Sustainable design in schools

Putting the wind and sun to work

OUR CLIMATE-CHANGED FUTURE IS DRIVING MANY SCHOOLS AND SCHOOL DESIGNERS TO REVIEW THE WAY THEY DESIGN, BUILD AND OPERATE SCHOOLS, AS **JOHN BRODIE** EXPLAINS.

Adopting a sustainable approach to all areas of school operations makes economic sense, whether you believe in climate change or not, or whether you believe it's man made or a naturally occurring cycle.

The sustainable approach is based on a clearer understanding of the benefits of efficiency, productivity and occupant health in the overall education equation.

The current financial and environmental crisis is the perfect opportunity to change the way we do everything in our society. The old adage of 'waste not want not' has renewed relevance. The days of leaving appliances running because we were too lazy to turn them off are over. The days of building schools that had no concern for inhabitants is over. The days of cookie-cutter school buildings, based on a default design that is completely irrelevant for the location are no more.

To make such assertions is all well and good, but the first response for many is to ask, 'What is sustainability?'

Sustainability was described in the 1987 *Our Common Future* report of the Brundtland Commission, formally the

World Commission on Environment and Development, as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

Sustainability encapsulates an interrelated assortment of design and operational philosophies that offer proven, measurable benefits to all people, commercial enterprises and the built environment.

My definition is quite simple and embraces benefit for both the financial and environmental proponents: profit + environment = sustainability.

Education is one of the major beneficiaries of that sustainable approach. Applying sustainability to new or refurbished school design as well as facility management, operations and maintenance will reduce costs as well as improve student learning outcomes, occupant comfort and health – and don't forget reductions in absenteeism, waste production and maintenance costs, too.

Show me the evidence

There is a large amount of evidence from overseas on the financial, health and environmental benefits of a sustainable school. The 1999 Heschong Mahone Report, *Daylighting in Schools: An investigation into the relationship between daylighting and human performance* for the California Board for Energy Efficiency, found that 'students with the most daylighting in their classrooms progressed 20 per cent faster on Maths tests and 26 per cent on reading tests in one year than those with the least. Students in classrooms with the largest window areas were found to progress 15 per cent faster in Maths and 25 per cent faster in reading than those with the least.

'In addition, the presence of an operable window in the classroom was also seen to have positive effect on student progress, associated with seven to eight per cent faster learning. These affects were all observed with a 99 per cent statistical certainty.'

Good classroom design that incorporates improved internal environment quality, improved crossflow ventilation, daylighting and daylighting control, improved views and acoustic performances were all found in a follow-up report in 2003 for the California Energy Commission be key issues in learning. The same report found that 'improving daylighting, introducing lighting controls and using thermal glass can reduce energy consumption in the classroom by up to 22 per cent.'

But what will sustainability cost?

According to a 2005 report by Australia's Green Building Council called *The Cost of Building Green*, the average cost premium of building a new green school can be from $0 to around $20 per square metre above the cost of building a conventional new school. The Green Building Council also estimates, however, that 'the return will be 10 times that cost over 20 years in energy savings alone.'

In the United States, seven area schools in one zone saved $667,500 per year in energy costs compared to the state average by implementing sustainable operational and maintenance procedures.

A 2006 report on the cost and benefits of sustainable schools, by Gregory Kats, shows 'they use an average of 33 per cent less energy than conventionally designed schools.' The same report also found that 'the financial benefits of greening schools are around $210 per square metre, more than 20 times as high as the cost of building green.'

How do we implement sustainability?

Using sustainable design science principles is a crucial step towards improving the comfort and academic productivity of your school.

How many schools in this country are boiling hot in summer, freezing cold in winter, or dark and dingy all year round? How many of then are so uncomfortable they need air conditioning, usually because we've built our schools using a default design and with the same materials whether they're located in Darwin or Hobart.

How inappropriate is that? We might as well provide all the schools in Cairns with igloos, which would be extremely comfortable and cool – for a couple of minutes.

How many freezing or boiling hot assembly halls have we been in? Stuffy and uncomfortable, many school auditoriums or halls are unusable over the summer months –when they're needed most. Such buildings cost a fortune to heat and cool artificially. If the designers had gone back to first principles and considered the sustainable science principles of building design then these often useless, wasteful and uncomfortable monstrosities would never have evolved into our unfortunate school vernacular.

Sustainable design science is based around understanding the local climate before any decisions on design are made and then ensuring the built form utilises that local climate to maximise comfort and reduce running costs.

Air conditioning is, of course, a major contributor to energy costs and greenhouse gas emissions. Lighting also contributes to these running costs. How many classrooms do you go into where the lights are on all day? How many classrooms do you go into that have the air conditioning running during the lunch break when the room is empty? Cooling classrooms is a major comfort issue across all parts of our country, and climate change predictions are that the need for cooling will only rise.

Consider how much cheaper it would be to have a school that was so well designed that it didn't require summer air conditioning or winter heating. Consider the running cost and greenhouse gas savings if there was enough daylight coming into your classroom because it was designed on the correct principles that you were able to reduce the running time of the lights to 10 per cent of their previous level.

Sustainable design puts the wind and sun to work

Using natural ventilation without electrical energy to cool classrooms and ensure fresh air is supplied to the buildings all through the year is one sustainable design principle that is easily applied. Another is to bring

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natural daylighting into a building. You can ventilate and light using energy and maintenance-free solutions like the Monodraught natural ventilation and daylighting systems now used in hundreds of schools in more than 20 countries around the world.

The money being spent on the thousands of new auditoriums and libraries across Australia should consider some of these natural cooling and daylighting principles. If we're committed to reducing carbon emissions and reducing our running costs then we need to apply sustainable design principles.

Consider this energy cost analysis over the next 20 years. Suppose the energy bill of your facility is $100,000 a year now and it goes up at five per cent compound a year. Your energy bill will be around $200,000 in 20 years. If the energy bills go up by 15 per cent compound a year the running cost of your facility will be around $1.5 million a year – and that's before you pay any carbon trading taxes.

The days of energy being a cheap commodity have gone. Your energy costs are now a major part of the financial accounting for your school.

Saving even 20 per cent of the running costs of your facility will add up to around $300,000 a year in 20 years! That's certainly more than lunch money. The good news is that achieving a 20 per cent saving in energy use alone can be quite easy to attain, especially in a new school.

Best of all, besides reduced costs and significantly improved learning outcomes, a school that operates with principles of sustainability provides students with opportunities for experiential learning about sustainability.

Surely, this is the future for our schools.

John Brodie has 30 years of experience in the design and construction industry. He has presented on different aspects of sustainability at over 50 conferences across Australia, has written for numerous journals and lectures part-time on sustainability at the University of Technology, Sydney. He is the principal and founder of Vim Sustainability Consulting, consultants on the world's first zero emissions development in Australia. Vim Sustainability offers a broad selection of innovative and practical sustainability skills, and delivers assorted presentations on sustainability to all education facilities as well as having a range of teaching and learning resource packages on sustainability suited to schools from Kindergarten to Year 12.

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