Building Performance Study,
The Productivity Commission
Locked Bag 2,
Collins Street East
Melbourne Vic 8003

Att: Vickie Thompson

Dear Ms Thompson,

Re SEIA Building Performance Study Submission

Please find enclosed a submission from the Sustainable Energy Industry Association (Australia) Limited relating to the Future Performance of Buildings Study. The submission consists of several papers as well as a specific response to the Issues Paper.

Many of the market failures, barriers and impediments have been documented over by the Commonwealth Government over the last 10 years during the various attempts at introducing a non-residential building energy code. SEIA, the peak association representing the sustainable energy industry in Australia, has also prepared a paper detailing the various market barriers together with examples and case studies of each impediment.

SEIA, as the peak industry association, believes that it is uniquely placed to provide the Commission with direct feedback from the 'coal face' of businesses engaged in providing sustainable energy products and services to commercial buildings. As such SEIA offers its services to the Commission and looks forward to be able to work together with the Commission to improve energy efficient performance of commercial buildings in Australia.

Yours sincerely
The Sustainable Energy Industry Association (Australia) Limited

Peter Szental
Director, Policy

Attachments:

1. ***IEAust***: Summary of work by the Institute of Engineers Australia.
2. ***Barriers***: SEIA Aust paper on Market Barriers to the uptake of Building Energy Efficiency
3. ***Case Study2***: Summary of 60 Energy Efficient Lighting Case Studies
4. ***2pagea~1***: Case Study on Lighting Energy Efficiency Best Practice
5. ***1997-art***: Improving Lighting Energy Efficiency in Australian Commercial Buildings: Mandatory v Voluntary Standards
6. ***PC Building Performance Study***: SEIA Submission to the Productivity Commission.

SEIA Australia Response to Productivity Commission Issues Paper

Performance Measures

1. Please refer to the table of Building Initiatives in Australia in the attached paper Market Barriers to the uptake of Building Energy Efficiency.
2. Please refer to the attached article on energy efficient lighting and mandatory building codes.
3. Mandatory Energy reporting in all Commonwealth Government departments is measured in KwHrs/m2/person/year.
4. Standards Australia, the Lighting Controls Association of Victoria, SEIA Australia all recommend KwHrs/m2/year
5. Refer to AEPCA representing the Energy Performance Contracting Industry.

Detailed Energy Usage information is only used in energy management and/or the design and construction of specific buildings only. Benchmarking is used in the Energy Performance Contracting Industry and in some energy audits.

Environmental Performance

Owners, managers and/or tenants do not routinely consider the environmental aspects of building performance due to various market failures and barriers including the failure of electricity pricing to include externalities such as greenhouse gas emissions. Please refer to the attached article.

Energy Performance Contracting is becoming the option of choice for improving energy efficiency and/or environmental building performance. These firms undertake the collection and analysis of energy, water and environmental performance and use this information to implement fixed price turnkey programs for a specific building that ***guaranty*** performance.

Life Cycle Costing

SEIA endorses the use of Life Cycle Costing. Various market barriers impede the uptake of Life Cycle Costing including the failure of electricity pricing to include externalities such as greenhouse gas emissions, owner/tenant split, access to capital and risk. Please refer to the attached article.

Input Savings Technologies

SEIA Australia represents the sustainable energy industry in Australia and as such represents the suppliers of Input Savings Technologies. As such a wide range of products and services are available through SEIA and its member organizations. Please find attached an article on the implementation of state of the art Lighting Energy Efficiency in Energetics Headquarters offices through an Energy Performance Contract as well as a list of more than 60 independently verified ECS Lighting Case Studies.

In general commercial buildings' energy consumption cannot only be improved relatively easily and economically; it also usually produces improvements in facilities. For example, increasing the use of daylight, together with localized lighting controls not only decreases energy consumption, it has been shown to

improve learning rates in schools, increase retail sales and decrease sick building syndrome.

Energy Efficiency measures generally do not represent a major cost component of the construction costs of a commercial building. The impediments to the widespread uptake of energy efficiency in commercial buildings are the market barriers and impediments such as the owner/tenant split. Please refer to the attached paper. In the case of lighting, energy amounts to 55% of the total cost of installing, running and maintaining that lighting system over a 5 year period. However, due to the owner/tenant split, the building owner is concerned with minimizing the initial capital costs while the building tenant is concerned with the ongoing running costs.

Incentives to implement input savings technologies

As the attached article documents, the impact of energy market reform has been to dramatically reduce the uptake of energy savings technologies due to the dramatic increase in payback periods offered by such investments as a direct result of decreases in electricity costs. Please refer to the case studies documenting the deferral of energy efficiency projects. Dollar savings made by end users as a result of energy market reform delivering cheap electricity (actually below the cost of production) have been used to augment short term profits, not to fund investments in energy efficiency.

Demand for energy efficient buildings

There are many examples of the failure of energy prices to include externalities and/or being skewed by various government policies. For example, the economic viability of Remote Area Power Supply Systems and Green Power are both radically altered by the failure of various policies to include the cost of externalities. Green Power is a cheaper source of electricity when externalities are included. RAPS schemes are cheaper than running electricity cables to remote areas. Solar Hot Water is similarly cheaper when externalities are included. Unfortunately, electricity prices do not reflect the true cost of producing that electricity and therefore the market does not make economically rational decisions.

Energy Market Reform has similarly distorted the value of electricity, not only ignoring externalities but also further distorting the market place as competition for market share by the electricity retailers resulted in electricity being sold in below the actual cost of production. The net result of a 35% to 60% reduction in the price of electricity has the effective doubling of payback periods for energy efficient investments.

Demand for energy efficient buildings

Energy Efficient Building Services do cost more to construct and therefore a building owner cannot afford to spend more than his or her competitor on construction costs if that building is to be commercial competitive in the market place in respect of rental values. The tenant is the one who benefits from such building improvements and generally it is left to the tenant to fund such investments.

Further many leases (NSW and the ACT) are gross leases in which electricity costs are included in the total rental figure. This means that the landlord has an incentive to promote energy inefficiency (as the landlord will receive a higher rent) and the tenant has no incentive to reduce energy consumption, as the landlord will receive all the benefits.

There are however several trends working against these impediments. These are the rise of Asset and Facilities Management and also Energy Performance Contracting, especially as the Australian Building Industry concentrates on building refurbishments rather than new building construction.

Impediments to incorporating input savings technologies

SEIA confirms that the adoption of IST's is far form optimal. Information is a serious barrier to the uptake of energy efficiency in commercial buildings. Technical assessment of various proposals is often difficult given the lack of standards and tendering procedures and tender evaluation.

SEIA would caution the Commission against adopting overseas models, especially those emanating from the USA due to the different operating voltages that exist in these countries and the effect this has on the performance of various IST's. Various attempts to resolve these issues have failed in Australia. For example, Standards Australia committee LG13 was established to develop a standard method of evaluating lighting energy savings in non-residential buildings. Unfortunately, this committee was disbanded prior to completing its work.

Energy Performance Contracting has been a market response to overcoming these barriers, in particular, removing the information, risk and evaluation market barriers. NSW DPWS and the Commonwealth government are both developing standard tender and contract documents in conjunction with AEPCA (the Australian Energy Performance Contracting Association). Another information failure relates to training and accreditation of qualified consultants and third party specialists. Finally, the Intellectual Property associated with many IST's covers the evaluation of energy savings initiatives. Please refer to the attached paper.

SEIA also does not support the use of discount rates to account for risk, as the risk is due to an information failure rather than an inherent risk in the particular IST.

Another owner/tenant market failure is that the tenant will have a much shorter time perspective than the building owner. Owners typically look at a building life cycle of 15 to 25 years while a tenant will be concerned with time periods of typically 3 to 5 years.

Budget considerations also act as an impediment as in many cases. Recurrent and capital budgets are often separated resulting in savings made by a capital investment being kept by a department or division other than that which made the investment meaning that the savings are nor available to repay that investment and/or the investing party not being able to receive the benefits of that investment.

Finally, please refer to the attached paper for the impact of the taxation scheme on investment in energy efficiency in commercial buildings. SEIA also directs the Commission to the Australia Institute "Business Tax and the Environment" Paper.

Facilitating the adoption of input savings technologies

SEIA supports Information Programs, Best Practice Demonstration Programs, ***Mandatory*** Building Standards, Market Transformation Activities such as those implemented by SEDA in NSW and of most importance, ***clear signals of leadership and commitment by the Commonwealth Government,*** whose record to date is woeful (refer to the Audit General's reports and to the recent Commonwealth report on Energy Use in Commonwealth Operations).

SEIA also offers its services in improving the availability of information in the market place through various industry development activities by SEIA including the development of a national directory of suppliers of energy efficient products and services in Australia, self-accreditation and training programs.

Case Studies

Please refer to the attached paper for various case studies and examples, particularly the one relating to the failure of the Department of Prime Minister and Cabinet to implement energy efficiency in its own building.

This paper attempts to address the key aspects of the interface between the building /building services industry and the energy marketplace. It identifies some of the major barriers and makes recommendations on appropriate initiatives that could be taken in the short-long term. In a paper such as this it is impossible to address all issues so it focuses on those which are thought to have the greatest impact and to be the most politically achievable

The problems

Barriers to a greater uptake of sustainable energy solutions fall into two main categories, Government and Market. While they are very inter-dependant, there are specific actions required in each to remove the major impediments.

In addressing the barriers, it is also worth restating some fundamental assumptions of what a more sustainable energy future in the interface between the building/building services industry and the energy marketplace involves. Specifically, the goal of moving towards energy neutral buildings requires explicit acknowledgement/restating that consumers of energy in buildings do not seek "energy" (predominantly electricity) as the end product which they wish to purchase but rather the service which the energy delivers. Accordingly, the barriers which need to be removed are those which impede the uptake of the appropriate products, technologies and services which enable different energy modes to most sustainably do the specific job required - for example, solar thermal energy for water heating; gas for cooking; heat exchange and cogeneration where appropriate; solar photovoltaics for electricity; passive design in buildings and energy efficiency for energy tasks to be delivered from the network grid.

Federal Government

Energy market competition

By far the biggest immediate barrier is the push for energy market reform with little, or no consideration of the impact such reform has on sustainability issues. As far as can be determined there is no proven long-term advantage from the reform process that can compensate for the loss of opportunity to improve the efficiency of energy use. (insert data from IEA) Refer the case study in the Appendix (insert ECS case study). Low energy prices certainly provide short-term cost saving benefits to consumers, but within a few years prices will return to pre-competition levels (they are already starting to do so) and customers will have little ongoing advantage. *The ESAA anticipates that the current low electricity prices will adjust and begin to rise well above current levels within 3-5 years. Energy efficiency initiatives and performance contracts require at least a five year contract period within which to demonstrate their savings, yet the current sales/contracting arrangements which structurally predominate in electricity sales fail to require any explicit statement of projected electricity prices over that time frame. As a result a rational comparison of the options are not made available to consumers.*

The fact that energy suppliers are able to offer their product to the market at just the marginal cost of production, without including any of the associated

societal or environmental costs, totally **distorts** customers buying decisions in favour of the status-quo. Electricity generators and retailers are therefore subsidised by the whole community - *a subsidy which could be made more explicit to consumers, particularly in relation to the cost viability of systems such as photovoltaics or solar hot water systems, which displace externality costs.*
Currently retailers have complete freedom to set electricity prices, subject only to an overview by IPART. Typically 30 – 40% of the total charge is based on demand, not energy, so the effective cost of energy, which is what creates greenhouse emissions, is discounted by this amount.

Lack of Demonstrable Leadership

There are many examples in Australia and overseas of initial mandatory requirements successfully changing community attitudes. *Cultural change requires leadership and directional signals to be given of the directions in which we need to head*. Examples such as the wearing of seatbelts in cars, and helmets on motor cycles, where initial community reaction was muted reluctance or grudging acceptance but is now full hearted support. There is no evidence that the Government sees any need to use its powers to mandate any initial requirements for sustainable activity. Indeed the original statement in response to the Kyoto conference specifically refers to encouraging voluntary energy efficiency standards in buildings. Yet most members of the building industry, including the Australian Building Energy Council, support the use of some mandatory requirements, as stated in the ABEC submission to Minister Hill on 16 December 1998.

Inappropriate Financial Analysis

Government typically takes the politically most expedient path is assessing the merits of proposals such as the construction of a new power station or the extension of a grid. *There needs to be a change of focus so that providing energy as such is not the issue, but rather, satisfying specific energy needs/outcomes becomes the focus.* This would entail looking at the full-cycle cost of satisfying energy service needs, so that energy-efficiency and distributed energy supply options gain appropriate recognition. For example a 100 watt light globe does not just cost a dollar. The power generation and supply infrastructure to run it costs from $100 to $500. Replacing the 100 W globe with a 20 W compact fluorescent lamp costing $15 can save $80 to $400 in supply capacity. A typical CBD office building might have a maximum demand of 800 KW with a supply cost up to $4 million; using ESD principles might reduce this to 500 KW at a saving of $1.5 million.

The problem is, in current structures, the developer has to pay for the ESD to generate the savings for the community, whether investing in energy efficiency or other capital investments which displace hidden capital costs of conventional grid sourced electricity – there are not many altruistic developers in the world! Accordingly, appropriate financial analysis needs to redress the structural advantages enjoyed by traditional energy sources and infrastructures, and address the structural disadvantages experienced by demand management, renewable and other sustainable energy sources and their delivery systems.

State and Local Government

Building approvals

Most state or local governments have building approvals processes in place for structural, fire and plumbing issues but few have similar requirements for energy or ESD in general. Of those that do, few apply them properly. Refer case study in the Appendix (insert RT case study). *Given the diversity of sustainable energy appliances and technologies which could readily be mainstreamed, many in local and state government are potentially unaware of how existing standards and approvals processes implicitly militate against the uptake of sustainable energy innovations, as the approvals processes have been written without attention to energy or ESD and/or are applied with a mindset that assumes existing conventional grid based energy and building conventions provide for optimal outcomes.*

An approval process can be the point at which poor designs are stopped before they become real buildings, but the **value** of such processes, properly applied, is not yet appreciated.

Cities for Climate Change provides a framework for potential further action in this area, however the importance of the approvals process as a driver for change and the delivery of real benefits needs to be more explicitly stated and mechanisms developed to ensure that action is comprehensively taken.

Marketplace

Split Responsibilities

Perhaps the single biggest barrier to good building design is the delivery mechanisms used in Australia to create our built environment. It applies to both residential and commercial buildings and shows little signs of change without external influence.

This mechanism is the "Developer" building. Whether it is a new housing estate, an industrial park or a major CBD office tower, there is usually a line of responsibility that follows the path Developer – Financier – Designers – Purchaser – Occupant.

In residential, and occasionally in other buildings, the Purchaser and Occupant are the same. More usually in the commercial/Industrial sectors, the Occupant is not the Purchaser but a tenant.

In both cases however, the people who build the facility and pay the initial costs to build it are not those who pay the on-going energy costs of occupancy. There is thus no incentive for the developer to put more effort into achieving a good design, and the occupant has no ability to change a building he doesn't own. The inevitable result is what we see all around us – badly designed building wasting resources for the next 50 – 100 years because the **process** doesn't allow any other outcome.

Reinventing procurement, design and operational practices and responsibilities is critical. Voluntary and mandatory codes, new commissioning and occupant contracts incorporating energy performance contracting and incentives to better articulate and share life cost responsibilities and cost saving opportunities are part of the reinvention required.

Lack of Market Knowledge

Because sustainable issues are not mainstream there is very little opportunity for knowledge to flow to the people who might be able to make a difference. This is true for:

- educational facilities – where universities and TAFE's have little or no formal course in ESD for building professionals
- *general public – where most information is from Utilities who promote "flavour of the month" fad products, which often give wrong (e.g. that green power "is" more expensive) and/or inconsistent messages (e.g.. a suite of sustainable energy product services, such as energy efficiency, isn't offered)*
- Governments at all levels – who do not have information transfer as one of their deliverables
- *Industry - e.g.. Quantity surveyors and Facilities Planners and Managers - who are not 'fed' the full range of energy product services which could offer capital and operating cost benefits.*

As a consequence, not only do the decision makers not make the correct choices, when approached with offers of assistance they fail to see the value and reject the offers.

Lack of Objective Measurements for Comparisons

There is a lack of data and of credible benchmarked performance comparisons to allow a prospective designer/purchaser/occupant to assess how well a building compares against some baseline. There have been thousands of energy audits done over the past 10 years but no attempt to make any sense of the information; on other SED issues there has been hardly any work done at all. *In recent years, schemes to develop a body of energy auditing professionals and standards of best practice have been deprived of funding, retarding mainstreaming and improvement of this critical area of industry development and innovation.*

As a consequence even someone who wants to do the right thing has difficulty knowing what "the right thing" is.

There is a need for comprehensive data collection, analysis and definition to develop guidelines for ESD so realistic targets can be set, against which actual results can be compared.

There is also a need for Australian case studies and demonstrations of technologies. While there are many examples of successful ESD buildings overseas these are often not applicable here. Even when they are Clients are reluctant to be the first to try something here. Private sector developers are very risk averse and there is a clear role for *Government to show leadership by*

committing to "risky" strategies if necessary - through their own building projects and assets, and by providing incentives and rewards for private sector innovation which may entail "risks" (either technical or financial, given the structural advantages enjoyed by the non-risky current mainstream).

Inconsistencies in Investment Criteria

It is a fact that the financial criteria established for investment decisions in, say, a power station are very different from those for investment in energy efficiency. Consumers generally apply much tougher financial criteria to investment in energy efficiency than energy suppliers apply to their investments, so information, incentives and/or regulations may be necessary for optimum take-up of end-use energy options: consumers often apply discount rates of 30 to 50% to savings from investments in energy efficiency, while energy suppliers use much lower discount rates of 10-15%.

On the question of investment, it is worth posing the question of who should be undertaking investment in innovative, potentially risky technologies, systems or forms of contracting.?

Competitive Design Environment

There is a lot of pressure on designers to reduce their fees, almost below costs. 30 years ago a M&E consultant would be paid about 6% of the cost of the works he designed, now he might get 1 _ - 2%. This reduction has been brought about by developers looking to reduce costs and seeing no value in designers reviewing options, considering the implications of design decisions, and looking for optimum solutions. *The goal for developers is thus often too low - a new building only needs to perform as well as the last, but perhaps it look different.*

The consequence is the abundance of identical buildings sprouting all over Australia with no regard to where they are located or what they are intended to do.

Reinventing the design, procurement and operational processes and contractual arrangements needs to address what has become a "mainstream" competitive environment which is geared to delivering lowest common denominator outcomes. The importance of good, site specific, locally pertinent design needs to be articulated and promoted, and rewarded through new contractual and incentive arrangements for the various stakeholders in the design, delivery and use chain.

Attitudes to Risk

The developers reluctance to accept risk has been mentioned in *Lack of Objective Measurements for Comparisons* but he is not alone. Australian business managers generally are totally risk averse, witness our failure to invest in homegrown new technologies, and lack of support of local inventions, all of which end up making a fortune for their overseas financiers. Venture capital financiers from overseas are

happy if 2 out of 10 investments are a winner, here we want 10 out of 10.

This, at least in part, explains the failure to date of Energy Performance Contracting to take off in Australia. EPC's are all about sharing risk, the more risk the contractor can pass to the client the lower his price can be, and the successful contracts overseas have a significant "partnering" element to them in which the client understands that the outcome may not be what he initially expected.

Here, our Governments have been locked into a process of developing a contract structure which passes all the risk to the contractor, where the client takes none at all, and the Industry doesn't like it. *Overseas (see the LEED scheme recommendations on alternative contracting structures) new commercial contracting arrangements have been developed to better enable the sharing of responsibilities and rewards accruing from EPC's.*

As a result, *in Australia,* the only successful EPC's to date have been relatively simple ones dealing with issues that are clear cut, like lighting. More complex EPC's, covering a wide range of energy end uses, have not been successful.

Renewable Technologies

The only realistic renewables technology which can be installed in distributed locations to replace central generation is solar.

Australia should have the highest installed solar water heating in the world, but we don't, because the initial capital cost is higher and there has been no Govt. programs to enforce it. Once again the wrong cost focus is to blame (see *Inappropriate Financial Analysis*). All residential and almost all the DHW needs of commercial properties could be met with current solar water heating technology.

PV is another matter. Residential PV can easily meet the energy needs of all residential developments other than, perhaps, high rise luxury apartments. Commercial buildings have a much higher energy density (MJ or KWh per sq.m.) and it is not likely that their needs can be met in the foreseeable future from building integrated PV alone. *A holistic approach to sustainable energy innovation targeting the goal of energy neutrality, could however make substantial inroads on reversing this situation in commercial buildings, via energy efficiency and the application of a range of renewable/sustainable modes of energy generation located on, in or near large buildings.*

However, given that residential energy use is about double that of commercial, perhaps the right *initial* approach is to focus on the area with the highest impact.

The problems here are:

- there is not yet a reliable, commercially available and easy to install package of PV array and all the other necessary equipment, approved by all Authorities and with grid connection and feedback process already in place. You can't just go and buy a "PV System" and have an installer fit it for you, and know that it will all work and that there will be no hassles from the Utility.
- inappropriate economics appears to show that the capital cost is so high that it takes perhaps 12 years for residential water heating and more than 20 years for PV to recover the cost. No one can be expected to invest under these outcomes.

Engendering Coherence - Critique Of Incoherence Of Current 'Whole Of Government' Approach: A Lack Of Demonstrable Leadership

This section identifies areas of government wherein the lack of coherence and commitment to ESD and energy innovation is most apparent. It is focused on particular areas wherein confusing and/or contradictory messages are most apparently confusing the marketplace or inscribing long-term infrastructures, which are inconsistent with sustainable energy buildings.

Opportunities for governments in various areas include (i) public buildings energy management and procurement practices, (ii) performance based rather than fee based initiatives, (iii) education and body of knowledge issues, iv) industry development and employment creation, and (iv) relation to innovation policy.

There are more than a dozen current initiatives in this area. This fragmented approach acts as a barrier in its own right to progress in implementing energy efficiency in Australian buildings. Reference should also be made to the following Organizations and their work.

	BUILDING EE PROJECTS
ABEC	1. Voluntary Code of Practice for Energy Efficient Building Design
SEDA	1. Commercial Building Greenhouse Rating Scheme 2. Energy Smart Business 3. Energy Smart Housing programs
AGO	1. Baseline Study for the BCA 2. Greenhouse Challenge program 3. Energy Market Reform Study 4. MEPS for various items of equipment
Energy Efficiency Victoria	1. Energy Smart Commercial Building Program
Productivity Commission	1. Study Commercial Buildings: Improving the Future Performance of Buildings
Standards Australia Committee	1. EN/3
IEAust	1. National Sustainability Framework Task Force on Building and Construction
MBA	1. Energy Efficiency Awards
Energy and Water Utilities	1. Demand Side Management programs
HIA	1. PATHE
RAIA	1. Education programs, Environment Design Guide 2.

Examples of Barriers at Work

1. Reserve Bank announced in 1998 that it was entering into long-term lease for office accommodation in Sydney. ECS approached the Reserve Bank with sustainable energy alternatives to a conventional lighting system design for incorporation into the tenancy fitout. As initial reactions from the Bank were favourable, ECS prepared detailed proposals for evaluation by the Bank's electrical consultants. After detail discussions ECS were able to comply with the technical and financial requirements of the end-users and the consulting engineers and the proposal was incorporated into the tender documents.

   At the same time, the Reserve Bank entered into negotiations with several electricity retailers in the newly contestable energy market in NSW. As a result of the price competition for market share by these electricity retailers, the Bank was able to negotiated short-term contracts at less than the cost of production: the initial cost of energy was reduced from 9.8cents per KwHr which to 4.194 cents per KwHr with no demand charge, a decrease of 47%.

   As a result of the decrease in the cost of electricity, the 3 year simple payback period increased to approximately 5 years and the proposal failed the end-users' financial hurdle despite the fact that the savings applied for the period of the lease (10 years) while the electricity supply contracts were for 1 to 2 years only.

   As a result the project did not proceed and the energy efficiency measures were not implemented and greenhouse gas emissions reductions were not achieved. To retrofit these energy efficiency works at a later date will be substantially more expensive. ECS were left with to bear the full cost of the engineering for the design work.

   The net result of the Reform of the Electricity Market in this case is that a Commonwealth Government body chose to follow the logical conclusion of energy market reform and failed to implement energy efficiency in its operations rather than leading by example and implementing stated government policies.

   This example highlights the fact that Greenhouse Gas Emission Reductions are achieved through Energy Efficiency and/or Renewable Energy. Therefore GHG Reductions must involve establishing methods of increasing the uptake of Energy Efficiency and/or Renewable Energy. The existing energy market reform has acted to impede the uptake of Energy Efficiency and/or Renewable Energy

2. The Federal Government has long acknowledged the need for energy efficiency standards for non-residential buildings. However, it has also failed to produce such standards despite a number of failed attempts including CBEC and ABEC, which failed to produce a final draft after 4

years work. Despite its stated promise to implement mandatory standards should the voluntary approach fail, the Commonwealth Government is supporting a voluntary approach to non-residential efficiency standards under development by the Australian Building Energy Council, despite that bodies recommendation for a mandatory approach.

The Commonwealth's support of this process also creates a conflict with its own mandatory energy reporting program in that Commonwealth program uses energy use per year per area per person while the Australian Building Energy Council approach uses power (watts per square meter).

3. In April 1998 the Commonwealth Government published its Energy Efficiency Policy "Measures for Improving Energy Efficiency in Commonwealth Operations" This involved Energy Intensity Targets, to be met by 2002/3, of 25% using 1992/3 as the base year. It also stated that "all buildings space is to be energy audited regularly and all cost effective recommendations implemented" and that "All building space must be energy audited within one year of occupancy and thereafter at intervals of not exceeding 5 years. Measures shall be considered cost effective if they have an IRR of 15% or better when calculated over the estimated period of occupancy, the life of the equipment involved or 7 years, whichever is the lesser."

   Energy Consumption data for the Commonwealth Government for the period 1997/98 shows energy consumption running at an average of 13,534 MJ/person/pa compared to the Target of 10,000 MJ/person/pa i.e. actual energy consumption is ***35% greater*** than target.

4. Subsidies are available for the Coal and Mining Industries such as the Aluminum Industry but the Commonwealth Government refuses to use this instrument to achieve its policy targets in the sustainable energy industry. Of course this represents one of the faces of real politics in that the Coal and Mining Industries provide heavy financial support to the coalition parties during elections and as such as significantly greater persuasive powers when it comes time for financial help from the elected government of the day.

5. The total absence of Industry Development activities by DIST (or any other government department) means that there is no effort to build an industry capable of delivering the outcomes the Commonwealth Government claims it wants to achieve. For example: the Commonwealth Government failed to support the DIST Energy Management Industry Working Group after several initial meetings. However, it refuses to disband the Group preferring instead to maintain the Group on paper without funding.

6. The failure of the Energy Market Reform Study, conducted by the Allen Group on behalf of the Department of Primary Industry and Energy, to consult SEIA Australia (the industry association representing the industry

directly affected by the reform of the Energy Market.) undermines all credibility this study may have with the industry it purports to study.

7. The Commonwealth Government has failed to address one of the consequences of reform of the electricity market: the disincentive for electricity producers to reduce greenhouse gas emissions since this simply adds to the costs of producing electricity making that producer less competitive than other producers. In a similar manner, the Commonwealth Government has failed to address the disincentive for electricity retailers to introduce end use energy efficiency since this leads to a decrease in their sales of electricity and hence their profits i.e. energy market reform has resulted in a basic conflict between the primary mission of electricity retailers to increase the use of electricity rather than to save electricity or reduce the consumption of electricity through implementing increased energy efficiency. Finally the Commonwealth Government has failed to address the different rules under which electricity retailers operate in different States. For example, Greenhouse Emission Reductions have been mandated in NSW for electricity retailers. However the absence of similar rules for electricity retailers in other states means that NSW retailers are at a disadvantage in the market place compared to other retailers and this also sends wrong signals to the market in that NSW retailers appear to be less competitive in the deregulated national electricity market. It should also be noted that this also increases business overhead costs as a result of different regulations in different states

8. Charging more for Greenpower (electricity from renewable sources) sends the wrong signal to the community in that renewable energy is more expensive when in fact it is cheaper ***if*** the total cost of production and transmission are considered, including most importantly, the cost of greenhouse gas emissions. Also the cost of renewable energy is artificially high due to the market barriers acting to restrict the uptake of renewable energy. Finally the cheaper cost of coal based electricity sends the signal to the market place that it is not a scarce resource compared to electricity produced from renewable sources.

9. The Department of Prime Minister and Cabinet (PM&C) has refused to consider energy efficiency measures in its own office accommodation. This is justified on the basis that it intends to sell the building it currently occupies in several years time and therefore will not be able recoup the investment in energy efficiency. This is despite the fact that the Department will commit to a long-term lease of the building from the new owner and hence will benefit from any energy efficiency measures implemented in the building prior to its sale. The Department of Finance and the AGO have recommended that an Energy Performance Contract be implemented in the PM&C building as a demonstration of Energy Performance Contracting in Commonwealth operations and as showing leadership and commitment to the stated policy of the commonwealth government of implementing energy efficiency improvements in commonwealth operations through Energy Performance Contracting i.e.

its refusal to lead by example actually undermines all credibility it may have in the sustainable energy arena.

10. NSW government claim leadership in sustainable energy in Australia, in particular with the creation of SEDA. NSW Government released its Energy Management Policy in 1998 (ISBM0731392124) in which it commits to saving 15% and 25% of its 1995/6 total energy use within specified time frames. The same NSW Government also recently published energy use in its own operations for the period 1997/98. When questioned about energy use for the 1997/98 period, the Director General of the Department of Energy admits that energy consumption data for 1995/6 is unavailable and hence the NSW Government cannot quantify the targets it claims it is committed to. It also means that its performance cannot be measured and monitored. This same government however insists on the wider community adhering to strict Monitoring and Verification guidelines for reducing energy use and associated greenhouse gas emissions.

11. Research into Sustainable Energy has been reduced significantly with the Commonwealth abolishing the Commonwealth Energy Research Development Corporation. The Federal Government also "rationalized" the National Energy Efficiency Program, reducing Commonwealth expenditure on the Sustainable Energy Industry by approximately $50m per year. This runs contrary to the stated aim of the Commonwealth Government to increase the use of renewable energy sources and the uptake of energy efficiency in order to reduce Australia's Greenhouse Gas Emissions.

12. The GST will have a negative impact on sustainable energy products and services. Currently sustainable energy products and services are currently exempt from sales tax and hence will experience the full impact of the GST. SEIA Australia has estimated that the implementation of a GST will result prices for sustainable energy products and services rising 9%. However competing conventional products and services are subject to sales tax and hence prices will not be severely effected and in many cases will actually reduce. For example, SEIA Australia estimates that the cost of Solar Water Heaters will increase approximately 10% as a result of a GST while electric and gas water heater prices may actually fall.

    The Australia Institute GST Report concludes that the GST will cause deterioration in urban air quality and compromise Australia's Greenhouse Gas reduction efforts. The Report estimates that the GST will increase CO2 emissions by 5 million tonnes per year. This compares with the 2% Renewable Targets which aims to reduce Co2 emissions by 5.5million tonnes per year i.e. the Australia Institute estimates that the GST will effectively undo virtually all the gains made by the 2% Renewables Target, the centre piece of the Commonwealth Government Greenhouse Response Strategy.

    A GST increases the barriers to commercialization of RD&D and industrial innovation by increasing the price of emerging products and services sold to

final consumers relative to established ones. It is also likely to discourage new entries to retailing and distribution, making innovators more dependent on existing distribution and sales networks, which is often inappropriate. Australia already suffers from a low level of commercialization of innovation: a GST will exacerbate this critical problem.

So a GST tends to disadvantage the rapidly growing, employment intensive and less environmentally-damaging service industries and light manufacturing - including sustainable energy industries, and advantage resource-based and heavy manufacturing industries which comprise a relatively small component of Australia's economy and have much less long-term growth potential.

Focusing taxation reform on a GST places Governments in a policy straightjacket, and misses many opportunities for constructive taxation reform that could create greater employment growth, encourage long-term investment, promote RD&D and commercialization of innovation, and reduce environmental impacts. These include introduction of 'ecotaxes' with part of the resulting revenue offsetting elements of the cost of labour inputs to business, such as cutting payroll tax and rebating employer contributions to mandatory superannuation.
The sustainable energy industry will be adversely affected in several ways.

First, it sells a higher proportion of its product to final consumers and has a higher service-related component in its costs than conventional energy suppliers. Final consumers will be charged GST, but businesses will be exempt, so sustainable energy industries will be disproportionately impacted.

Second, potential customers will be comparing a significant GST-driven increase in up-front cost of sustainable energy options against future increased conventional energy costs - which are heavily discounted by most decisionmakers. And conventional energy suppliers can manipulate tariff structures to obscure price increases - for example by raising fixed supply charges instead of the unit price of energy.

Third, a number of sustainable energy technologies will lose existing sales tax exemptions but will be liable to a GST. Their competitors will experience price increases equivalent to the difference between sales tax and the GST. The sustainable energy technologies will experience the full impact of the GST.

Fourth, any special treatment of diesel fuel would also disadvantage sustainable energy systems that compete with diesel-fueled power generation and transport equipment.

The claimed benefits of the Government's tax package for the service sector and advanced manufacturing come from two sources. First, a number of stimulatory measures are proposed to soften the impact of the GST on some

groups: such measures could be introduced without a GST, and may only have transient impacts. Second, the indirect effect of higher spending by individuals with increased disposable income is supposed to benefit the services sector. But will people spend this money on sustainable energy systems, or will they buy imported consumer goods and buy services such as cable TV? Thus, there is no guarantee that the negative impact of the GST on the sustainable energy industries will be reduced by the other elements of the Government's tax package.

13. The failure of the voluntary Federal Government programs is well documented. The Auditor General has reported on the Commonwealth Government National Energy Management Program (Report #47 "Energy Management of Commonwealth Government Buildings") as has the House Standing Committee on the Environment. The Auditor General has also documented the failure of the voluntary National Greenhouse Response Strategy (Report #32 "Implementation of an Interim Greenhouse Response Strategy").

    Further evidence of the failure of Australia's voluntary programs (together with a failure to implement a wider range of more stringent programs) is provided by Kim Donaldson in the ABARE report of April 1997 "Australian energy production and use" by who concludes:

    > "Based on these figures, (compound growth [of electricity] of 2.5% from 1990 to 1997 and 2.1 % form 1998 to 2010) electricity consumption will have increased over 50% by 2010 compared to the target of stabilization at 1990 levels! Even this disastrous consequence for Australia relies on "improvements in energy efficiency"

14. Application by Transgrid/Energy Australia to upgrade the Sydney CBD network through the provision of more cables and substations which will result in an additional 1million tonnes of CO2 emissions. Also the National Electricity Code is under review to include the net public benefit test i.e. including externalities.

15. Moves by the Commonwealth Government to include coal seam methane and cogeneration in the commitment by the Commonwealth Government to source an extra 2% of electricity supply from renewable energy sources. This sends conflicting signals about the commitment to renewable energy, as coal methane is a fossil fuel. It also contradicts the recommendations of the Commonwealth's own Australian greenhouse Office Working Group. The inclusion of coal methane will also undermine Australia's Greenhouse Response Strategy

16. The Living Cities program announced as part of the Coalition Government's environment policy has allocated $16m to reduce air pollution in major cities while at the same time it announced a 25cents per litre cut to diesel prices as part of the GST package which will result in

increased concentrations of pollutants including an increase of 2.2 thousand tonnes annually from transport alone and oxides of sulfur are predicted to increase by 5.1 thousand tonnes. It is also predicted that the increase in the excise will remove the prices advantage of gas as a transport fuel compared to diesel resulting in a removal of the incentive to convert to gas powered transport. This is in direct contradiction to the Coalition Government's policy to provide increased funding for gas filling stations.

17. The same Coalition Government rejects subsidies as a policy tool for the sustainable energy industry provides subsidies to other industries and technologies including medical technology, Aluminum, agriculture, etc..

Improving Lighting Energy Efficiency in Australian Commercial Buildings: Mandatory v Voluntary Standards

Peter Szental, B.A., B.Sc., M.B.A., M.I.E.A., F.A.I.E., M.I.E.S.
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Introduction

According to the Electricity Supply Association of Australia, Australia spent over $12 Billion on electricity purchases in the year to June 1993. The Lighting Controls Association of Australia has estimated that lighting accounts for more than $4 Billion of this. This is equivalent to approximately 40 million tonnes of CO2 per year.

Energy Efficient Lighting and Lighting Controls can save over $1 Billion per year of this expenditure, improving Australia's international competitiveness, reducing green house gas emissions and creating a multi-billion dollar industry with the associated benefits of job creation, exports and wealth creation. The implementation of Energy Efficient Lighting and Lighting Controls in Australia will also reduce green house gas emissions by more than 10 million tonnes of CO2 per year.

Such a program would also achieve Commonwealth commitments contained in the recently announced Australian Government Greenhouse 21C: A Plan Of Action For A Sustainable Future. Key Initiatives include a 15 million tonnes reduction in Greenhouse Gas Emissions by the 2000, an integrated strategy for Commonwealth delivery of energy efficiency and Industry Co-operative Action Agreements. These commitments are all to real given that the Kyoto Climate Change Convention meeting looms next month with key policy initiatives expected to include mandatory targets.

The Failure of Voluntary Standards, Codes and Programs

The Australian Experience

The following figures indicate the failure of the Government's Greenhouse Gas Challenge, involving ***voluntary*** emission reductions by companies:

- The Commonwealth Minister for the Environment, Senator Hill released figures on the 26th of September 1997 that showed Australia's Greenhouse Gas emissions rose 6% over the 5 year period form 1990 to 1995.
- The Steering Committee of the Climate Change Study of the Institute of Engineers Australia has suggested that Australia's excess emissions of CO2 will be approximately 10 million tonnes per year by 2000. (Engineers Australia June 1997).

Failure of these voluntary programs means that Australia will also fail its international commitments. This is increasing international pressure on Australia and threatens Australia's international standing. The penalties for failure are indeed high. The current environmental catastrophe in Indonesia, effecting the

health of over 70 million people in 6 nations and also threatening as an economic disaster for the region, illustrates how climate change is an international issue with the gravest of consequences.

Australia's international standing is affected when the Prime Minister, Mr. Howard states that the result of Australia winding back its CO2 emissions to 1990 levels would be 90,000 job losses plus a doubling of the cost of petrol and electricity while ABARE and the Industry Commission figures show that 50,000 more jobs will be created. These false arguments and figures recently prompted the US Undersecretary of State for Global Affairs, Mr. Tim Wirth, when referring to Australia's economic modeling and the impact of greenhouse gas reductions to ask "...what those people are smoking".

The Federal Government earlier this year "rationalized" the National Energy Efficiency Program and abolishing ERDC. In light of the above, the $50m saved each year does not seem a reasonable trade off compared to the potential of $300m per year penalties and possible international Sanctions on Australian Coal Exports estimated by the Institute of Engineers Australia.

In Australia, the failure of the voluntary Federal Government programs are well documented. The Auditor General has reported on the Commonwealth Government National Energy Management Program (Report #47 "Energy Management of Commonwealth Government Buildings") as has the House Standing Committee on the Environment. The Auditor General has also documented the failure of the voluntary National Greenhouse Response Strategy (Report #32 "Implementation of an Interim Greenhouse Response Strategy"). The failure of the voluntary Greenhouse Gas Challenge has been discussed above. Finally, the proposed voluntary Building Energy Code of Australia has failed to produce a final draft after 4 years work.

Further evidence of the failure of Australia's voluntary programs (together with a failure to implement a wider range of more stringent programs) is provided by Kim Donaldson in the ABARE report of April 1997 "Australian energy production and use" by who concludes:

> "Based on these figures, (compound growth [of electricity] of 2.5% from 1990 to 1997 and 2.1 % form 1998 to 2010) electricity consumption will have increased over 50% by 2010 compared to the target of stabilization at 1990 levels! Even this disastrous consequence for Australia relies on "improvements in energy efficiency"

The International Experience

Over the past 2 decades or more, governments in both developing and developed countries have initiated polices to reduce energy consumption in buildings. Building Codes or Standards range from voluntary guidelines to mandatory requirements. A survey of standards around the world by K. B. Janda & J. F. Busch ("Worldwide Status of Energy Standards for Buildings", Energy Analysis Program, Lawrence Berkeley Laboratory, published in Energy Volume 19, No. 1, pp27-44, 1994) reveals that 27 countries have mandatory energy standards (approvals and/or penalties) while only 11 have voluntary standards. i.e.

internationally, countries have chosen mandatory standards at a rate of more than two to one.

The article concludes that “countries with existing building energy standards, such as Sweden, are increasing their technical stringency, while others are making their legal status stronger. ..... Such national and international initiatives suggest that the question about energy standards for the future is not *whether* governments will regulate building design to limit energy consumption but in what ways and by how much”. This supports the commonly held view that mandatory and/or binding targets will be the likely outcome of the Kyoto Climate Change Convention meeting scheduled for December 1997. And Mandatory Standards and/or Codes would seem a logical consequence of this.

Finally, the Sustainable Energy Industry Association of Australia (SEICA) has recommended a Mandatory National Commercial Building Energy Code, Mandatory Minimum Energy Performance Standards and Mandatory Energy Consumption Targets for Government Owned and Occupied premises. Such Mandatory Standards for commercial buildings have been proven to be effective in a number around the world over a number of years without negative impacts on the economy or the building sector.

Of course, “without appropriate educational programs and implementation mechanisms for the construction community, mandatory standards will not save energy.”

Market Failures

There are a number of impediments to the market delivering the desired policy outcomes. These impediments are what cause for the failure of voluntary programs. The following groupings of market failures are based on articles by P. Harrington for the EMFT for the Australian and New Zealand Minerals and Energy Council “Improving Energy Efficiency in Australian Commercial Buildings” and on the ESAA IRP Management Committee report “Least Cost Energy Services for Australia, 1994”.

Information Market Failure

Cost effective opportunities for investing in improved energy efficiency are not made because the decision makers do not have access to the appropriate information. Of course, if they are not aware of the information they are also unaware of the value of this information to them. This information failure includes

- a lack of standards for evaluating technical and system performance and the risks associated with the project (e.g. the incomplete work of Standards Australia Sub-committee LG13 “Evaluating of Energy Savings in Interior Lighting”)
- electricity prices not reflecting the true or full costs of production and transmission
- unequal market access to end users by energy efficiency industries compared to the electricity retailers

- a lack of information on the energy efficiency performance of products and/or appliances
- a lack of benchmark performance indices and historic data base

The clearest example is the price of electricity, which does not reflect all the costs associated with producing that electricity i.e. the external costs of energy use are not internalised in the decision making process. These external costs include environmental impacts such as CO2 and greenhouse gas emission, acid rain, and EMI from high voltage transmission lines and transformers.

Today the market is delivering electricity at prices below the cost of production as competition between electricity retailers fight for market share in the new deregulate electricity industry. This conveys the wrong signals to the market - cheap electricity encourages increased use and discourages investment in energy efficiency and greenhouse gas emission reductions because end users face longer payback periods. Also, while the profit levels of the electricity retailers are linked to sales of electricity, these retailers have an incentive not to reduce energy consumption.

Split Incentives

Because building developers and/or owners in many cases are not responsible for the energy consumption of a building over its lifetime, they will not be able to recover all or part of any investment in energy efficiency. This is particularly the case where a series of end users or tenants will gain the benefits of any such investment. This routinely acts as a major impediment to improved energy efficiency in the non-residential building sector.

This split between building occupant or tenant and building owner is also a major impediment to the effectiveness of voluntary codes or standards - competition will always force an owner or developer to delete such investments in order to be price competitive.

It should be noted that this split incentive is also at work impeding invest in Demand Management programs. The electricity generator gains the benefits (reduced load demand) while the electricity retailer pays for the investment.

Industry Structure

The energy efficiency industry suffers from barriers to market entry in that they are small and diverse compared to the large electricity utilities.

This means that they do not have equal access to financial, political and market resources, suffer from a lack of trained human resources, tax anomalies (sales tax, cross subsidization, tariffs, rebates, etc.), lack of R&D and finally, import duties on components act as a barrier to local manufacture.

The electricity market will only be a truly competitive market when financial returns from energy efficiency investments reflect such externalities such as reduced greenhouse gas emissions. This must also be seen to work from an international trade perspective with different countries applying different standards and policies and with the opportunities to export CO2 emissions.

These factors result in a failure of the market to invest in energy efficiency projects and to reduce greenhouse gas emissions in a voluntary manner.

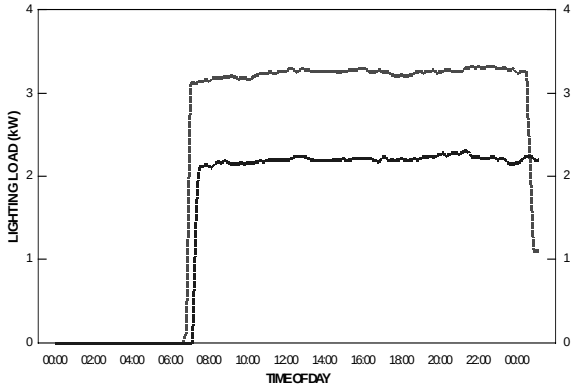
Toward a Sustainable Energy Building Code

Power v Energy: W/m2 or kWh/m2/Year?

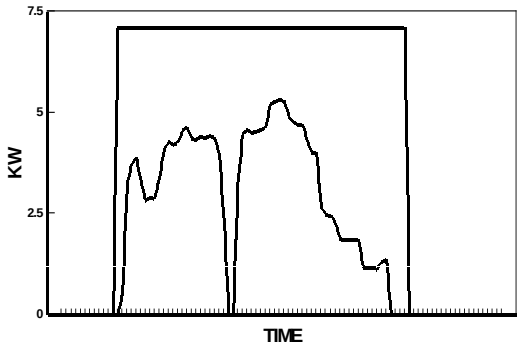
Energy is the amount of power multiplied by the time that power is used, i.e. the unit of energy is Watt Hours, not Watts. Energy Reduction involves both the power density and the time that power is used for. Therefore the use of Watts per Square Meter, which does not include the time element, only addresses power reduction, not energy reduction, i.e. it only tackles half the problem.

Building codes around the world reflect this by also considering the time that the energy is used. This approach has been used in the UK (CIBSE Code), Australia (AS 1680 Lighting Code), Singapore (new draft Building Energy Code) and the Netherlands (Building Energy Performance Regulations). Please see the summary in the next section.

The following two case studies illustrate Load Reduction and Time of Use Savings Strategies in different applications:



Load Reduction: Supermarket Lighting

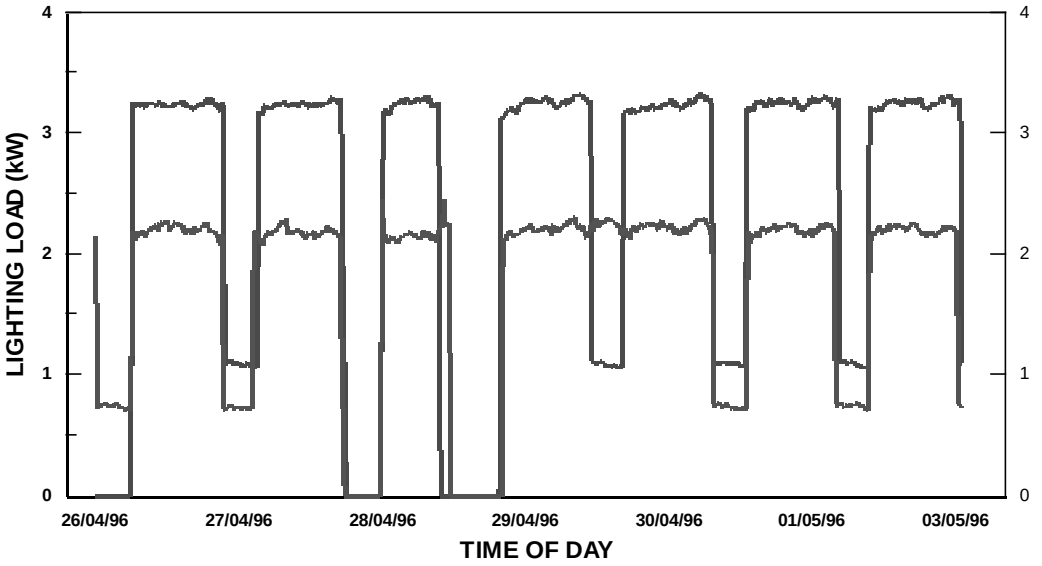


Time of Use Control: Office Lighting

The pre and post monitoring results of a supermarket in Eaglevale, NSW on the following page illustrates what can happen when load reduction strategies are implemented without considering the time that the reduced load will be running. In the case of this supermarket, the lighting was left ON all night on the evening of

the 29th of April, 1996, thereby defeating energy savings achieved through the load reduction strategy.

In summary, Load Reduction Strategies are concerned with watts per square meter, Lighting Control Strategies are also concerned with reducing the time the lighting is used.



International Building Energy Codes

Australia

Watts Per Square Meter would also appear to conflict with the Australian Lighting Code, AS 1680, in particular the "Advise on Energy Efficient Lighting" contained in Section 10.3 of the Draft AS 1680.2.2. in that they do not address the time element of energy. This section refers to Energy Efficient Lighting. While not intending to examine in detail all possible means of saving energy, suggestions supplementary to AS 1680.1 are offered to assist lighting designers achieve energy efficient solutions. A summary relying directly on much of the text of Section 10.3 is attached. These recommendation cover the use of switching to reduce running hours, including the provision of local switch groups.

It should be noted that AS1680 is effectively mandatory due to its inclusion in the Building Code of Australia.

Australia: Draft Building Energy Code of Australia

Standards Australia recommend **Kilowatt Hours per Year per Square Meter** be used and not Watts per square meter due to:

- Watts per square meter is not a unit for the measurement of energy and ignores how long this power is being used for. Units of Energy (Kilowatt Hours per Year) should be used instead so as to take into account the time of usage,

and the better usage of daylight. This means using units of ***Kilowatt Hours per Year per Square Meter.***

- The time of use of the lighting is also required for calculating the affect of the lighting on the energy usage of the HVAC system.
- The Illuminating Engineering Society stated its position on watts per square meter in a 1995 letter from the National President of IES to the then Minister for Primary Industry and Energy: " watts per square meter is the wrong criterion for the measurement of energy. Kilowatt hours per year per square meter should be used instead in order to take into account the time of usage, and the possible better usage of daylight".

UK: CIBSE Code

Lighting Controls for new buildings are now mandatory in the Building Regulations Part L, 1995 in the UK, endorsed by CIBSE, ETSA and the Lighting Industry Federation. In order to address time control, Part L stipulates that there must be a light switch in no more than every 8 square meters or 3 times the mounting height of the luminaires or that lighting controls be installed.

The CIBSE code also addresses load reduction and time control as follows in Section 2.5: Energy Efficiency Recommendations: "The object of any energy efficient recommendations is to achieve the best design for human effectiveness and to meet the design specification but with the lowest practical energy use". ***"The energy (kWh) used by a lighting installation depends on both the power (kW) and the time(h). Energy efficiency can be achieved in three ways:***

a) By using efficient lighting equipment
b) By ensuring that the lighting is not in operation at times when it is not needed, ie that the period of operation is kept to a minimum.
c) A combination of both."

"In practice much energy is wasted outside normal working hours, by lighting being left on when not required ..... Similarly, lighting may not be required during working hours if there is sufficient daylight or if an spaces are is vacant. Adequate lighting controls should be installed to allow the building occupants to use only that lighting which is actually needed at any particular time.

Netherlands: Building Energy Performance Regulations

The highly successful Dutch program is based around measuring energy reduction in units of Gwh per year, i.e., the Dutch government uses units of energy rather than units of power density to set targets in its energy codes.

Singapore: Building Energy Code

The current code used watts per square meter, but also addresses the time the lighting is in use through recommendations regarding switching and lighting control systems.

The 1996 draft review of the Singapore Energy Building Code is aimed at achieving higher energy efficiency and greenhouse gas emission reduction is

proposing that mandatory energy targets be set. Targets are to be set in units of kWh per square meter per year. The package also includes legislative requirements, standards and software modeling. Two methods of compliance are recommended for the Performance based standard - following a prescriptive method or by examine the energy performance of the whole building.

A Model a Building Energy Code

Based on the preceding analysis is it clear that ***kilowatt hours per square meter per year.*** Time of use is required for calculating energy usage (of both the lighting and the HVAC systems). SEICA recommend that Kilowatt Hours Per Square Meter Per Year be the unit used to measure energy consumption, as do the 1994 BOMA Energy Guidelines, as do Standards Australia.

Such a code must be ***Mandatory*** due to market impediments and failures and because of the mandatory nature of the Australian Lighting Standard, AS1680. Energy efficiency improvements are ***site and application specific***. Each system must be tailored to the building, its use and its occupancy patterns if it is to operate correctly, produce the savings it was designed to achieve, be accepted by the occupants and ***conforms to all relevant standards*** including the lighting code, AS1680. The Quality and quantity of lighting must never be jeopardized by energy efficiency projects.

This complicates codes and standards because of the complexity of different building types and their uses. In general codes can be considered as being similar to appliances standards (prescriptive approach) or as a whole system performance (performance based) standards. The later approach, while more complicated than the simple prescriptive method, has the advantages of ensuring the uptake of new technology and encouraging new and innovative approaches such as performance contracting. That is, a code must include both ***Whole System Performance*** as well as ***Prescriptive*** measures and ***designated buildings***.

This performance based option also opens up ***Performance Contracting*** options and opportunities for effective market delivery mechanisms since performance contracting can circumvent a number of traditional market failures such as access to capital, risk assessment, information failures, etc.

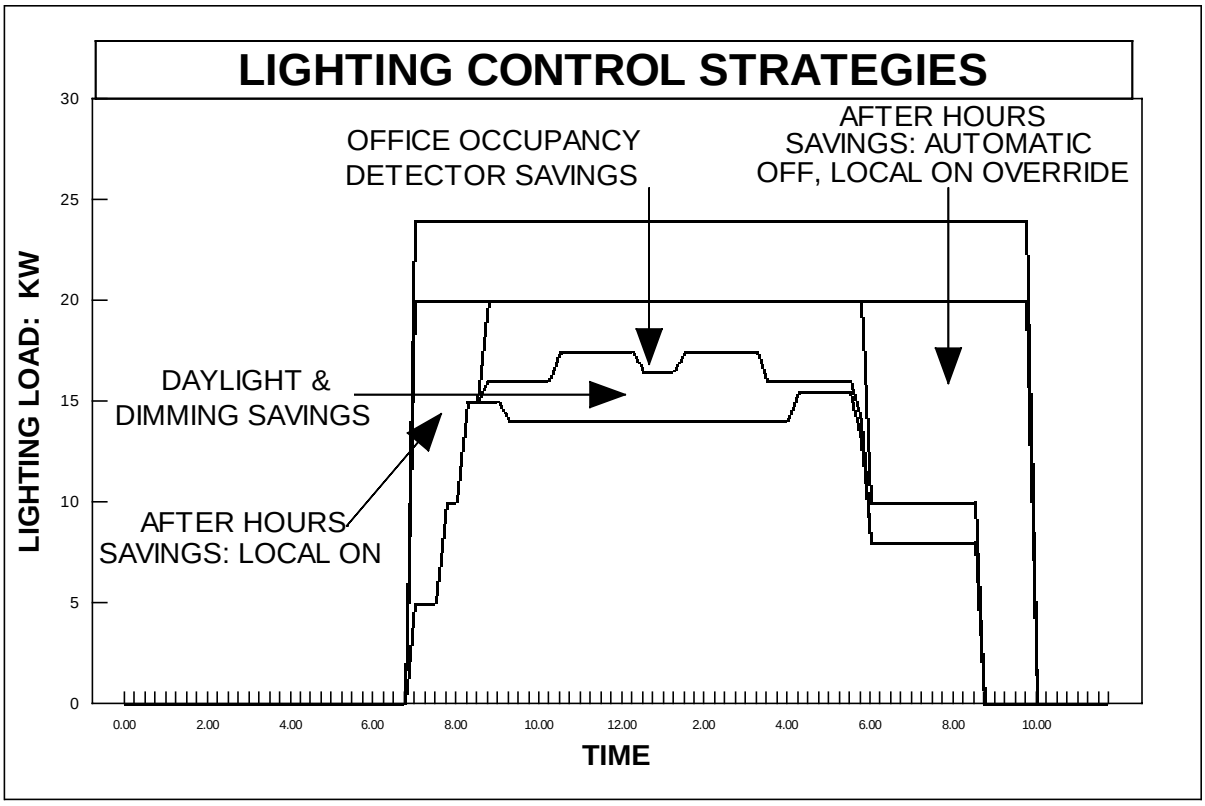
The inclusion of the performance based option and the time element in energy savings (kWh/m2/year) opens the possibility of the complete range of energy efficient lighting and lighting controls being used to supplement load reduction strategies, rather than simply relying on these alone i.e. Local on/off Switching, Time Control, Occupancy Detector Control and Daylight Linking can be used to supplement energy savings from load reduction strategies.

Finally, such a model should include mechanisms to overcome market failures. One such option is the development of ***a tradable carbon credits markets*** based on CO2 emission decreases resulting from improved energy efficiency. this tradable credits will help offset the price market failure discussed above.

Energy Efficient Lighting and Lighting Control Strategies

The graph on the next page illustrates the 4 main areas of energy savings through implementing Energy Efficient Lighting and Lighting Controls:

1. Load Reduction Strategies
2. After Hours Control: Manual ON, Automatic OFF Time Based Control
3. Occupancy Detectors
4. Daylight Linking



Load Reduction Strategies

The purpose of every lighting installation is to provide the right amount and the right quality of light at the right time for people to effectively carry out their tasks within the work space. The emphasis on energy saving must not compromise the definite relationship that exists between the lighting and the productivity of the people under the lighting system. The lighting system must enhance sales in a retail environment, it must not create headaches for office workers and it must allow warehouse operators to efficiently identify and pick products. Safety factors must not be compromised. The following factors must be addressed When designing a cost effective energy efficient lighting installation:

1. Choose the right light source, including lamp, ballast and luminaire .
2. Choose the right number of luminaires and lamps.
3. Implement proper maintenance procedures.
4. Local control of lighting via on/off switches located within the area

To achieve an energy efficient installation the lighting designer must carefully choose the appropriate light source to give the highest possible lumen per watt output whilst considering the light level, glare requirements and the demands of the task. It is not simply a matter of choosing fluorescent tubes over incandescent for example; choosing the most energy efficient type of fluorescent is also important.

For example, tri-phosphor tubes produce 15% more light than standard tubes as we;; as providing a 60% longer lamp life. When used with Fixed Energy Reduction Systems specifically designed to take advantage of these high efficiency lamps, the installed load can be reduced by 30% while improving the quality and quantity of light.

The lighting designer should also ensure that the luminaires chosen not only meet aesthetic requirements but that they have the highest light output ratio (LOR) suitable for the task while meeting glare and uniformity requirements. Individual tube switching (to provide 0%-50%-100% control) should also be considered when choosing luminaires. Regular maintenance is also an important function in keeping the lighting system operating efficiently and cost effectively.

Ballast Losses typically consume more than 20% of the total energy consumption of a fluorescent light fitting. The use of low loss electro-mechanical or high frequency electronic ballasts can reduce energy consumption by 10% to 15%.

After Hours Control: Manual ON, Automatic OFF Time Based Control

One of the most cost effective measures for lighting energy management is the implementation of appropriate light switching. A proper energy effective switching system comprises many parts but can lead to substantial energy savings.

In commercial office applications Automatic "on" light switching systems, such as those provided by a building management system and the simple multi gang switchplate by the entrance create considerable wastage as it leads to every light on the entire floor being switched on even if only one occupant is present on that floor. This is a huge waste. The entrance switch should provide background lighting only, with local switches being strategically located throughout the floor to enable occupants to turn lights on or off in their own area. Open plan offices should ideally have one light switch within each $100m^2$ of space whilst individual offices, stores, meeting rooms etc. should be provided with their own control.

On the other hand it is important that an automatic system be installed to set a lighting "scene" for cleaners after normal office hours and to then turn lights "off" because people simply do not bother to switch lighting "off " when they leave their workplace. Convenient local switches for after hours over-ride is imperative. This can be achieved by circuiting luminaires alternately or, preferably, by having individual tube switching in all luminaires.

Occupancy Detector Control

There are always offices that are not occupied. Staff are away at meetings, visiting clients, or simply away on holidays or sick leave. Occupancy detectors should be installed in these rooms so that lighting is only activated when the room is occupied. Similarly detectors should be installed in conference rooms, store rooms, class rooms, lecture theatres and rooms that need lighting only occasionally.

Detectors should be chosen that posses sufficient sensitivity to continuously detect the small hand movements that people make while doing routine office tasks. Lesser sensitivity means a longer the time out period required to compensate which results in lower energy savings being made.

Detectors designed for turning lights on, not keeping lights on should be avoided. As with all switching equipment, detectors should be suitably rated to switch the inductive load of fluorescent fittings by having inbuilt inrush current suppression for fluorescent tube start up.

Daylight Linking Control

As the level of outside daylight increases, there may come a point where some of the artificial lighting in an area becomes unnecessary. In such a case substantial energy savings can be achieved by switching OFF or dimming selected luminaires, or lamps within multi-lamp luminaires, according to the amount of daylight available.

Circuit arrangements should allow switching of the outer row of luminaires (or individual tubes in outer luminaires) along perimeter faces of a building to compensate for natural lighting. Manual local switching must be provided to allow the user to override the system if so desired. To ensure sufficient daylight exists for implementation of this type of strategy daylight linking should be limited to a maximum of 1.5 times the window height.

Where dimmable high frequency ballasts are installed individual luminaire control is possible through daylight systems that regulate the amount of each light produced by each luminaire in response to the amount of available daylight. Occupancy Detectors can also incorporate photocell switching such that lights turn off whenever there is sufficient daylight present.

Solar savings are particularly attractive in industrial installations where high daylight levels are often available from generous skylights.

Conclusions: An effective Building Energy Code Model for Australia

A sustainable and effective non-residential building energy code for Australia must contain the following elements to be an effective:

1. Mandatory Energy Consumption Targets in kWh/m2/year for various types of non-residential buildings
2. Whole System Performance as well as Prescriptive elements
3. National Standards and models for Performance Contracting as a mechanism for delivery of the Mandatory Energy Consumption Targets.
4. Tradable Carbon Dioxide Reductions credits to offset the failure of the market pricing mechanism.
5. Be developed by Standards Australia to ensure conformity to all relevant standards, including AS1680.
6. Includes load AND time of use reduction strategies i.e.

    - Load Reduction strategies,
    - Local Switching
    - Time Control
    - Daylight Linking
    - and Interface into HVAC energy use

And, regardless of whatever the energy efficient lighting regulations or standards, the quality of lighting must never be compromised - ***Protect Your Lighting Standards!***

Appendix 1

Legal Status Of Energy Building Standards In 57 Countries

Fig. 1. Legal status and coverage of energy standards for buildings in 57 countries

Reproduced from Energy Volume 19, No. 1, pp27-44, 1994 “Worldwide Status of energy Standards for Buildings” by K. B. Janda & J. F. Busch, Energy Analysis Program, Lawrence Berkeley Laboratory, Berkeley, CA94720 USA

Lighting Retrofit Saves 85% of Energy

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eter is an international speaker and has contributed a number of articles to major technical journals in Australia nd overseas over the last 12 years.

CS offers a full range of turnkey services including supply, installation, commissioning and on-going ıaintenance, thus assuring a smooth running, successful and cost effective energy conservation scheme.

CS areas of expertise include:

- Energy Efficiency in non-residential Buildings
- Energy Efficient Lighting & Lighting Controls in non-residential Buildings
- CO2 Abatement Strategies in non-residential Buildings
- AIJ Capability in Malaysia, Singapore and Thailand
- Energy Performance Contracting including Zero Capital Investment and/or Guaranteed Savings
- Energy Auditing
- Greenhouse Gas Emission Reduction Trading

eter Szental is also a Director of Matida Nominees Pty. Ltd. and also has a background of 25 years experience ı property development and investment. **Matida Nominees Pty. Ltd**. is a private company wholly owned by eter Szental. The company is a property developer and investor with a highly successful 30-year history in ustralia. Matida's activities include residential subdivision, commercial office accommodation and retail centers. latida is a preferred developer of the Coles Myer group. Matida also owns and operates a number of shopping

Lighting Retrofit Saves 85% of Energy

enters around Australia. Matida currently has projects of approximately A$100m in various stages of evelopment and/or construction. Please refer to attached company profile.

Lighting Retrofit Save 85% of Energy

ENERGY CONSERVATION SYSTEMS PTY. LTD.

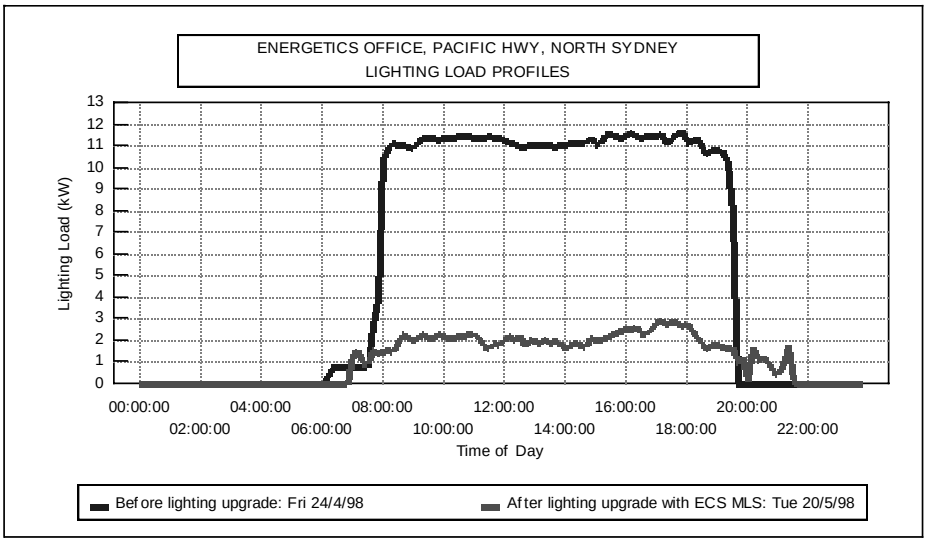
Lighting Retrofit Saves 85% of Energy

By Ray Rudkin, Energy Conservation Systems Pty Ltd, and Robert Turner, Energetics Pty Ltd, Australia.

Energetics

Integration of energy efficient luminaires and state of the art lighting controls demonstrate that extremely high overall energy savings can be achieved. Improvement of the lighting environment, in terms of lighting quality, user control and automation offer an enhanced working environment and large energy savings.

Energy Performance Contracting provided the client with a means of installing the new energy efficient lighting system at no capital cost and a continuous positive cash flow.



Energetics head office in North Sydney CBD has become one of Australia's most energy efficient lighting installations after its recent lighting upgrade. The lighting upgrade, which entailed the removal and replacement of existing inefficient fluorescent luminaires with leading edge TL5 lamp technology and a state-of-the art lighting control system, has resulted in an exceptional energy saving of 85%.

Description of Work carried out

Existing exposed T-bar 1200x600 luminaires with K12 prismatic lens, 4x36W halo phosphor lamps and 4x9W standard switch start magnetic ballasts were replaced with leading edge technology luminaires and controls. Incorporated with these new luminaires are dual function sensors having combined movement and light level sensing allowing each luminaire to be controlled individually or as a group.

The new system complies with AS 1680 (The Australian Standard for interior lighting) in relation to recommended lighting levels and discomfort glare for screen based tasks.

Energy Savings

The high degree of control offered by individual sensors attached to every luminaire ensures that light output is reduced when ambient light levels increase. The sensors also detect movement ensuring that only those luminaires that are required are on. This high degree of control coupled with state-of-the-art luminaires is what achieves the very impressive 85% reductions in lighting costs.

Sustainable Energy Industry Association (Australia) Ltd.
P O Box 411, Dickson 2602 ACT
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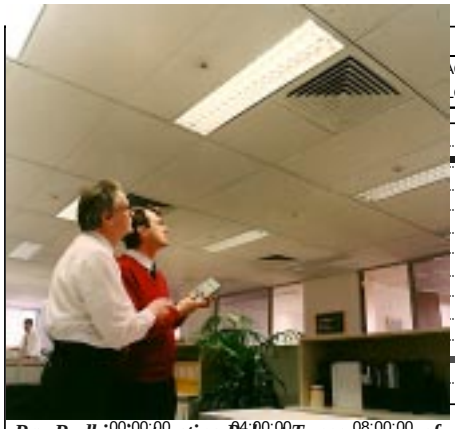
Scope of Energy Savings

- High efficiency luminaires
- TL5 Triphosphor Lamps
- Electronic High Frequency Ballasts
- Ambient Light Compensation (natural and artificial)
- Allowance for Lamp Depreciation
- Presence Detection
- Individual Luminaire Control
- Calibrated illuminance to individual luminaires
- Reduced maintenance costs from fewer lamps, lower running hours, and soft start ballasts.



Ray Rudkin instructing Robert Turner on use of the hand held controller.

Previous Lighting System:	
Connected lighting load	11.7 kW
Annual Energy Consumption	34,500 kWh
Annual Energy Cost	3,770AUD
New ECS Managed Lighting System:	
Connected lighting load	2.6 kW
Annual Energy Consumption	5,330 kWh
Annual Energy Cost	585AUD
Savings:	
Annual Energy Savings	29,170 kWh
Annual CO_2 Greenhouse Gas Reduction	27 tonnes
% Energy Savings	85%
IRR	20%

Table 1

Energetics are delighted about their new lighting system, because it generates cost effective energy and dollar savings for them, and because it demonstrates their commitment to energy efficiency and the environment. This is a world-leading innovation in technology and commercial approach, and the first of its kind in Australia.

Other benefits resulting from the lighting upgrade are:

- Reduced air conditioning load, therefore additional savings;
- Excellent example of modern technologies operating in a working environment (as against a show room environment), giving an opportunity of marketing the technology to clients which visit the office;
- Improved lighting quality from flicker free HF;
- Triphosphor lamps improve colour rendition;
- Low brightness luminaires meet lighting code requirements;
- Improved work environment;
- Improved productivity;
- Flexibility results in decreased churn rate costs from office relocations;
- Provides maintenance savings from long life lamps.

Summary of Results

Extrapolating over 12 months expected annual savings are as detailed in Table 1.

If the technologies were used in a new installation, such that only the additional cost

was incurred (rather than the full cost for a replacement) the payback is expected to be around 3 years.

Project Implementation

Energy Conservation Systems (ECS) Pty Ltd, a lighting control specialist and an experienced energy performance contractor implemented the project. ECS coordinated the project from inception to completion on a turnkey approach consisting of organising funding, design, supply, installation, commissioning and monitoring of savings.

Energy Performance Contract

To pay for the project, Energetics implemented the system as an Energy Performance Contract with ECS providing the financing. The repayments are geared to the energy savings (which are guaranteed) to ensure a positive cash flow over the life of the contract, which is 5 years. However, there is a cancellation clause to match the remaining lease term. Energetics was not required to outlay any capital up-front through this arrangement.

- The Energy Performance Contract is based on a 20% IRR over 15 years (simple payback 4.9 years).

- The Energy Performance Contractor is an experienced lighting control company that provides turnkey supply and construct lighting solutions.

Innovation

Utilising leading edge technologies in luminaires and lighting controls:

- Luminaires are Philips TBS 300 incorporating 2xTL5 28W lamps, high frequency electronic dimmable ballasts and extra low brightness parabolic louvre assemblies.

- The integrated ECS Managed Lighting System incorporates combined occupancy detection and photoelectric cell for individual luminaire control. The control is integrated via a communication bus giving the ability to program instructions between sensors and any luminaire.

- The control system allows for the reconfiguration of the lighting system without the need for rewiring if future office‘ fitouts occur, such as new partitioning, thus providing additional retrofit cost savings. The total lighting control system and each individual luminaire is configurable by a hand held infrared controller (see photo).

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Work by the Institute of Engineers Australia.

The Institute of Engineers Australia has undertaken the development of a National Sustainable Energy Strategy for Australia. The Building and Construction Task Force has prepared a preliminary report which is summarized below.

Building and Construction- incentives for energy efficiency

The IEAust's communiqué states that sustainable design practices and products are not yet being fully embraced by Australia's building and construction industry. The Task Force work is structured to add strategic, long term value to the number of initiatives in the building and construction industry currently underway which address energy issues, sustainable design, voluntary and mandatory codes, and new financing mechanisms.

"Today's business culture tends to encourage new construction ahead of retrofitting and other initiatives, such as installing energy efficient designs for new and old buildings," said Pedersen. "Ecological Sustainable Design is still being seen as adding to the cost of construction," he said. "Longer term savings and environmental impacts are not being recognized. This is not to say 'stop everything now' but rather that we need to work towards achieving these ambitions over the next 20 years."

"The Government should provide incentives for energy efficiency measures in new and existing buildings. A whole of government approach to ESD and energy issues – including taxation reform – is not only appropriate but becoming imperative." The Task Force went on to state that "consistent government policy, supported by incentives such as enhanced depreciation allowances and tax credits for innovative, greenhouse gas abating technologies and initiatives" is now needed.

Least cost, long term benefit

"These examples merely demonstrate the need for commitments to be made and long term plans to be established. It is now well recognized internationally that sustainability can generate opportunities for 'least cost', with long term benefits to the community and industry." Said Peterson. "As we said in our communiqué: Australia should use and foster its diverse resources in ways that will provide a sustainable energy future to meet the social, economic and environmental imperatives of this and succeeding generations."

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The 60 site international demonstration case study program documents proof of the savings achieved over 16 years by ECS Energy Effective Lighting Controls:

PROJECT SITE	SAVINGS
Energetics Headquarters, Sydney	85%
Sustainable Energy Development Authority, NSW	38%
Western Mining Corp.	67%
Concord High School	50%
Defence Plaza	46%
Coles Supermarkets	31%
CIC Insurance	43%
Qantas	38%
Freehill Hollingdale & Page	61%
Parkson Corporation Department Stores (Malaysia)	28%
Sony TV Industries (Malaysia)	29%
Energy Conservation Centre of Thailand	56%
Ernst & Young	40%
Franklins Supermarket	31%
Jewels Supermarket	37%
Carrefour Department Store (Malaysia)	40%
Carrefour Department Store (Thailand)	33%
Post Malaysia	33%
Adelaide Mail Exchange	44%
National Panasonic	29%
Quix Store	32%
Sime Darby Car Park	28%
Richmond Bank Branch	30%
Target Department Store	30%
Rebel Sports Stores	30%
Electricity Generation Authority of Thailand Head Offices	28%
CP Seven Eleven (Thailand)	28%
Siam Knitwear & Garment Co. Ltd. (Thailand)	29%
Sandringham Telephone Exchange	64%
MCC Dynan Rd. Workshop	62%
NSW Schools	60%
SADME: Schools	60%
South Australian Dental Hospital	60%
ICI Headquaters	44%
Department of Health Offices, ACT	59%
Panorama TAFE, Adelaide	57%
Adelaide TAFE	51%
Telecom: 5/333 Queens Street, Melbourne	45%
SECV 12th Floor, Monash House	45%
Office of Energy, Adelaide	44%
NSW Department of Education: Schools	60%
Safeway Supermarkets	30%
Toshiba (Thailand)	30%
Department of Finance, Melbourne	42%
Commonwealth Bank	40%
Finlaysons, Adelaide	50%

Department of Energy Development & Promotion (Thailand)	44%
Park Ridge Primary School	67%
TOPS Supermarket, Bangkok	32%
Arnott's Biscuits Laboratory, Sydney	49%

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