0.5
Troubleshooting	18	1.1	10	1	0.1
As for current career/position	-	-	99	8	-
Other	29	1.8	20	2	-

In the right-hand column, differences between current job and sector experience are presented; differences in bold are noticeably greater than the bulk of the results. A positive.% indicates the skill was noted more frequently, and considered important, in relation to current jobs; a negative number indicates the opposite case.

Thomas [19] also notes: ‘Similarly from a survey of international business leaders, results indicated that education institutions were expected to develop employees, and future business leaders, “with the knowledge, skills, attitudes and behaviours to manage sustainability issues as an integral part of the way they think about business [20] (p. 49)”’.

This implies that educators and trainers need to develop in their graduates the ability to manage sustainability issues and integrate them into broader business practices. To achieve these outcomes, graduates from all relevant disciplines, not just engineering and science, require content knowledge related to energy efficiency but also an understanding of existing business models and practices.

### 3.3. Functional Skills for Energy Efficiency Assessment

This section reviews research on participants in the Australian Energy Efficiency Opportunities program which applied to large energy-consuming businesses using more than 0.5 petajoules of energy each year (now closed). The study identified 33 ‘functional skills’ required to conduct effective energy efficiency assessments at industrial sites [21]. It highlighted team-based approaches involving a range of disciplines, to confidently and effectively complete assessments, establish corporate strategies and implement appropriate measures.

Key overarching abilities included:

- Project planning and management. Direct and guide a group in completing tasks and attaining goals.
- Communication planning and implementation. Exchange, engage, convey and express knowledge and ideas in an energy efficiency context.
- Understanding energy use. Arrange and retrieve data, knowledge and ideas, research and investigation of specific technical and financial issues.
- Identification of potential opportunities. Think logically and creatively.
- Decision-making. Develop and assess business cases for implementation of measures.
- Monitoring and investigating. Install appropriate monitoring equipment and develop analysis systems.

Useful specialist attributes included:

- Understanding legislative and compliance requirements;
- Financial planning, accounting and audit skills;
- Understanding new trading and reporting mechanisms, and their strategic business implications.

The most effective approaches involved people from across an organisation, bringing a diversity of backgrounds and capabilities, such as corporate management, procurement, site management and operations. Senior management backing and adequate resources were important.

Effective teams engaged:

- Project managers to oversee assessment implementation and organizational change;
- Technical staff who understood how energy is used within production processes;
- Data analysts to model trends and relationships;
- Business case developers capable of securing management support;
- External resources who provided business and process-specific knowledge and alternative perspectives.

### 3.4. Systems and Services Thinking

An understanding and capacity to apply ‘systems and services’ thinking and analysis is fundamental to energy efficiency. These often involve social, economic, political and behavioural elements, not just technical dimensions.

Many opportunities emerge from reframing ways of delivering services: for example, 'efficient comfort' can be provided by options such as high efficiency heating and cooling equipment, a thermally efficient building envelope, targeted heating and cooling, changing operating hours and/or motivating occupants to wear different clothes.

Understanding the systems that deliver a useful service, from raw materials or primary industrial activities, through all participants in the value chain, to the point of service provision can support identification of energy waste and alternative business models for service delivery, while also identifying opportunities to add business value worth far more than the energy costs saved.

Several reports by the Australian Alliance for Energy Productivity [15–17] have shown the application of systems and services thinking to the farm-to-plate and raw-materials-to-shelter value chains to identify energy waste and reduce it through measures that improve business productivity. A key element of the A2EP approach is to engage with participants in the value chain, to understand what they value, what issues they perceive to be 'significant problems' and the cultural framing of their activities. Energy efficiency is framed by A2EP as a key element of the 'tool-kit' that can allow value chain participants to achieve their objectives or address the problems they perceive.

In many cases, substantial energy savings come from cooperation between value chain participants and different cultural groups or business units within organisations, and through increased accountability. This can be driven by improved monitoring, analysis and real-time communication of data from multiple data streams such as vehicle movements, product temperature, calculation of operating parameters such as chiller efficiency under varying environmental conditions and operating practices, pressure drop across filters and so on. For many organisations, energy management increasingly depends upon advanced data analytics, machine learning and access to a variety of data streams. Its messages are increasingly integrated into business management and practices.

### *3.5. Networking and Change Agent Skills*

Another potentially important role for educators and trainers is to help students to begin to build networks within the energy efficiency sector and among potential employers across all sectors. The reality is that energy efficiency is still an emerging industry, and many employment opportunities are not widely advertised. Word-of-mouth communication regarding both opportunities and the potential capabilities of applicants can be crucial. Awareness within firms outside the energy efficiency sector of the potential value to them of a worker with strong energy efficiency knowledge and skills is low, so employers and recruitment consultants must also be educated.

Work placements, both for individuals and cross-disciplinary teams, can help to build experience and confidence among graduates, as well as building networks. For example, at RMIT University in Melbourne, Australia, social and physical science students in the environment program, in which the author has taught, carry out client-based research projects that require a range of skills and involve a wide range of organisations. Some RMIT postgraduate programs attract students with a range of backgrounds, which can contribute to 'cross-fertilisation' of cultures and challenge assumptions made within traditional disciplines. Indeed, workers who wish to reposition themselves within an existing organisation or their discipline may pursue short courses or graduate programs to build capability and formal qualifications in sustainability issues, including energy efficiency.

Energy efficiency professionals often play 'change agent' roles. Many potential users of energy efficient solutions need help to see their own activities through 'fresh eyes'. To implement changes, they may have to work with product and service suppliers from outside their trusted networks, so they may perceive risks that have to be managed. There may be winners and losers within an organisation, staff may require retraining and roles may change. Managing change involves multiple skills, or the capacity to recognise a need to call in people with appropriate skills.

Guerin [22] emphasises the importance of understanding business priorities, so that project proposals can be framed in ways that highlight the value to a business. He comments that 'While there are usually many worthwhile PP&I (projects, programs and initiatives) concepts in any organization,

only those that create new value for the organization and that meet that business's commercial and financial success criteria are likely to be supported by the executive team'.

An example of the importance of a focus on increasing business value instead of just reducing energy costs can be seen in A2EP's study of the refrigerated food chain [15]. Energy efficiency and productivity improvement, facilitated by digitalisation, provided key mechanisms to identify and capture business value, but energy savings were not a strong motivator for action. Businesses were much more focused on avoiding food loss, maintaining and extending product shelf life, enhancing or avoiding damage to reputation, health issues and reducing labour and logistics costs. The project found that real-time information from temperature sensors in food not only guided major improvements in energy efficiency but also increased understanding of many issues in the value chain. Poor practices and inefficient or faulty equipment could be identified, business systems optimised, risks better managed and the business value of change quantified. The initial project really opened up new approaches to business management and work practices.

Different energy efficiency professions require different combinations of skills: A designer of energy efficient equipment will need different skills from a sales-person or a project manager. So courses will necessarily vary in emphasis.

#### 4. Who Are the Potential Employers?

Potential employers of professionals skilled in energy efficiency include:

- The supply chain for energy efficiency services, products and systems, from manufacture of energy saving and more efficient equipment to sales, installation, maintenance, on-site analysis and management of energy;
- Participants in existing value chains, whose work tasks may change as they incorporate energy efficiency into their mainstream activities and business models;
- The energy supply sector, from energy forecasters to energy generators, distribution system operators and energy retailers;
- Government agencies and departments at local, state and national levels;
- Emerging service providers from outside the traditional energy sector, such as communications services and data analysts, appliance manufacturers and building sector businesses;
- Energy consumers, from large to small businesses across all sectors, households and businesses that provide them with advice, support services;
- Research and development organisations or units within organisations;
- Universities, for teaching, research and property services;
- Financiers, who will require independent evaluation of energy efficiency aspects of projects and business models;
- Consulting firms.

Different categories of employer want different combinations of skills. Energy efficiency expertise will often be only the one element of the 'package' employers want. Indeed, many potential employers may, at present, not even realise they need energy efficiency skills, or that they are already using them!

##### 4.1. Integration of Energy Efficiency into Broader Courses

In practice, many graduates incorporate their work on energy efficiency within broader roles. For example, an HVAC design engineer's core role is to design HVAC systems that work properly and meet budgets. Clients may have more or less interest in achieving energy efficient outcomes, so the extent to which energy efficiency principles can be applied will vary. A sustainability officer may deal with waste, water, health, safety, environmental compliance and organisational change, as well as energy efficiency and renewable energy issues. Some will negotiate energy procurement. A sales-person will engage with customers as they make purchasing decisions.

In many cases, practitioners will study several courses over time, and pursue informal self-education to build and broaden their skill base. But there is also a need to provide basic skill levels in energy efficiency across a wide range of disciplines, if the potential value of energy efficiency is to be captured in mainstream business activity and social systems. This is a challenge in crowded curricula with high workloads, rapid turnover and casualisation of staff in tertiary education. In some cases, courses are certified by professional associations that have traditionally been 'siloed'. This can constrain introduction of new content, as well as limit cross-disciplinary education. It may also mean some students are excluded because they do not meet entrance requirements. Of course, these issues apply to many areas other than energy efficiency.

Options to address the 'crowded curricula' problem include provision of courses in Masters and Diploma programs, where students generally seek choices to suit their requirements. Adapting existing examples, problems and assignments in courses to incorporate energy efficiency can be effective. Short courses and micro-credentials can also be offered. These can evolve into longer programs and core course content as they gain popularity, or can be adapted in response to student feedback. While use of online courses offers a low cost approach, this approach can lack focus on dialogue, debate and discussion that helps to develop deeper understanding and broad capabilities.

There is also potential to develop courses in cooperation with industry and business associations. Some of these already run courses and provide accreditation, but there are potential synergies from working with tertiary educators, while the educators can benefit from enhanced engagement with industry.

There is some evidence of universities making commitments to incorporate 'sustainability' into all courses, for example RMIT University and the University of Melbourne in Australia, where the author teaches. However, progress is slow, and exactly what aspects will be included and how they may be delivered is not yet clear. High-level tracking of references to energy efficiency in course guides may not accurately reflect the realities.

The evolving nature of energy efficiency roles, as organisations 'learn by doing' and gain more confidence to pursue more ambitious energy efficiency strategies, and as pressures build to cut climate impacts and address other issues, means that ongoing training will be needed. So educators need to offer micro-credentials, on-line courses, flexible work-integrated options and other forms of engagement. There is a need for courses that support ongoing development of career paths, and target potential students with varied educational backgrounds, both by discipline and by entry knowledge and skill level.

#### *4.2. Issues for Educational Institutions*

The cross-disciplinary and rapidly evolving nature of energy efficiency creates challenges for educational institutions. The content may be unfamiliar, and changes quickly, so teaching staff must be allocated more time for knowledge and skill enhancement, course development and industry/government engagement. Staff may lack motivation to incorporate new content.

Desha and Hargroves [23] discuss issues to be faced in developing and updating curriculum to incorporate energy efficiency. They surveyed engineering educators, and identified numerous barriers and benefits. Top barriers included lack of knowledge of content and industry contacts, limited information and preparation time, and 'an overcrowded curriculum'. Perceived benefits included improved pedagogy and marketability of courses, cross-functionality of content, new research opportunities, and networking and professional development. This book includes many useful resources and practical ideas for energy efficiency educators.

### **5. Conclusions**

Global progress on energy efficiency is falling behind optimal cost-effective action. The focus of energy efficiency tertiary education has traditionally been technical and scientific programs. However, energy efficiency involves all sectors of the economy, and has multiple benefits and impacts because

it is embedded in all elements of our society. This is very different from energy supply. So a range of educational programs is needed to address the changing needs of many different graduates and their employers. This will require incorporation of energy efficiency into most tertiary education, and development of appropriate educational resources and certification. It will also require education of potential employers so they value energy efficiency qualifications. Allocation of resources for course development and delivery is a challenge because of the lack of status and profile of energy efficiency within business and academic leadership groups. The energy efficiency sector is already a substantial employer, but energy efficiency is just one element of many jobs. So it must be integrated into courses across a range of disciplines, not just engineering and science, while the latter groups must be educated to work with cross-disciplinary teams.

Integrating energy efficiency will improve employability, leading to greater ability to contribute to a sustainable future of the community, and to improved business outcomes.

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