A SUBMISSION TO THE PARLIAMENTARY JOINT COMMITTEE ON TREATIES INQUIRY INTO THE KYOTO PROTOCOL

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BACKGROUND

"**North Pole running out of ice.** The North Pole is melting.... The last time scientists can be certain the pole was awash in water was more than 50 million years ago and they say it provides more evidence that global warming is already affecting climate." Sydney Morning Herald, 21 September2000. Since that article was published the news has arrived that a Canadian ship has sailed through the Northwest Passage without meeting a nice barrier for the first time in recorded history. These dramatic events merely highlight the facts that climate change is occurring and that accumulation of anthropogenic greenhouse gases are likely to prove to be a major contributor.

Ratification of the Kyoto Protocol to the United Nations Framework Convention on Climate Change will formally endorse Australian commitment to an international effort to address a significant risk to the wellbeing of the entire international community.

The protocol is designed to establish a set of targets for control of emissions of greenhouse gases by the developed nations of the word. It will also establish a methodology for measurement of progress to these targets. Main green house gases are carbon dioxide (CO_2),methane (CH_4), nitrous oxide (NO_2) and CFC-11 and CFC-12. Of these CO_2 appears to be the major component by a considerable margin. Residence time in the atmosphere for CH_4, NO_2, and CFC-11 and CFC-12appears to be quite well understood. The carbon cycle and residence time for CO_2 is much less clearly understood and is surrounded by many uncertainties as explained in a major review paper by Ledley et al (1999)[1].

There are, however, some aspects of the greenhouse phenomenon and climate change that are quite well understood. One is that there has been an unprecedented accumulation of anthropogenic greenhouse gases in the atmosphere since the industrial revolution with a sharp increase in rate of accumulation in the last half of the20th century with CO_2 as the major component. Another is that there has been a rise in surface temperature of the earth in the corresponding period.

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[1] Ledley, TS, ET Sundquist, SE Schwartz, DK Hall, JD Fllows and TL Killeen (1999). EOS 80.39, p.453. American Geophysical Union,http://www.agu.org/eos_elec/99148e.html.

It appears that there have been considerable variations in concentrations of CO_2 (the most significant of the greenhouse gases) in prehistoric times with corresponding periods of warming and cooling and change in sea levels. We have no idea of what, if any, effects these changes may have had on early human populations. However they have taken place at times when populations were tiny and there was ample space for slow migrations to permit adjustment to them. Such migrations would present great difficulty in a currently highly populated world but arise of only a metre in sea level, for example, would impose great hardship on a substantial proportion of humankind. It seems to me that prudence would recommend considerable caution in actions that further contribute to change that is likely to be irreversible in many lifetimes.

TEN REASONS WHY AUSTRALIA SHOULD RATIFY THE PROTOCOL

1. Ratification will provide positive incentive to participate in a worldwide effort to avoid risk of major future calamity for the whole human race. Australia must accept its share of the effort.
2. We have a moral obligation to the international community. We drove a hard bargain at Kyoto and won a very favourable deal form it in comparison with other developed nations. We are in an analogous position to a person who has shaken hands on a bargain and now must proceed to sign the contract.
3. We have a duty of care to avoid any kind of future risk to the human race. The very uncertainty surrounding current predictions underlines the need to proceed with caution.
4. In particular we have a moral obligation to avoid risk from sea level rise to Australians who live and work in low-lying coastal areas. Consider the possibilities of one metre rise along the Gold Coast for example; or to people living near beachside areas or the popular canal developments.
5. There is an economic imperative to preserve property values in such low-lying places.
6. The moral obligation to avoid such risk extends to occupants of other parts of the world e.g. Holland, Bangladesh.
7. There is both moral and economic obligation to avoid risk of more intense storm activity in Australia and throughout the world. There is some evidence to suggest that this activity is increasing and is linked to served global warming.
8. There is potential economic benefit in developing new technologies to minimise accumulations of anthropogenic greenhouse gases. In an article “Faster, higher, smarter: Olympian effort still needed”(Sydney Morning Herald, 2 October 2000) leaders of the business and academic community have called for more research into innovative technologies so that Australia can maintain its place as a developed country. Emission reduction is one of the emerging technologies for the future. Acceptance of the Kyoto

Protocol will provide a serious incentive to research in an area likely to grow strongly over the next century at least.

9. There is potential economic benefit in applying relevant new technologies in Australia and overseas.
10. There is further potential for synergy in combating land salination by afforestation. The madness of continuing land clearance while Governments fail to act is nothing short of appalling. Andone more:
11. It would seem prudent to act to conserve resources of fossil fuels which must be finite in either the short or the long term.

THE PRESENT POSITION IN AUSTRALIA

It was recently reported that since the Kyoto conference the Australian rate of greenhouse gas emissions has *increased* dramatically. This increase has been attributed mainly to price reduction due to competition among suppliers of electricity since de-regulation of the industry. A further contribution can be attributed to the panic clearing of vegetation; a clear case of Nero fiddling while Rome burns. Thus we will have to work even harder than before Kyoto to bring our emissions under control.

WHAT CAN BE DONE TO BRING OUR EMISSIONS UNDER CONTROL?

1. Government, particularly the Federal Government *must* spend some *real* money on the issue. We have just won an outstanding crop of Olympic medals. The Federal Government investment per gold medal has been reported by Horin (2000)[2] as $40 million. It has also been reported that the Federal budget is in surplus by several billion dollars more than expected. It must be recognised that there is an element of public good in seeking to mitigate climate change and this should receive contribution from the Government as agent of the people, both to compensate those who will suffer hardship from acts of restraint and to invest in research in this emerging area of new technologies.
2. Federal and State Governments can act to end the ridiculous stalemate overcompensation for Queensland land clearance controls. My career experience is that there are few conflict situations that cannot be resolved by negotiation in good faith. Surely mature adults can negotiate a settlement to this dispute with its very serious implications for wellbeing of the Australian population as a whole and for our international reputation. As a person living in New South Wales, I am concerned, not only for the potential impact on climate change but also on the Murray-Darling river system. I suspect that people in Victoria and South Australia may share my concerns.
3. As a community we can develop new technologies to:-

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[2] Horin, A. Sydney Morning Herald, 30 September, 2000.

- produce energy from clean(er) sources e.g. renewable energy technologies (biomass, solar, wind driven, etc.);
- sequester atmospheric carbon;
- use energy more efficiently in transport and the energy industry at macro level; and
- encourage more efficient use of energy at the micro level of individual factories, buildings and homes, etc.

A PERSONAL EXPERIENCE

My area of knowledge and interest is in building services engineering, mainly in commercial buildings.

The Productivity Commission (1999)[3] said "In 1990greenhouse gas emissions attributable to the operation of commercial buildings represented 8.5 percent of Australia's total emissions for that year. These emissions are growing at an annual rate of 5 percent".

Despite efforts to improve efficiency of energy use in our buildings following the price crises of the seventies there are still many opportunities for reduction of consumption. There is, however, little incentive to explore them because the cost of energy is insignificant in comparison with other owning and operating costs. These issues and a suggestion for a market based scheme to increase incentives were explored in a submission to the Productivity Commission inquiry into the Environmental Performance of Commercial Buildings by me in association with colleagues Julian and Forwood in 1999, copies of which are attached to this submission.

The Productivity Commission reached the conclusion that "Significant amounts of energy (and other environmental resources) are used in the construction, operation, maintenance, refurbishment, demolition and disposal of commercial buildings. There are both sound economic and environmental reasons to make efficient use of scarce resources, and to limit damage to the environment." They also concluded that "The most appropriate response to greenhouse gas externalities is to use market based mechanisms to ensure that the price of greenhouse gas intensive energy reflects the social cost of its production. The higher price that would result from such an approach would not only provide an incentive for firms to be more efficient in their use of energy, but would also provide an incentive for them to re-examine contractural arrangements between building owners and tenants..... Further these effects would not be confined to the commercial building sector." Presumably this approach would be based of the concept of" tradeable emission permits".

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[3] The Australian Productivity Commission (1999). The Environmental Performance of Commercial Buildings, Research Report, AustInfo, Canberra, p7.

It is difficult to argue with this conclusion except to suggest that it will take a considerable time for any effects to “trickledown” to positive results from individual buildings. It is suggested that a parallel scheme to provide further incentives, specifically targeted at individual developers and building owners would considerably enhance the prospect of achieving lower impact more rapidly.

Concerning research activity, the Productivity Commission says that Governments in Australia direct significant resources toward research and development through a variety of initiatives including university funding through the Australian Research Council (ARC). We have seen prominent business and academic leaders dispute the adequacy of such initiatives(Sydney Morning Herald, 2 October 2000).

My personal experience bears out this contention. We have in the Architecture Building at Sydney University, an enviable piece of infrastructure for research into the behaviour of building occupants in a mixed mode environment where people can exercise choice between use of passive environmental controls such as windows and doors or supplementary mechanical cooling and heating equipment. This infrastructure was the result of donation by the firm Daikin Australia Pty Ltd. of cooling/heating equipment worth approximately $90,000, backed by funding from the university of $55,000 for its installation. The equipment has been in use for nearly three years now and its energy consumption is less than one quarter of what would be expected if the same space were air conditioned in the now conventional manner.

This installation has attracted international interest, having been adopted as a pilot study case by the International Energy Agency Annexe 35Expert Committee on Hybrid and Natural Ventilation. While some results will be gained from study of it, there is much more that could be learned by more intensive observation if there were funds to employ a research assistant. This information would be of considerable value to designers of such systems which are particularly useful in the benign climate of southern Australia. Applications for ARC funding were unsuccessful for three successive years, despite the applicants having held grants previously for other projects. Preparation of a serious grant application takes three to four weeks so I have now wasted about three months of (honorary) labour on this fruitless task.

CONCLUSIONS

We won a very favourable deal at Kyoto. On behalf of the Australian people, the Australian Parliament must now ratify the Protocol to the United Nations Framework Convention on Climate Change without delay or further negotiation.

In doing so it will accept the challenge to minimise risk of irreversible damage to the biosphere and harm to future generations. It will also provide a powerful incentive to embrace new technologies, develop new industries and thus help to maintain Australia's position as a "lucky" country.

Having signed the contract, the Australian people through their agent, the Government, must provide serious money to fund the meeting of its obligations. Such funding would be provided for:-

- compensation for those who may be disadvantaged by the results such as curtailment of land clearing or loss of employment through uptake of new technologies;
- and research and development leading to:
    - increased use of renewable energy sources;
    - improved efficiency of use of energy from fossil fuels (including use of passive energy flows for cooling, heating and lighting buildings); and
    - methods of carbon sequestration.

Attachments:

1. Improving the Future Performance of Buildings: A Submission to the Productivity Commission. File: PRODCOM1.DOC
2. Addendum to submission to the Productivity Commission inquiry into the future performance of buildings: a proposal for providing incentives to the introduction of input saving technologies. File PRODCOM2.DOC

Improving the Future Performance of Buildings
A Submission to the Productivity Commission

By The Department of Architectural and Design Science,
The University of Sydney.

Introduction

The Department of Architectural and Design Science offers teaching in architectural science to architectural undergraduates and postgraduate degree programmes in Facility Management, Building Services and Energy Conservative Design to professionals in the areas of building design, construction and management and conducts research in these areas. Staff are in regular contact with building industry professionals and this submission is offered as an objective view of building performance from that perspective.

We believe that concern "by Government, that in some instances the adoption of environmentally sustainable design features, relating to energy consumption, durability and operations and maintenance, within Australia's commercial building stock may be constrained by current development and procurement processes" is well founded.

It must be said that performance of buildings in the broad sense of 'fitness for purpose' is observed to be patchy. Whilst the focus of the issues paper appears to be on energy efficiency of buildings, this is only one aspect of performance. Another is the impact of the indoor environment on comfort, health and productivity of occupants. A database of comfort and health vectors in 16office settings collected over the past six years in this Department suggests that performance of some buildings in terms of providing a comfortable and healthy environment for building occupants leaves much to be desired. It also suggests that productivity of office workers is strongly associated with perceptions of comfort and satisfaction. Clearly improvement of energy efficiency must not be at the expense of performance in this area.

Prospects for improvement of performance do not appear to be bright. CSIRO Division of Building and Engineering is active in research and development of tools aimed at improving prediction of performance through development of its BUNYIP energy simulation software and activities related to better understanding of alternative technologies for ventilation and control of the indoor thermal environment of buildings. But the Property Council of Australia has reduced its activity sharply in recent years. Funding has been withdrawn from the Energy Research and Development Corporation and its activities are being wound back. The research unit in Worksafe Australia was abolished just as its work on aspects of occupational health and

productivity in commercial buildings was beginning to bear fruit. And news has just been released that funding for the NSW Sustainable Energy Development Authority is to be withdrawn over the next couple of years.

Commercial buildings are produced over a wide range of quality from premium CBD office construction to speculative suburban developments where the only criterion for design and construction is the lowest possible first cost and the building will be sold, warts and all, on or before completion, with its problems bequeathed to a succession of owners.

Research in the United Kingdom by Bordass, Bromley and Leaman(1994) suggests that occupant satisfaction is often highest in buildingsthat are low in energy consumption. In Sydney large CBD premium buildings are usually designed and maintained with both these objectives in view. Anecdotal evidence suggests this is not the case with the much larger component of the building stock of lower cost fringe CBD and suburban buildings although it also suggests that some building owners are making efforts to improve performance in the light of a forecast oversupply of rentable space in the next few years.

Research based evidence reported by Williams and Watts (1991)supports concern for the performance of the buildings at the lower end of the quality spectrum. In a study of 58 air conditioned office buildings in an inner Melbourne suburb they found that access to equipment was so poor as to deter any regular cleaning in 23 percent of them. They also found:-

> *"an alarming lack of basic understanding of the essential features of mechanical systems among owners, agents, key tenants, etc., often matched by a lack of responsibility for maintenance; and lack of key documentation....often design and construction documents of the initially installed system had been lost, even in cases of relatively new buildings. Records regarding modifications and servicing were equally in short supply."*

It seems likely that the situation was no different in Sydney and that little has changed since the report was written. The anecdotal evidence of unsatisfactory indoor environment in some commercial buildings is further supported by evidence presented in a current paper by Rowe and Dinh (1999), titled , *"Experience with occupant control of supplementary cooling and heating in a naturally ventilated environment: some preliminary results from work in progress"* (copy attached) which outlines some research based evidence for this. It has been prepared for presentation at the HybVent 99 International Forum to be hosted by the Department in conjunction with CSIRO at the University on28 September this year. This research did not take energy consumption into account due to funding limitations but it has been demonstrated that the two best performing settings in terms of

thermal comfort and perceived air quality (numbers 13 and 16) use very low quantities of energy for indoor climate control.

Funding for research into performance of buildings is scarce and in the absence of a substantial body of published material, this submission is, of necessity, based to a large extent on anecdotal evidence gathered during numerous conversations and discussion with building industry professionals. It will attempt to address specific matters raised in the Issues Paper and will conclude with recommendations considered likely to make energy conservation more attractive to building owners and methodologies for achieving improvement in overall performance of buildings generally and particularly at the lower end of the market. It will also propose research to establish benchmarks that will link building performance in terms of both occupant satisfaction and health some information already in existence concerning energy efficiency.

Indicators and Measures of Performance

As far as can be established nobody is keeping systematic performance records or indicators for commercial buildings in New South Wales.

The Property Council gave up preparing its very useful annual report on energy use in office buildings in 1995 because of cost and lack of demand. As far as can be ascertained no other building type such as hospitals, shopping centres, police stations, court houses to name a few, has been studied by anyone. The Property Council has also abandoned its broad grading scheme for quality of office buildings because of objections from members who considered that periodic re-grading tended to reduce their property values. It is understood that the Facility Managers' Association does no systematic benchmarking.

A firm called Cityscope has a database listing Sydney CBD buildings by owner and address with details of total and net rentable area, number of storeys and such general information. This service is used by Property Managers and also by some energy performance contractors who use it to select a group of buildings within a size range which they approach as prospects for their services. These firms apply their own methods to identify high energy buildings which offer opportunities for profit. Thus the market tends to offer rectification to the worst performers.

Incentives and Impediments for adopting ISTs

Incentives:

A warm fuzzy green feeling. A few owner/occupiers are attempting to reduce energy costs significantly by pursuing alternative strategies for cooling, heating and ventilation such as hybrid or mixed mode ventilation systems, displacement ventilation, radiant cooling and the like but there are significant risks as explained below.

Impediments:

- Low cost of energy Energy is cheap and there is no serious money in energy conservation. Increasing the price is not a strategy likely to succeed. If it were doubled it would still be of minor importance in relation to other costs. Most developers look for a simple payback of less than 12 months. Two to three years is probably the most that can be expected to be considered even marginally interesting. ISTs with a longer payback period are considered poor risks in the light of uncertainties inherent in the business cycle. Conventional design concepts have been refined since the seventies oil price crisis and generating such payback requires real design effort but money is not available to pay for it. It must therefore be recognised that energy ranks very low in the hierarchy of costs associated with constructing and operating a building. The last energy Report published by the Property Council in 1995 suggested a target cost figure for owner's component of energy at just under $14 per m^2. If tenant energy is assumed as 40% of the total it will amount to about$12 per m^2. A comparison with other costs is as follows:-

    - Owners component of energy costsay $14 per m^2 per annum.
    - Tenant component of energy cost say $12 per m^2 per annum.
    - Construction say $1,000 to $2,500 per m^2.
    - Rental say$150 to $800 per m^2 PA.
    - Cost of average employee per annum. say $4,000 per m^2

A saving of 10%on total energy consumption would yield a cash saving of about $2.50 per$m^2$ per annum. This is hardly a sum to excite serious interest.

- Intense price competition for design services The current practice of inviting tenders for design services brings intense pressure to bear on consulting architects and engineers to minimise costs. Consideration of options and integrated team design both exert upward pressure on costs and the tendency is to reduce these services. This leads to compartmentalisation of design with each party in the team seeking to produce the lowest cost solution without consideration of its effect on the work of other members. For example choice of more effective glazing systems or more

efficient lighting systems which could be paid for by reducing the cost of air conditioning are usually ignored on all but the most prestigious projects.

- Design and construct procurement procedures put further pressure on the price of design. Whilst design professionals are required to observe ethical standards, current practices favour transfer of responsibilities and tend to reduce individual accountability.

- Risk Attempting the use new input saving technologies involves substantially increased risk to marketability of buildings and is not attractive to developers unless some exceptional reward can be confidently predicted

- Real estate industry inertia Real estate industry advisers to developers are well aware of the extra risk attached to he marketing of unconventional technologies and will exert pressure to avoid them

Performance measures

Performance measures and their interpretation will vary in importance depending on the nature of the owner and intended use of the building.

Government and local government projects are funded from loan funds. Operating costs are usually paid from recurrent funds and are not tax deductable. Operating costs are therefore of more significance than they are to private sector owners.

Private sector owners are able to claim operating costs including cost of energy as business expenses and their impact is therefore less important. Those who develop buildings to be held as a long term investment will be more concerned with them than speculative developers who intend resale on completion or as soon as possible thereafter. Also in the commercial sector energy costs are usually split between owner and tenant(s), further reducing influence on design decisions.

Comments under this heading will be directed to the dimensions of performance listed at the foot of page 12 of the issue paper.

- Up front costs are the most important consideration on almost all building projects. They can range from $1,000 to $2,500 or more per square metre for office buildings depending on the target market. Perhaps 5 percent of this would be allocated to design services. Many buildings are treated as a commodity to be bought at a rate per square metre. Finance is worked out on the basis of maximum rentable area allowed on the site, cost per square metre

and expected rate of return and development consent is sought and obtained before any consideration is given to design concepts.

- Capital utilisation A very important measure. Estimated rate of return is fundamental to a decision to proceed with a private sector building project. Cost of energy is, however, usually a secondary consideration ranked well below the first cost of a project.

- Energy efficiency, reflected in operating cost is likely to be ranked far lower in importance than performance measures such as rental and rate of return on capital. Energy is cheap and plentiful and the price is falling.

- Location, location, location. Importance cannot be overestimated. Convenience topublic transport is significant.

- Staff and/or customer comfort Evidence (see Rowe and Dinh, 1999) suggests that staff comfort has a significant impact on productivity as measured by self-assessed effect on performance of work. It is however difficult to measure and many employers are reluctant to do so, possibly because the result may confirn their suspicions. Many building managers keep a complaints log but this information is commonly used as a basis for ad hoc responses and is not made public.

- Aesthetic appeal (image) is very important. Money is spent on the front of house that could be diverted to energy efficiency if that were considered more important. Hence the marble and granite foyers found in quite modest suburban buildings.

- Staff productivity see above under staff/customer comfort.

- Health and safety Public health regulations require regular testing and maintenance of cooling water systems in buildings as a safeguard against legionnaires disease. Recent publicity in the Sydney Morning Herald has suggested that the regulations, in New South Wales at least, need revision in the light of increasing prevalence of this disease. It was also suggested that inspection and testing procedures are not adequate and are not being carried out by some building owners as they should. Some responsible building managers commission regular air quality surveys as evidence of diligence in maintenance of a healthy indoor environment. This information is treated as confidential and is not available to the public.

- Waste minimisation. Some building owners and tenants use recycling for paper and sometimes glass and metal.

- Ease of upgrade/alteration Difficult to measure and when the building is built there is little that can be done to improve the

situation. Some large buildings provide a condenser water loop and occasionally an exhaust riser as a service to tenants.

Environmental Performance of Buildings

The Building Code of Australia specifies basic requirements for health and safety of building occupants including fire protection and ventilation requirements. These do not include requirements for the thermal environment of for any limits to energy consumption. More detailed specification of requirements for control of smoke and heat in the event of fire and for ventilation is provided by AS 1668which is mandated by the BCA.

Concerning thermal comfort AS 1837 -1976 recommends 21to 24^{o}C for both offices and factories. NSW WorkCover guideline “Safety and Health in the Office” says “most people work comfortably between 20 and 26^{o}C. The preferred winter temperature is usually about two degrees lower than in summer.” (note: there is evidence to suggest substitution of “acceptable” for “preferred” might more accurately represent occupant sensations).

The Property Council of Australia (formerly the Building Owners and Managers Association) used to provide energy consumption and cost target suggestions in its annual energy report but the report has been discontinued and has no to been issued since 1995 and the data is not being collected at present. It is understood that the reasons for this action were cost and lack of interest which underlines the low interest in energy conservation on the part of commercial building owners. The Property Council also used to provide guideline sheets for service provisions as part of its building grading service. This service is no longer available. It is understood that it was not popular with building owners because a downgrading as a building aged would reduce its rental potential. The excellent “Guideline to Management of Indoor Air Quality”, also a production of the Property Council, is no longer in print due to the cost of its maintenance.

Total energy and water consumption in buildings are of course measured regularly by the supply companies and the billing information is, of necessity, available to management. However it represents a minor item in overall cost of operating a building. It is most unlikely that senior management would take an interest in it unless a dramatic increase occurred. No doubt it would be reviewed by an intending purchaser but it is unlikely that it would be significant in a purchase decision as it represents a tiny fraction of the total cost of owning and operating a building unless grossly out of proportion. Once the building is built there are few cost effective measures that can be taken to improve matters.

Life Cycle Costing

Life cycle costing is a useful technique for achieving a balance between first and operating costs. It is believed that it is used only on the largest and most prestigious projects because of pressures on the construction bottom line and on design costs.

It should be used on Government projects because of the importance of reducing recurrent costs but it is suspected that current methods of procurement do not favour it.

Some large financial organisations are likely to require lifecycle costing of options when the building is intended to be held as a long term investment. Speculative developers whose only interest is the construction bottom line would not be prepared to pay for this service.

Input Saving Technologies

Energy is very cheap and getting cheaper as report in the Sydney Morning Herald, Monday 16 July. Most of the ISTs likely to produce effective energy savings in air conditioning (outdoor air cycles, zero energy band control), electric lighting systems (high efficiency lamps, integration with daylight in perimeter zones) and energy efficient cladding systems have been thoroughly explored in the period since the energy crises of the seventies and the conventional servicing of buildings can be regarded as a mature technology with few opportunities for further saving within individual design disciplines.

It is believed that there are opportunities for further improvement in performance to be gained from integrating the design process so that all members of the team including owners review the interaction of systems. For example, more efficient glazing and/or electric lighting systems are likely to cost more but the reduced cost of cooling and heating systems may pay the difference leaving a net energy saving advantage. Unfortunately pressures on design costs usually inhibit this approach.

Some consulting engineers e.g. Lincolne Scott Australia and Norman Disney and Young are exploring alternative technologies such as hybrid ventilation and geothermal systems for ventilation, cooling and heating of buildings. Life cycle costing techniques are employed for assessing the cost/benefit. These works are mainly on behalf of government or semi-government organisations with a strong interest in operating costs. Some of these techniques were discussed at an intensive course in air conditioning design given by the Department of Architectural and Design Science at Sydney University from 24th to 28th June this year and attended by 50 industry professionals from around Australia.

There are opportunities for reducing energy consumption in some types of commercial buildings by adoption of alternative climate control strategies. The University of Sydney has invested $55,000 from its energy conservation programme to pay for the installation of

supplementary cooling and heating equipment donated by Daikin Australia Pty. Ltd as an experimental hybrid cooling system designed to improve thermal comfort in 25 staff offices in the Architecture building without the full penalty of increased energy consumption and cost of conventional air conditioning. This installation has been operating now for some 18 months and is demonstrating very significantly lower energy consumption than would be expected of a conventional air conditioning system for the same space. High scores have been recorded for thermal comfort and air quality. Some preliminary results are about to be reported by Rowe and Dinh (1999), copy attached.

Assessment of benefit of this system has been done by analysing continuously recorded energy consumption of the system and comparing monthly totals with those produced by energy simulation of a conventional well designed system using ACADS-BSG ESPII software. Occupant surveys of thermal comfort and air quality were conducted before installation of the system and again 10 months after it was putin operation.

Further monitoring of the system is planned using equipment donated by Honeywell Ltd. to record room temperatures and status of fan coil units, windows and doors and occupancy with a view to developing design tools to facilitate uptake of this technology. This is an experiment designed to demonstrate effectiveness in providing comfort with low energy consumption and therefore reduced pressure on emission of greenhouse gases. The project has been adopted as a retrofit case study by the International Energy Agency Annexe 35 - HybVent expert committee.

Input pricing

Energy is cheap by comparison with other inputs. It is therefore difficult to make a case for sophisticated ISTs unless they can produce very large and reliable savings. Impact of energy, gas and water market reforms has been to reduce prices and thus lower still further cost incentives to adoption of ISTs.

Therefore ISTs do not rank highly in the priorities for design of commercial buildings against such issues as location, access to views, image, capital cost and rental income. The energy crises of the seventies brought about a burst of interest in energy and water conservation. Since oil prices have settled at a fairly low level this interest has diminished although some of the lessons learned immediately after the crises are still being applied.

Clearly there is no likelihood of energy prices rising and renewing intense interest in energy conservation in the near future. And competition for export markets will prevent any artificial increase in price to a point where it would become a major objective.

It can, however, be argued that conservation of non-renewable energy resources and reduction of greenhouse gas emissions carries an element of public good and the public as represented by its Government should make a contribution. A possible way of doing this might be to offer a tax-free bounty to any individual or organisation that brought about a reduction in its energy consumption for a year compared with the previous year. This would not be enormously expensive and would be easy to administer. Energy suppliers routinely provide comparison of billing for a current period against a comparable past period. These data could be used as the basis for claiming the bounty payment.

Demand for Energy Efficient Buildings

Energy efficiency of buildings is at best a secondary consideration after such issues as rental value, location, image and ambience. It is likely to vary from real interest among developers or buyers of large buildings for long term investment to very low among speculative developers or buyers who are interested in short term capital gain as a result of their investment.

Owners of buildings that are particularly heavy users of energy might be interested in an approach by a performance contractor. This is particularly likely in the case of owner occupied buildings or public sector buildings. Owners of most buildings will accept energy costs as they are and will merely pass them on to tenants either by direct billing or as a component of the rent.

The discontinuation of its annual energy report by the Property Council is indicative of a serious lack of interest on the part of firms that market and sell buildings and building space.

Availability of Information

There is no shortage of information on ISTs for commercial buildings. Firms with technology to sell ensure this. Building industry professional shave difficulty finding time to evaluate new technology within pressure on design costs for all but the very large projects or those that are commissioned by the few clients with an ideological commitment to energy conservation.

As mentioned above, the Property Council annual energy report, a key source of information, is no longer available.

Various educational bodies provide courses in energy conservation and management. The Department of Architectural and Design Science at Sydney University offers a postgraduate coursework degree programme in DesignScience (Energy Conservation) and also courses in energy conservative design and energy management for students in its Design Science (Facility Managment) and Design Science (BuildingServices) programmes. Development of these programmes

has, however, been hampered by withdrawl of Australian Government financial support. Research is also hampered by the intense competition for inadequate funding to the Australian Research Council and other potential funding bodies.

It is noted that the Australian Government has in train a programme to regularly audit energy use in all of its buildings. This initiative is welcomed provided the results are publicly available to form benchmark data for a variety of building types. It is suggested that an invitation to private sector owners for inclusion in the audit procedure at no cost would further enhance the value of this project and the resulting benchmark data.

Hidden Costs and Benefits

Hidden costs include:-

- extra time spent on evaluation of options;
- risk of reduced marketability
- risk of failure of the technology due to poor maintenance (e.g. the outdoor air economy cycle).
- risk from lower durability of the technology.

Risk Premium

The building and real estate industries are highly conservative. Proven technology carries a substantial premium because the risks are low and well defined.

There have been notable disappointments in energy saving technologies, e.g in Grosvenor Place in Sydney, and the industry has a long memory for them.

A prestigious name can be used to force change as for example in the Foster building in Elizabeth Street Sydney where radiant cooling is being applied at the insistence of the noted British architect Sir Norman Foster. The industry will be watching this one closely and if it succeeds it is likely to set a new precedent. Otherwise it will be more difficult to establish the technology.

Summary and Conclusions

Following its commitment at Kyoto to curtail growth of emissions of greenhouse gases, the Government must recognise an element of

public good in reducing energy consumption by the commercial building sector. It must recognise also that in the major population centres of Australia energy is cheap and plentiful to the extent that its conservation in buildings is of minor importance among the conflicting priorities faced by owners, developers and managers of buildings.

In the absence of worthwhile financial incentives to the uptake of Input Saving Technologies it must accept the necessity of providing some incentives from the public purse to encourage alternative technologies for control of the indoor thermal and visual environment of buildings.

Incentives might include:-

- provision of dedicated funding for research aimed at exploring and demonstrating alternative strategies for design and construction;
- provision of financial support for targeted teaching programmes in tertiary educational establishments;
- tax free bounty payments for proven reduction in energy consumption by building managers;
- contribution to the additional cost of life cycle costing of Input Saving Technologies in the early design stages of buildings;
- expanding the energy audit of Australian Government buildings to provide the service free of cost to private sector building owners and managers;
- supporting a coordinated research study to examine the relationships between energy consumption in buildings and the health, comfort and productivity of workers in a representative sample of commercial buildings in each state and territory.

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ADDENDUM TO SUBMISSION TO THE PRODUCTIVITY COMMISSION INQUIRY INTO THE FUTURE PERFORMANCE OF BUILDINGS: A PROPOSAL FOR PROVIDING INCENTIVES TO THE INTRODUCTION OF INPUT SAVING TECHNOLOGIES

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In our original submission it was argued that the public as represented by Government could offer a tax free bounty to an individual or organisation that brought about a reduction in its energy consumption for a year compared to the previous year. It was also recommended that consideration be given to introduction of trading in carbon credits to reward positive efforts to conserve energy and to penalise developers who produce projects with energy consumption higher than a reasonable benchmark. Further consideration suggests that it might be possible to combine both approaches in an incentive scheme that would be voluntary, equitable but largely revenue neutral to reward corporate good citizens and to penalise those who waste energy.

Trading in carbon credits is a concept widely discussed as a market led approach to energy conservation and is one that could provide significant incentives in very large and highly concentrated industries. The building and real estate industries are, however, diffuse and the allocation of equitable carbon credits could be expected to be a difficult and costly exercise.

A simpler approach could be based on the Commercial Buildings Energy Rating scheme newly launched by the NSW Sustainable Energy Development Authority. The rating system could be used to benchmark performance of an energy consumer with rewards and penalties allocated in accordance with the rating level achieved.

On this basis an equitable system could be structured as follows:-

- Government legislate a requirement that participating building industry customers lodge a certified energy rating with the supplier(s) within a period of grace of say twelve months.
- Energy suppliers adjust billing in accordance with the table below:-

Rating	**Bill adjusted by**
1 star	Penalty addition say 50 percent
2star	Penalty addition say 25 percent
3 star	Neutral
4 star	Bonus reduction say 25 precent

5 star	Bonus reduction say 50 precent

- The scheme would be voluntary. No consumer would be compelled to provide a rating but in the absence of one the energy supplier would be obliged to apply the maximum penalty amount of50 percent addition.
- Recognition of the element of public good in more efficient use of energy could be achieved by Government allowing a bonus reward as a fully deductable item from taxable income.

It can be argued that conservation of energy carries an element of public good and the public as represented by Government should sponsor a system to provide a monetary incentive to an individual or organisation that brought about a reduction in its energy consumption and to penalise one that uses energy waste fully.

A simple approach could be based on the Commercial Buildings Energy Rating scheme newly launched by the NSW Sustainable Energy Development Authority. The rating system could be used to benchmark performance of an energy consumer with rewards and penalties allocated in accordance with the rating level achieved.

On this basis a system could be structured as follows:-

- Government legislate a requirement that participating building industry customers lodge a certified energy rating with the supplier(s) within a period of grace of say twelve months.
- Energy suppliers adjust billing in accordance with the table below:-

Rating	**Bill adjusted by**
1star	Penalty addition say 50 percent
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3 star	Neutral
4 star	Bonus reduction say 25 precent
5 star	Bonus reduction say50 precent

- The scheme would be voluntary. No consumer would be compelled to provide a rating but in the absence of one the energy supplier would be obliged to apply the maximum penalty amount of 50 percent addition.
- Recognition of the element of public good in more efficient use of energy could be achieved by Government allowing a bonus reward as a fully deductable item from taxable income.

Such a system would be voluntary, equitable and market driven. It would be inexpensive to operate and would provide a positive incentive to developers to pay more attention to life cycle costs by adoption of ISTs.