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BUILT ENVIRONMENT

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GUIDELINES ON EDUCATION POLICY FOR SUSTAINABLE BUILT ENVIRONMENTS

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TERMS OF REFERENCE

- Research current policies, knowledge and practices on education for sustainable built environments
- Develop education policy for different built environment stakeholder groups
- Provide exemplars of education for sustainable built environments in formal, informal and professional education.

INTRODUCTION

More people are moving to and living in cities than ever before. In many regions, demand on existing urban infrastructure, supporting eco-systems and for new building has never been greater. At the same time climate change is creating new vulnerabilities for urban populations that must be addressed. Globally the building sector is responsible for up to 40% of our energy and resource consumption, up to 30% of our solid waste production and up to 30% of all energy-related greenhouse gas emissions. It is clear that such impacts are unsustainable. So how do we learn to build and operate our cities, towns, villages and buildings so that impacts such as these are not only avoided, but so that our built environments repair, replenish and sustain?

These issues highlight the urgent need for education that supports eco-settlement and sustainable building. Sustainability education for the building sector is fundamental to the creation of sustainable urban and rural settlements. *Guidelines on Education Policy for Sustainable Built Environments* has been commissioned by the United Nations Environment Program (UNEP) to contribute to capacity building and policy making during the UNESCO Decade of Education for Sustainable Development.

This guideline provides a framework of:

- Key sustainability education principles;
- Sustainable design values and precepts;
- Generic teaching and learning strategies for targeted stakeholder groups;
- Appropriate pedagogies;
- Best practice teaching/ learning programs; and
- Case studies of exemplary curricula.

The framework presents a synthesis of sustainability education and aims for key stakeholders in the built environment (Figure One). The outcome of this synthesis is a suite of learning aims, strategies and case-study curricula that can empower people to transform cities, towns and villages into eco-settlements. The framework also guides and informs the development of new educational policies that promote the capacity building for sustainable buildings and construction (SBC).

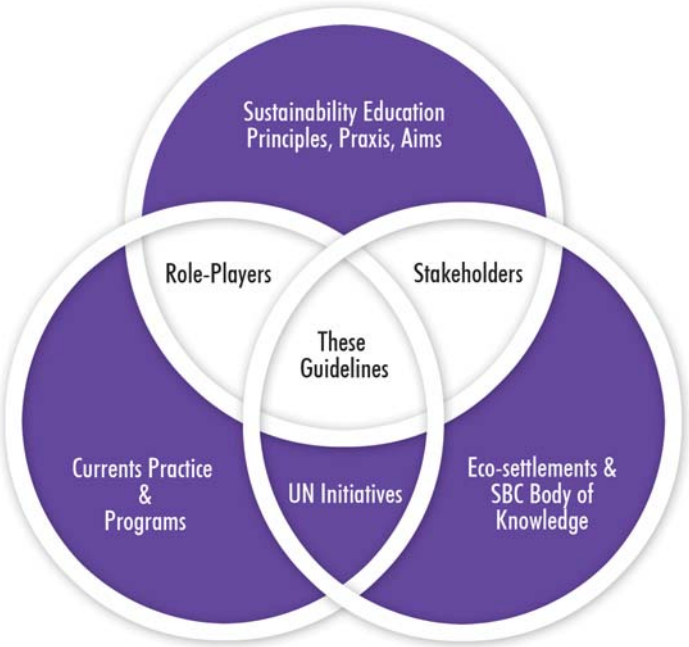

Figure 1: Synthesis provided by these guidelines

In providing this synthesis, the guideline draws on a wide range of foundational texts and key references in sustainability education, and in eco-settlement design, construction and maintenance. It consolidates Agenda 21, which emerged from the UN Earth Summit at Rio de Janeiro in 1992; the UN Habitat Agenda; the UN Millennium Development Goals; Agenda 21 for Sustainable Construction (CIB, 1999) and Agenda 21 for Sustainable Construction in Developing Countries (Du Plessis, 2002).

This guideline emphasises the key role of the construction sector in the creation of sustainable urban and rural settlements. It also provides a framework for linking sustainability education in the built environment with the United Nations Decade for Education for Sustainable Development (DESD).

Humanity has reached a significant turning point in the history of settlement patterns: this is the first time that the majority of humans are living in cities, rather than rural settlements. This 'turn of the tide' brings into sharper focus the urgent need for eco-settlements and sustainable buildings.

The guideline is structured into three parts.

Part 1 - A Framework for Eco-Settlement Education

In Part 1, the broad framework of appropriate sustainability education principles, core sustainable design values and precepts is developed for the design, construction and maintenance of eco-cities and villages. An appropriate range of transformative pedagogies and learner-centred curricula models is also presented.

Part 2 - Eco-Settlement Education Strategies & Policies

The broad framework developed in Part 1 provides a rationale for selecting and recommending appropriate teaching, learning and capacity building strategies for different key stakeholder groups in the Asia-Pacific. Both UNESCO's International Implementation Scheme for the DESD and the UNESCO/UNEP Working Paper: *Asia-Pacific Regional Strategy for Education for Sustainable Development* makes a clear case for developing educational strategies, policies and programs for these eight foundational stakeholder groups:

- Governments and inter-governmental bodies;
- Communities;
- Private sector industries including professionals and trades-people;
- Formal education institutions;
- Civil society and NGOs;
- Media;
- Youth; and
- International agencies.

Recommended educational policy strategies, together with accompanying implementation methods and enabling actions for **role players** within stakeholder groups are also described. These targeted role players include:

- Decision makers and policy leaders in local to international levels of government, industries and educational institutions;
- Educators, industry trainers and learners in formal education sectors – schools, universities, polytechnics, vocational training colleges and so forth;
- Community educators and champions involved in non-formal or grass-roots learning programs and projects;
- Professional accrediting associations in Architecture, Planning, Landscape Architecture, Construction Management and so forth;
- Professionals and tradespeople in government departments and private sector companies; and
- Village builders and artisans.

The teaching and learning strategies assist all role players to become actively involved in continuously learning how to plan, design, build and manage eco-cities and villages. Educators, educational policy makers and industry trainers are also encouraged to utilise interdisciplinary approaches to develop holistic policy frameworks that address key trends and issues for rural and urban eco-settlements.

Part 3 - Best Practice Models of Curricula, Syllabi & Programs

In Part 3, opportunities for interdisciplinary and multi-stakeholder sustainability education for eco-cities and villages are identified in the context of common needs, actions and challenges for sustainability education. Best practices are highlighted and regional exemplars and case studies of innovative programs and projects in communities, schools, universities, research centres, professional learning and training programs are also presented. Appropriate monitoring, reporting and evaluation strategies are also discussed in Part 3.

PART 1

PART 1:

AN EDUCATIONAL FRAMEWORK FOR SUSTAINABLE BUILT ENVIRONMENTS

Intent: To provide a framework of sustainability education principles and learning aims for built-environment educators and policy-makers.

Overview

In Part 1, a broad framework of appropriate sustainability education principles, core sustainable design values and precepts is developed for the design, construction and maintenance of eco-cities and villages. Part 1 also presents a range of transformative pedagogies & learner-centred curricula models. A broad framework setting out learning aims for education and capacity building among key stakeholder groups in the building sector is then presented. Appropriate monitoring, reporting and evaluation strategies for best practice projects are also outlined.

1.1 ECO-SETTLEMENTS

Richard Register, a pioneer of the eco-city movement once wrote ". . . we teach how to build, but what we build teaches us how to live" (Register & Peaks, 1997). We are now learning from our built-environments lessons about the effects of pollution, poor air-quality, resource consumption, climate change, socio-economic inequality, loss of bio-diversity and waste. Simultaneously we see city sky-lines crowded with energy-intensive commercial sky-scrapers reflecting the power of private capital and global corporations, while the perimeters and vacant lands sprawl with the desperation of people living in informal settlements. Our settlements are the best class-rooms we have to learn about what is unsustainable. So what should we be learning to become sustainable?

One of our greatest challenges is to learn how to eliminate the unsustainable from our built-environments and develop ways of regenerating our cities, towns and villages so that they are places in which everyone can learn through experience to live in peace, health, harmony and joy. This ideal has been called an '***eco-settlement***' and is the fundamental vision and learning aim for these guidelines.

1.1.1 What are eco-settlements, and how do we get there?

Foundational concepts for eco-cities and villages are introduced below that engage the heads, hands and hearts of stakeholders with the three pillars of ESD (ecological, economic, socio-cultural). Exemplars of these concepts are initially drawn from Herbert Giradet's *Creating Sustainable Cities* and other key sources. Each concept is based on core principles for eco-settlements including ecological integrity, sustainable lifestyles, good governance, and maintenance of cultural diversity and harmony.

BOX 1. Definition of Sustainable Human Settlements

Cities, towns, villages and their communities planned, designed & constructed to:

- Minimise Ecological Footprints (biophysical) and
- Maximise Human Potential (human ecology) in order to
- Repair, replenish and support the processes that maintain life.

(Downton *et al*, a. 2006)

The key challenge for educators is to foster urban and village cultures – regionally and globally – that reconcile large scale urbanization with sustainable development, the preservation of natural resources and protection of agricultural lands. Such urban cultures will need to have an intergenerational sense of continuity and longevity, so that acquired knowledge of sustainable practices and skills can be passed on.

Giradet defines a sustainable city as being "*organized so as to enable all its citizens to meet their own needs and to enhance their well-being without damaging the natural world or endangering the living conditions of other people, now or in the future"* (1999: 13). It is also crucial that eco-cities create and maintain viable connections and relationships to their hinterlands: *"The mode of adaptation of cities to their hinterland ultimately defines their sustainability, or lack of it."* (1999: 17)

Cities as Super-organisms:

A key challenge for policy makers and designers of educational strategies and capacity building programs is to contribute significantly to changing the metabolisms of cities, from open and linear systems with huge footprints, to closed and self-regulating systems with sustainable footprints and thus stable relationships with their hinterlands. Educational/ awareness strategies and capacity building programs can utilize eco-footprinting methods and techniques to analyse the spatial impacts of cities on hinterlands and to implement the design of key changes to urban metabolisms.

Metabolisms of Cities:

Transitions towards the long-term viability of eco-cities and eco-villages will depend in large measure on successfully designing and implementing closed

loop models based on the cyclic metabolisms in ecosystems and their finite carrying capacities – also known as *ecological systems thinking*:

Outputs will also need to be inputs into the production system, with routine recycling of paper, metals, plastic and glass, and the conversion of organic materials including sewage into compost, returning plant nutrients back to the farmland that feeds the cities. (Giradet, 1999: 34)

From Urban Sprawls to Convivial Cities:
Successful stages of transition to eco-cities and villages should be envisioned in plans and celebrated after successful implementation for regaining one of the most beneficial attributes of urban living: **conviviality.** Convivial eco-cities are characterized by compactness, vitality, diversities (social, economic and cultural), pedestrian planning for safe and 'walkable' streets, urban villages and neighbourhoods filled with local identities, and cheap and efficient public transport.

A mixture of traditional and innovative urban farming techniques, and permanent retention of peri-urban agriculture will also be crucial attributes, replacing the historically recent trend towards long distance haulage. This will enable nutrients to be recycled, thus preserving soil fertility.

'Smart Cities' and Urban Best Practice:
The development of 'Smart Cities' will be characterized by the integration of sustainability planning and design, and research and development of feedback tools and information systems to assist in self-analyses of energy and water consumption, leading on to best practices that minimize consumption and close loops:

Eco-feedback is an evolving system of information feedback that allows individuals to influence their behaviour patterns in accordance with their own experiences …To make the best possible use of feedback, people need a good knowledge base. For this, the most important thing is the collection and dissemination of best practices, giving people information about new options – about projects that have helped to make cities into better places. (Giradet, 1999 p58)

1.1.2 Sustainable Buildings & Construction

Buildings and built-infrastructure are fundamental to the form, function and value of human settlements. Yet as previous performance definitions of eco-settlements clearly show, they are more than merely the sum of their parts – more than just a collection of environmentally friendly buildings. Therefore, the processes of creating, operating, maintaining, refurbishing and demolishing the 'built-environment' must all contribute positively to creating and sustaining the qualities of eco-settlements.

The influence of building on sustainable development is profound. Globally the sector is responsible for more than a third of all resource consumption, and produces around a third of all waste and greenhouse gas emissions. The magnitude of the sectors influence is also a major opportunity for tackling the current over-shoot of earth's bio-capacity and climate change.

The Inter-governmental Panel on Climate Change (IPCC) for example states that the building sector offers the largest potential of any industrial sector to achieve major reductions in greenhouse gas emissions. It estimates the building sector could reduce its emissions by up to 30% at a zero cost or net financial saving to an economy (IPCC, 2006). Buildings can also be designed to operate in ways which provide ecological services such as cleaning pollution, providing energy and reusing resources that would otherwise be wasted.

The sector is also the world's largest single industrial employer, providing jobs to more than 111 million people and accounting for up to 10% of employment at a country level (UNEP, 2007). Because of the amount of time we spend in and around buildings, the design, maintenance and operation of buildings can have a significant influence on human health and well-being. Buildings also define and reinforce cultural identities.

While the building sector is fundamental to the environmental, social and economic pillars of sustainable development no building activity is sustainable unless its net contribution in all three fields is positive over its life-cycle. From this perspective it is important for educators not to confuse the terms 'eco-efficient', 'green', 'positive' and 'sustainable' which refer to different levels of building performance but which are commonly promoted under the heading of 'sustainable building or construction'.

Eco-Efficient Building
The term efficiency simply means to do more with less. When applied to sustainable building performance it commonly relates to *resource* efficiency. Common resource efficiency goals include:

- Minimising the amount of resources used relative to the size of a building;

- Maximising the ease with which resources can be refurbished, reused and / or recycled;
- Minimising the amount of resources required to provide thermal comfort and services in a building; and
- The proportion of resources wasted during construction, refurbishment and demolition.

In the field of sustainable buildings and construction energy, water and material efficiency are most commonly promoted.

Energy Efficiency

Energy-Efficiency is promoted because the building sector must reduce its greenhouse gas emissions by reducing its use of fossil fuels. Reducing energy-demand in a building also improves the financial viability of utilising renewable energy systems and reduces operating costs. Because buildings account for more than 30% of all energy consumption, reducing demand for energy use through resource efficient building provides a major opportunity to save money. Building new, and refurbishing existing buildings for energy efficiency also provides the greatest potential greenhouse gas emission reductions; reductions which can be achieved at a net saving to an economy.

The highest performance goal from an energy efficiency perspective is the passive-building. So called 'passive' approaches to building aim to create or retrofit buildings so that their over-all energy-related environmental impact is entirely off-set by a combination of operational efficiencies and use of renewable energy.

Water Efficiency

Although water is a renewable resource, the way it is used in buildings is often unsustainable because it is commonly consumed faster than sources can be replenished. It is also often polluted during use and can pose serious health risks if it does not undergo expensive treatment processes. Water-borne disease is still one of the largest causes of disease and death in human settlements. Using water efficiently is essential to providing security of supply, reducing the risk of disease, the cost of treatment and for increasing the financial viability of integrating strategies such as rain-water collection, on-site biological water treatment. Heating water is also a major source of energy consumption for many building types, especially in homes. Therefore, using less water can aid energy efficiency and reduce greenhouse gas emissions.

Material Efficiency

According to some estimates building activity accounts for about 40% of total annual natural resource consumption. This includes 25% of all timber use per year (Graham, 2003). The environmental impacts of material consumption and industrial manufacturing are most significant in countries with rapidly expanding urban populations due to the high rate and volume of new construction.

In recent years many companies that manufacture building materials have greatly improved the resource efficiency of their production processes through the application of methods such as life-cycle assessment. There has also been increasing application of eco-labelling standards for materials in some countries. Still the environmental burdens of material transportation and waste remain a concern. Principles of adaptable design are important to follow to ensure material efficient building.

'Green' Building

The term 'green' building refers to buildings that are not only resource efficient but which take measures to improve the health and well-being of occupants, reduce or minimise environmental pollution and waste, use certified environmentally friendly materials and/ or incorporate renewable energy systems. The scope of issues covered by new 'green' buildings is now commonly defined by rating schemes such as LEED (USA), BREEAM (UK), HQE (France) and Green-Star (Australia). Generally, green buildings aspire to minimise the life-cycle *environmental* impacts of building. The economic and social aspects of sustainable development are generally not an explicit concern. Green-building also focuses more on eco-efficiency and thus on limiting the negative impacts of building.

Because of the rapid deterioration of life-supporting ecosystems and rate of climate change, there is a need for buildings to not only limit harm but to repair and replenish eco-system services. In short, building must have a net positive influence if it is to contribute to eco-settlement.

Positive Building

Positive building is in fact a far older form of design, construction and living with buildings than modern industrial techniques. Many vernacular building traditions follow principles that aim not only at positive ecological influences but also at positive psychological, social and even spiritual effects.

In the positive paradigm building is considered as an interdependent aspect of social-ecological systems – in essence a natural process that can be harmonised with and nourish living systems. Positive building aims to create more resources than are consumed, treat and re-use rather than generate waste, to provide eco-system goods and services, and promote health and well-being. With these aims in mind efficient or green-buildings may be means, but are not the ends.

In order to build in such a positive way it is necessary to use a combination of biological, ecological and technical strategies designed to operate in symbiotic (mutually reinforcing) ways. A simple illustration of a positive approach is the reticulation of waste water through roof or wall gardens which can simultaneously clean water for re-use, nourish gardens that can provide psychological well-being and habitat, insulation and that protect the building envelope.

Such strategies can also save money by reducing maintenance and energy costs, and boost people's productivity and health. Positive building seeks to integrate social, ecological and economic systems in mutually beneficial and reinforcing ways. It is therefore the fundamental form of building for developing and sustaining eco-settlements. Again no building activity is sustainable unless its net contribution is positive over its life-cycle

Sustainable Building

A distinction is commonly made between the terms sustainable construction (the process) and sustainable buildings (the outcome). 'Sustainable construction' is also often used as a general term to describe all *types* of building including civil and industrial structures. However it is most helpful to think of sustainable building or sustainable construction as a *process of continual improvement* in the building sector from unsustainable practices to positive ones. From this perspective sustainable construction has been described as —

". . . a holistic process aiming to restore and maintain harmony between the natural and built environments, while creating settlements that affirm human dignity and encourage economic equity." (Du Plessis, 2002 p3)

Figure 2 below describes this process.

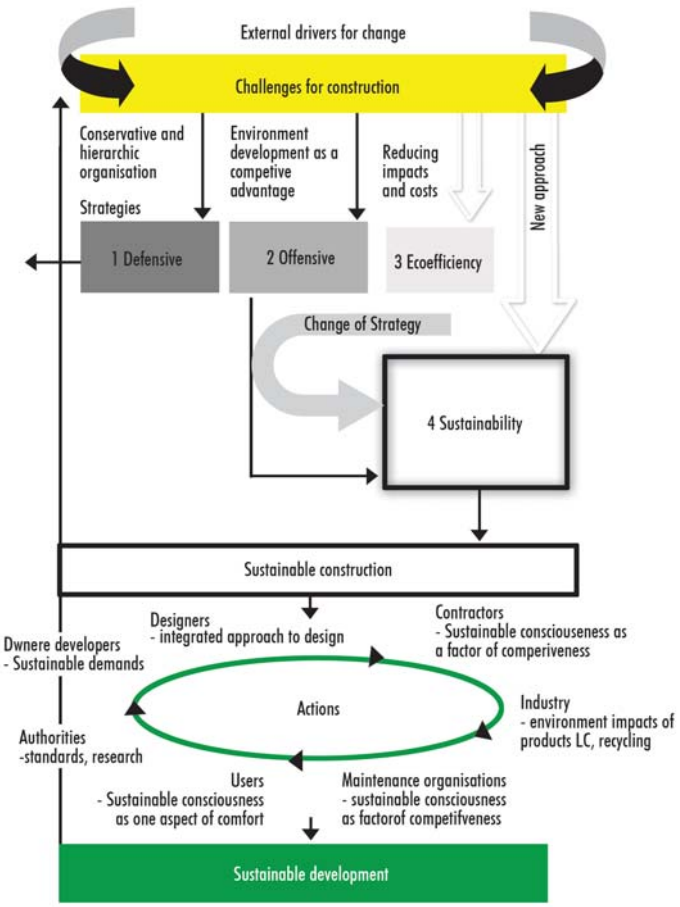

Figure 2: Strategies and Actions for Sustainable Construction. Source: Agenda 21 for Sustainable Construction, CIB 1999 p 21

1.1.3 Summary

The concepts of sustainable cities and building described above should be read not solely as a blue-print for new city development or building design, but also as a way of assessing opportunities for regenerating our existing settlements. Learning how to identify sustainable aspects of existing settlements and using these as catalysts for further eco-settlement development is essential. We should ask ourselves, not only how we might create new eco-settlements, but how we can eliminate the unsustainable, and enhance the sustainable aspects of the settlements we already have.

While the organic re-conceptualisation of cities is an important ideal, education must deal with the current unsustainable trends that are shaping urban form and urban life. The most important issues are ensuring that human settlements become non-dependent on cars for transport, non-dependent on non-renewable fuels for energy, and adaptable to change – particularly climate change. Apart from the environmental impacts of emissions and roads, there are social equity and security concerns with this form of development. As oil becomes scarce and more expensive, cars (which are already unaffordable for the majority of Asia-Pacific city dwellers) and fuel energy will become more expensive. Mobility and the basic needs met by cheep, efficient and clean energy are rights, not privileges. The same applies for buildings.

The term eco-settlement has been adopted in these guidelines to refer to eco-cities, towns and villages. It is used primarily as a verb rather than a noun. The prefix 'eco' from the Greek *Oikos* for home is intentionally used in order to relate to the psychological and physical locus of what we are trying to sustain. In this sense eco-settlement is the process of making home socially, ecologically and economically sustainable. Eco-settlement is also a process of adaptation to changing circumstances, without diminishing life quality and life supporting capability. The perception of eco-settlement as a process is therefore central to the philosophy of education described here, which is in essence the strategy for learning how to sustain the process of eco-settlement. This approach to education is described in the next section.

1.2 SUSTAINABILITY EDUCATION FOR CREATING ECO-SETTLEMENTS

"*If you've come here to help you are wasting your time. But if you've come because your liberation is bound up with mine, then let's work together*"
(Watson in Gough, 2000 p115)

One of the outcomes of the Rio Earth Summit of 1992 was the recognition that education is fundamental to long-term change toward sustainable human societies. Education for Sustainable Development (ESD) was the term created to describe any form of education that assists the sustainable development agenda, which was initially defined as "meeting the needs of present generations without compromising the ability of future generations to meet their needs" (WCED, 1987). Globally, the nature and scope of ESD has been evolving for more than a decade: UNESCO has described ESD in the new millennium as "an emerging but dynamic concept that encompasses a new vision of education that seeks to empower people of all ages to assume responsibility for creating a sustainable future" (2002 p5).

2005 marked the beginning of the United Nations declared 'Decade of Education for Sustainable Development'[1]. This is a joint UNESCO and UNEP initiative to implement sustainability education globally. Also in 2005, the International Initiative for Sustainable Built Environments (iiSBE) launched an education initiative aimed at mainstreaming sustainable building education (Graham, 2006). The motivation for these efforts related directly to the United Nation's agenda on Education for Sustainable Development. This agenda maintains that the primary purpose of all modes of education should be to empower people to contribute to sustainable development.

"…Education for Sustainable Development involves learning how to make decisions that balance and integrate the long term future of the economy, the natural environment and the well-being of all communities, near and far, now and in the future." (Australian National Commission for UNESCO, 2005 p. 1)

However, the concept of sustainable development, commonly described as a synthesis of economic growth within the capabilities of the natural environment, lacks a common value system or ethical frame-work that can assist in answering questions such as – what should we sustain?; for how long?; and for whom? **Sustainability education** is therefore promoted as a new paradigm that establishes a clear ethical framework for determining whose interests should be served by sustainable development (e.g. Fein, 2000; Sterling, 2001; UNESCO, 2005)

[1]The United Nations General Assembly proclaimed the ten-year period from 2005 to 2014 as the United Nations Decade of Education for Sustainable Development (UNDESD). UNESCO ratified the UNDESD at its 166th Session in April 2003.

Key concepts in Sustainability Education:
The emphasis of 'mainstream' (western) education has been criticised by proponents of sustainability education for perpetuating specialisations of information and expertise; for privileging analytical, quantitative scientific knowledge; and for indoctrinating people into ideologies that serve economic rationalism (Sterling, 2001; Fein, 2003; Thomas, 2000). It is argued that the effect of this mindset makes identification of unsustainable human activities difficult, and leaves those who are caught in it with no alternative solutions. Therefore, continuing education within this model is likely to increase rather than decrease unsustainabile lifestyles and practices (Orr, 1994); "Most of the contemporary education system simply reinforces patterns and pathologies that cannot and should not be sustained over the long-term." (Orr, D. in Sterling. S. 2001 p8).

Sustainability education is therefore positioned as an alternative paradigm of education for social change "relating to the best humanistic education traditions" (Sterling, 2001 p11). To adhere to these traditions requires a participatory approach to eco-settlement education; one in which the teacher is also an experiential learner and the students/ stakeholders also reflect on and share their experiences, thereby teaching each other. As Friere (1972 p66) explains, "Authentic education is not carried on by A *for* B or by A *about* B, but rather by A *with* B, mediated by the world." This is described in contemporary theory for education as a learner-centred approach. With this approach learning is manifested in the dialogue between teacher and student/stakeholder and the objective of each lesson is fundamentally mutual transformation and empowerment.

"Learning is a process of personal growth and discovery, not just an accumulation of knowledge." (Edwards, 1997 p243)

Learning in sustainability education is therefore intended to be transformative rather than transmissive. Transformative learning is facilitated by reflecting on action taken to eliminate unsustainability. This kind of reflective practice is a continual process, or *reflection-in-action*, which leads to deeper understandings about the person acting, the context in which action is taking place, and the forces which reinforce unsustainability. Learning through *reflection-in-action* is an essential element of sustainability education. This is because sustainability education seeks change, and often factors that are contributing to unsustainability in personal activity, a city, town or village do not become apparent until change is attempted (Edwards, 1997).

The vision of sustainability education is therefore to engage people in learning how to stop replicating *unsustainability* and how to think and act in ways that promote sustainable development (Sterling, 2001). To this end sustainability education applied to human settlements:

- Engages people in learning how to stop replicating *unsustainability* (Sterling, 2001);
- Facilitates understanding of the meanings of sustainability and how to think and act in ways that assist sustainable development (Australian National Commission for UNESCO, 2005);
- Encourages people to learn ways of living that promote "sustainable and equitable use of resources" (Benn, 1999).
- Provides an approach to life-long learning that helps people become active citizens in processes of environmental and social action.

Sustainability education can be described as education about, for and with a set of guiding ethical principles which can equally be applied in the development of curricula for eco-settlement education. These have been described variously as education that is:

- Values-based;
- Learner centred;
- Holistic in scope and praxis;
- Interdisciplinary;
- Critical, participatory and self-reflective;
- Locally relevant;
- Culturally appropriate; and
- Inclusive of minority, community and indigenous knowledge, wisdom and opinion.

(Tilbury *et al*, 2002; Australian National Commission for UNESCO, 2005; Sterling, 2001)

1.2.1 Learning Aims
These broad intentions and principles of sustainability education can be focused for eco-settlement education and facilitated by four contributory learning aims. These are:

1. Systems Thinking: Being able to understand and analyse settlements as dynamic interdependent socio-ecological systems of people, "resources, processes and products" through time;

2. Care & Stewardship: Being able to develop environments that people feel good in (psychologically and physically) and feel good about (accords with their values and memory); Being able to accept, protect and enhance cultural, technical and biological diversity;

3. Symbiosis, Efficiency & Effectiveness: Being able to design, engineer, construct, maintain and adapt systems that turn wastes into resources and regenerate resources for future use; Being able to do more with less and put energy, resources, information and people to the highest and best use first;

4. Learning & Innovation: Being able to identify unsustainable elements of settlement systems and then instigate, manage and monitor change, learn from experience and innovate.

These four learning aims are obviously interdependent and generally relevant to all learners in built-environments. Learner-centred eco-settlement education needs to be tailored to respond to local priorities and constraints. In so doing, educators can develop these four fundamental capacities in all stakeholders and facilitate the development of more context specific learning outcomes. These are described below.

1.2.2 Learning Outcomes

Learning for sustainability and sustainability education are constant processes. We are always immersed in an environment that, if observed, informs us how to live sustainably. For most people in the Asia-Pacific region, this environment is a built-environment - a city, a town or a village. Our surroundings affect not only what we learn, but also how we develop and express our value-systems.

Common design features and learning outcomes of eco-settlement education include learning about social, economic, ecological, spatial, and temporal interdependencies. Such outcomes empower students, teachers and researchers to identify and then strategically work towards changing unsustainability within their fields of influence. Appropriate pedagogies and curricula models for eco-city, eco-village and sustainable building development intend to facilitate:

- Understanding interdependencies between sustainability issues in varying contexts, human settlement patterns, and the perspectives and activities of different stakeholder groups;
- Knowledge and skill in eco-design and sustainable construction;
- Development of life-cycle awareness and systems thinking;
- Skills for life-long learning;
- The competence and willingness to play the role of change agent (Action Competence);
- Learning by doing and reflecting on outcomes (Action Learning);
- 'Practicing what is preached' – education as sustainable development is preferred;
- Learning how to identify and eliminate 'unsustainability' from personal, professional and social activities, and reflecting on the effectiveness of actions taken;
- Learning how to conduct ethical inquiries and ethical approaches to decision-making; and
- Ecological literacy.

(Orr, 1994; Benn, 1999; Sterling, 2001)

Students have also asked "...how we can build a sustainable future?" and have drawn attention to the power of multi-cultural and interdisciplinary collaboration to generate new ways of thinking for sustainable design and construction. They argued that sustainable building must use the concept of symbiosis as a foundation for sustainable design education. They conceptualised sustainable building education as learning 'green building + symbiosis', expressing this as a formula GB + Symbiosis = Sustainable Building (SB05, 2005).

One hundred and thirty-six undergraduate and post graduate students from thirty-six different countries took part in a conference which developed a position statement on sustainable building to table at the main conference. The "Student Statement" describes the position of the participants on priorities for research, education and advocacy. Students called for education that would:

- Enable them to influence construction industries to operate as industrial ecologies;
- Equip them with detailed knowledge of building and building material life-cycles;
- Help them to determine the social impacts and influences of construction; and
- Develop their knowledge of adaptive environmental management. (Student Session, SB05, 2005)

Sustainable building education they concluded should not just be directed at building professionals. They argue that sustainability education should seek to "educate the citizen" (p3), and that it must be introduced at all levels of education. Graham (2003, 2005) organises these *learning outcomes* in terms of developing knowledge of **interdependency**, knowledge of **experience,** and knowledge of **change**. These categories of knowledge are:

Knowledge of Interdependency:

- Local, regional and global ('Glocal') scales of stakeholder awareness of sustainable development;
- Critical literacy in socio-cultural constructs

- Ecological Literacy[2]
- Whole-systems and life-cycle thinking.

Knowledge of Experience:
- Historical understanding of a context
- Ability to identify and eliminate unsustainability
- Ability to design, construct and maintain places people feel good in and feel good about.
- Ability to develop and monitor appropriate sustainable development indicators.

Knowledge of Change
- Ethics and values toward care, stewardship and equity
- Policy development and enactment
- Civic '**action competence**[3]'
- How to learn, innovate and adapt.

1.2.3 Learner-centred Teaching Methods

In order to achieve this vision, theory and practice (Praxis) of education themselves need transformation from education **about** and **for** sustainability, to providing reflection-in-action based learning **as** a means of sustainable development (Sterling, 2001). The differences between these three foci are defined as follows:

Education about sustainability typically introduces content and knowledge about sustainability issues. This approach allows sustainability to be taught through principles, rules, or laws in special courses within a program and does not require any change to standard curriculum models.

Education for sustainability emphasises learning for change. This approach includes learning about social values, critical analysis to identify areas of contemporary practice that require reform, and developing capabilities to affect the reforms. This type of curriculum is predicated on the conviction that aspects of current practice are not sustainable and need changing. Education for sustainability teaches students how to facilitate change but does not request personal change toward sustainable practice from either students or the teaching program.

Education as sustainability emphasises learning as change. In this model the process of actually trying to cease unsustainability and live sustainably becomes the learning activity. As a result the classroom, the studio, the administration, the campus, the practice, the professional organisations etc should become contributors to sustainable development.

A range of perspectives, approaches and tools are required to achieve holistic change toward sustainable settlements. Globally, there is no single paradigm of thinking, approach or model that can address the needs of all stakeholders in local contexts - people are learning how to understand sustainability principles and initiate action projects in very different ways, in response to different issues and needs. Sustainability educators will need to offer a variety of teaching methods and approaches to learning that guide hands-on learning. Selecting the best methods and techniques will depend on the learners, the situation, and the learning objectives.

The challenge of sustainability education is to learn by practicing what we preach. Applying these intentions to eco-settlement education broadens the emphasis for learning from enhancing the environmental performance of the building, to learning how to sustain the amenity created by the whole building process; and shifts the purpose of design from impact mitigation to regeneration of healthy environments, re-use of buildings and symbiosis[4] (Graham, 2003; AIJ, 2005).

At a higher level of preparation, sustainability education pedagogies and curricula must be designed to respond to the distinctive regional and local contexts in which (and for which) they are implemented. However, sustainability curricula and pedagogies share two common features. First, sustainability education is predicated on experiential learning, life cycle thinking, application of critical and reflective pedagogies, and culturally appropriate methods and techniques for formal education sectors, industry training and community-based learning including adult-centred learning processes.

Second, sustainability curricula require scope to engage learners within a community, to interact with civil society, and develop a sense of civic

[2]Ecological literacy (www.ecoliteracy.org) refers to developing an understanding of ecological interdependency, developing an ethic of care and stewardship, and developing systems thinking and skills necessary to instigate ecologically sustaining activity. Educators must acknowledge indigenous forms and expressions of ecological literacy, and not assume ecological illiteracy because of different cultural perspectives of nature (Spariosu, 2004).

[3]*Action competence* is a pedagogy and change theory that encourages self-directed capacities to learn, plan and undertake strategic actions that that will resolve an environmental problem or priority issue and make a difference locally and may also ripple out regionally or globally. *Action* expresses willpower to take on sustainability projects either individually or collaboratively *Competence* is characterised as the abilities to consciously frame problems, envisage solutions, plan and enact a project which is neither too big to accomplish nor too small to warrant self-respect, and be answerable for one's own actions. (Jensen, B. and Schnack, K. eds., 1995).

[4]Symbiosis is literally defined as living with each other for mutual advantage. It defines the conceptual difference between 'eco-efficient' approaches which aim at reducing environmental impacts and a sustainability approach which seeks the concurrent improvement, regeneration and restoration human and natural environments.

responsibility (Fein, 2000). Sustainability educators therefore need to be explicit about the social purposes as distinct from the economic and technical purposes of their curricula (Fein, 2000; Thomas, 2000). They need to clarify the 'core convictions' and identify the values and ideologies that are embodied in each curriculum. To this end, curricula require a 'statement of purpose' for the education on offer.

The physical manifestation of eco-settlements must first manifest as a positive idea in a person's mind (Figure 3). Transforming an unsustainable human settlement into a sustainable one must therefore begin with a transformation of the image of the settlement in the minds of the settlement's stakeholders. Transformative education for eco-settlements must therefore focus on the mind of the learner; it must be "learner-centred".

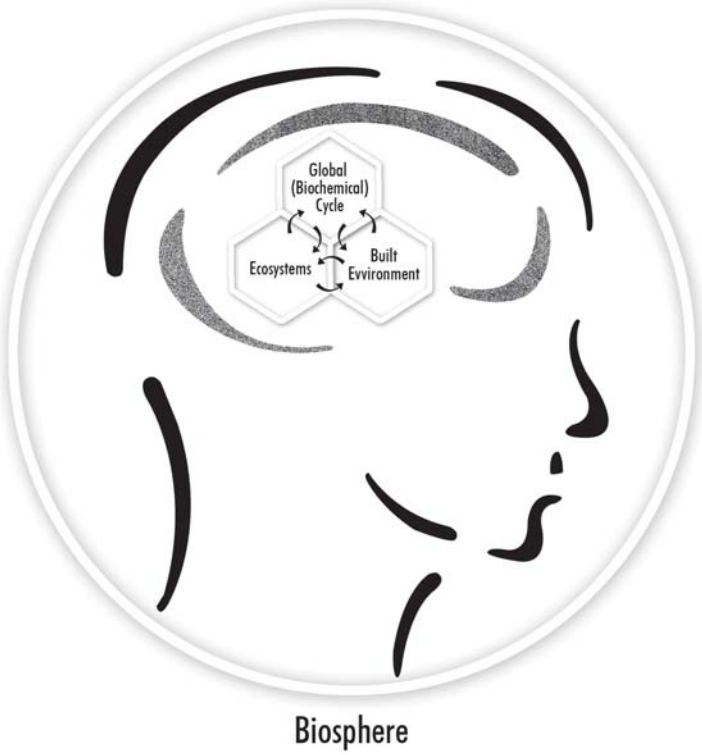

Figure 3: Transformative education for eco-settlements must be learner-centred and focussed on transforming the patterns of thinking and habits of mind of the learner. This image: "The trilogy of interdependency" Source: Graham, 2003 p23.

Learner-centred strategies can be offered to building professionals, educators, students and communities that engage the "heart" (values,) the "hands" (action) of life and the "head" (cognitive learning). They are well suited to developing the life-long learning needed to create eco-cities and villages, and for developing the new kinds of thinking and acting required to contribute to sustainable development. These strategies can be used in various combinations, assisted with appropriate teaching methods that reflect the context and curriculum.

The learner-centred engagement strategies listed below inform the development of curricula and teaching programs for formal education sectors, and community awareness/capacity building.

- Deep learning
- Scenario building and problem solving
- Rich tasks
- Service-learning
- Action learning
- Action competence
- Community engagement
- Risk-based community dialogues and adaptive management strategies

They can be utilised by educators and facilitators in various combinations to consolidate learning aims and outcomes. Each strategy is fully described in appendix A.

In Part 2, key stakeholders are identified as 'learners for sustainability' in the built-environment and policy strategies that create the foundation for education that can achieve these aims are described.

1.3 MONITORING, REPORTING AND EVALUATION METHODS

All educational and capacity building strategies across the Asia Pacific will need to be effectively devised, implemented, monitored and evaluated. All sustainability educators will need to clearly understand why, how when and where to conduct key evaluation processes - in order to track the relevance and successful impact of programs, projects and priority actions or initiatives - and furthermore, be able to teach monitoring and evaluation skills to stakeholders. UNESCO's Working Paper on Asia-Pacific Regional Strategy for Education for Sustainable Development (p.12) highlights the crucial importance of utilising appropriate evaluation methodologies:
"There is no question that monitoring and evaluation mechanisms will be essential to all stakeholders at all levels . . . A key challenge for monitoring and evaluation will be the identification of suitable, relevant and measurable indicators at every level - local, regional, national and international – for each initiative and program … It will be necessary for each stakeholder group/sector to establish its own objectives, outcomes and indicators within the implementation framework." (UNESCO, 2005 p12)

Good evaluation methodologies for educational and capacity building programs and projects can usually be divided into three core or basic phases, summarised below. Good evaluation processes also develop into a cycle of continuous improvement. This means that timing is an important consideration for each phase of evaluation:

1st phase–Formative
Analyses for Program/Project Design
This is also known as the 'front end' phase and it is very important in clarifying and guiding the aims and intended outcomes of a program or project. It comprises situation analyses, needs assessments, and analyses of 'gaps' and risk factors or issues that are likely to hinder progress. These analyses inform the production of relevant and measurable Key Performance Indicators (KPIs), Key Deliverables and Outcomes that are correlated in an Outcomes Hierarchy Framework and a Logic Matrix.

2nd phase–Monitoring the Program Implementation & Project Management
This middle phase comprises piloting and 'road testing' the objectives, measured against the KPIs. This leads on to fine-tuning during the stages of implementation, and if necessary to revisions prior to a full summary evaluation. In other words, the monitoring phase is an iterative learning process, informed and updated as fresh information is revealed.

3rd phase–Summary Program/Project Evaluation
The final 'wrap up' phase comprises culminating reflections on the overall program success rates of goals and outcomes, reviews of strategies and tactics for stakeholder engagement, and other project management and process issues. For example: What worked? What didn't work and why? These culminating reflections inform and guide improved planning processes for the re-design of continuing programs, and the design of follow-on or future projects.

Each of the core phases is reduced to a series of measurable Tasks or Action Steps that provide a strong framework and tools to comprehensively plan

and build integral evaluation processes into new projects, in conjunction with the development of an accompanying Outcomes Hierarchy, which is described below together with the following key components of an evaluation framework:

- Outputs
- Frameworks of short, medium and long term outcomes

Outputs are measurable material products of a program, project or priority action, including new educational tools, processes and networks that have been developed. They provide appropriate base data for monitoring progress.

Outcomes are the short, medium and long term changes achieved that, acting together, build up cumulative transitions towards sustainability. These three stages form a comprehensive timeframe and structure – known as an outcomes hierarchy - for evaluation processes. Depending on the task, different criteria and indicators may need to be developed to identify the effectiveness of each stage:

- **Short term** (or immediate) outcomes include immediate objectives and results such as successfully communicating positive skills, knowledge and values to stakeholders in a priority action; and identifying new skills and knowledge that emerge from an innovative program or project. Short term individual and/or community outcomes begin to generate momentum for transitions towards sustainability

- **Medium term** (or intermediate) outcomes are longer-lasting aims, results and impacts of programs and projects such as changed work practices and community recycling. They generate cumulative changes including improved social, environmental, economic and political contexts; and, if regularly reinforced, generate increased momentum for transitions towards sustainability

- **Long term** (or ultimate) outcomes are the ultimate goals and deep impacts of effective programs and projects: they are consolidated changes that help to achieve permanent shifts towards sustainability e.g. the successful redesign and implementation of new settlement planning and building codes

"Educational outcomes are both people and system-focused, and support the ability of individuals and communities to analyse sustainability issues, to envision and evaluate alternative solutions and scenarios, to make action plans, and to work co-operatively with others to implement them effectively. This means that educational outcomes are rooted in present issues and contexts, but are also future oriented – towards a time when people act on their plans … [and achieve] positive impacts on the sustainability status of an area or resource". (UNESCO, 2005 p. 23)

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PART 2

PART 2:

EDUCATION STRATEGIES AND POLICIES

Intent: Identifies key stakeholders in education for sustainable built environments and outlines the most effective curriculum and policy strategies.

"It is true to say that everyone is a stakeholder in education for sustainable development. All of us will feel the impact of its relative success or failure, and all of us affect the impact of ESD by our behaviour, which may be supportive or undermining." (UNESCO, 2004)

Overview

In Part 2, stakeholder groups are identified and their broad sphere of influence on eco-settlement education is described. Both UNESCO's International Implementation Scheme for the DESD and the UNESCO/UNEP Working Paper: Asia-Pacific Regional Strategy for Education for Sustainable Development (Bangkok, 2005) make a clear case for developing educational strategies, policies and programs for these eight foundational stakeholder groups:

- Governments and inter-governmental bodies;
- Communities;
- Private sector industries including professionals and trades-people;
- Formal education institutions;
- Civil society and NGOs;
- Media;
- Youth; and
- International agencies.

Following the reflection-in-action approach to learning described in Part One, people within each of the eight foundational stakeholder groups have roles as learners, providers and reflective practitioners in eco-settlement planning, design, development and ongoing management. *Agenda 21 for Sustainable Construction in Developing Countries* (CIB-UNEP-IETC, 2002, p.1) highlights how successful shifts towards the creation of sustainable built environments will require the evolution of specific strategies for action for various **role players** within the key stakeholder groups identified above.

Similarly, within each of the key stakeholder groups some people will have different roles to play in developing, supporting and implementing eco-settlement education, training and capacity building. In Part 2, descriptions of these educational role-players within each key stakeholder group provide for a more focussed reading of the suite of strategies and policy goals presented.

Initially, these role players can be seen as learners or providers in eco-settlement education, training and capacity building. **Learners** are those who need to acquire specific knowledge and skills, then progress as informed and empowered stakeholders. **Providers** are educators, trainers, community facilitators and others with primary responsibilities and tasks to provide sustainability knowledge (including recent research), skills and praxis.

However, consistent with the need for everyone to become involved in life-long learning for sustainability, many role players are likely to have **multiple roles** as both learners and providers at various times. This includes sustainability educators, industry trainers and community facilitators, who will need to participate in continuing education programs and learn from ongoing engagements with industry partners, communities and other stakeholder groups. Informed stakeholders who have been provided with a program of sustainability education and/or awareness and capacity building will also shift roles from learners to **enactors:** they will now have things to do/tasks to enact within their sphere of influence, for example as:

BOX 2. Roles for Stakeholders

- Clients need to demand a more sustainable built environment;
- Professionals need to adopt and promote sustainable construction practices through their work;
- Construction industry needs to commit to following sustainable construction processes; and
- Regulatory bodies need to encourage, enable and enforce sustainable construction.

If all these stakeholders are to fulfil their roles, the educational sector has to provide them with the necessary training and with educators who themselves are committed to sustainability. These educators will need the knowledge that is being developed by the researchers . . . . For the researchers to develop this new knowledge, they will need the participation and support of clients, contractors, professionals, governments and regulators.
Agenda 21 for Sustainable Construction in Developing Countries (Du Plessis, 2002:1)

- Informed graduates;
- Informed employees and leaders in industry;
- Active members of professional associations;
- Trades-people in private sector companies;
- Village-level builders and artisans; and
- Empowered community champions.

Lastly, learners, providers and enactors must learn how to **reflect on actions** taken to contribute to eco-settlements, and identify where they need to build further capacities and develop action competency. Through this process, role players become reflective practitioners and may also become members in ***communities of practice***[5], who share social learning experiences, a sense of identity and purpose in reviving traditional wisdom and/or generating new skills and knowledge with other practitioners and stakeholders.

Communities of practitioners share a concern or a passion for something they do and learn how to do it better as they interact regularly and collaborate to resolve problems: a band of artisans reviving a traditional building design that provides thermal comfort; a group of green engineers working on similar problems, a gathering of sustainability managers helping each other to cope with complex situations. Each community of practice is likely to engage in one or more of these types of learning: *problem solving; requests for information; seeking experience; reusing assets; coordination and synergy; discussing developments; documenting projects; site visits and field trips;* and *mapping knowledge and identifying gaps (*Wenger 2006: 2-3)

Eco-settlement education strategies for each key stakeholder group are presented in the following sections. Each section describes the general role of each group, identifies role players and sets out policy goals. Taking action is essential to situated learning. Methods for implementing strategies are therefore listed and used to organise a suite of enabling actions. This provides a framework for engaging role players in the built environment to become more actively involved in eco-settlement learning. A tabulated summary of this framework is provided at the end of this section.

[5]**Communities of Practice**: "Communities of practice develop around things that matter to people. As a result, their practices reflect the members' own understanding of what is important. Members of a community are informally bound by what they do together–from engaging in lunchtime discussions to solving difficult problems–and by what they have learned through their mutual engagement in these activities. A community of practice is thus different from a community of interest or a geographical community, neither of which implies a shared practice. A community of practice defines itself along three dimensions:

- **What it is about** – its *joint enterprise* as understood and continually renegotiated by its members
- **How it functions** *mutual engagement* that bind members together into a social entity
- **What capability it has produced** – the shared repertoire of communal resources (routines, sensibilities, artefacts, vocabulary, styles, etc.) that members have developed over time." (Wenger, E. 1998)

2.1 STRATEGIES FOR GOVERNMENTS AND INTER-GOVERNMENTAL BODIES

Governments at national, regional and local levels play a key role in initiating eco-settlements as regulators, planning authorities and as clients for building and infrastructure. There are two key role-players in this sector, namely elected officials and representatives, and bureaucrats. Elected officials are responsible for ensuring that needs, values and priorities of their constituents are considered in the on-going development of built environments. Bureaucrats must be empowered to play strategic roles in ensuring the longer-term development of sustainability in urban and rural systems. Governments at all levels must take leadership roles, as major procurers of buildings and infrastructure, to generate demand for sustainable buildings and infrastructure in cities, towns and villages.

Government at all levels must also ensure that innovative projects become learning opportunities by documenting them as case-studies and through performance monitoring. Governments can also educate the private sector in the value of sustainable development strategies by supporting sustainability performance rating schemes for buildings, rewarding best practice, and assisting the mainstreaming of sustainable building through establishing communities of practice supported by information technology. These communities of practice can help support the review and reform of school curriculum to ensure that sustainable building education is a core component. These initiatives allow the private and public sectors to share knowledge and educate each other about eco-settlements on a project-by-project basis, using a "bottom-up" approach (Lutkendorf, 2005).

Key role players:

- Ministers, elected officials and representatives;
- Senior administrators of government departments or bureaus involved in education at all levels.

Policy goals:

- Public sector role players who understand and can implement the eco-settlement principles, practice and education;
- Eco-settlement learning to become the core in formal education curricula;
- Communities are engaged in developing and monitoring indicators of sustainable development in their settlement;
- Communities are empowered and encouraged to participate in learning through adaptive management of their settlement to eliminate unsustainable policies and practices.
- Government procurement practices for eco-settlement lead by example.

Implementation methods:

- Education policy review and reform;
- Continuing professional development;
- Capacity building programs;
- Encouraging & supporting communities of practice;
- Performance assessment & rating of settlements;
- Leading by example

Enabling activities:

In general, governments at all levels should follow the recommendations of the UNESCO/UNEP Working Paper: *Asia-Pacific Regional Strategy for Education for Sustainable Development* (UNESCO, 2005). More specifically, government and intergovernmental bodies can contribute to eco-settlement learning by prioritising and undertaking the following enabling activities:

2.1.1 Eco-settlement Education Policy–Review and Reform

a. Review and reform formal education systems so that eco-settlement learning is a core requirement of curricula;
b. Eco-settlement education policies are inclusive of traditional knowledge systems and governance practices, especially in village contexts;
c. Curricula should emphasise ecological welfare as a common good and encourage intercultural and interfaith dialogue about moral responsibilities for environmental stewardship.
d. Ensure that policies enable learning *from* as well as *of* local indigenous knowledge;
e. Ensure that policies enable learning how to integrate traditional and contemporary systems and technologies in eco-settlement planning, design, development and operation;
f. Encourage 'sustainable schools and campuses' – provide financial resources and subsidies for retrofitting campuses and school grounds as exemplars of eco-settlement strategies.

2.1.2 Continuing Professional Development

a. Establish requirements for bureaucrats and professionals to develop basic environmental literacy and knowledge of sustainable construction through continuing professional development;
b. Educate policy makers in principles of closed

loop design and management such as industrial ecology, building ecology, permaculture, product ecology, and life-cycle assessment.

c. Develop education programs for the finance industry to encourage entrepreneurial engagement with eco-settlement.

2.1.3 Capacity Building

a. Conduct needs analyses with urban and rural communities to identify specific community capacity building requirements.
b. Develop community capacity building programs in sustainable design and construction, accessing funding for eco-development, monitoring programs, home maintenance, citizenship, consensus building and conflict resolution.
c. Develop community education that supports recycling programs, waste minimisation and management, and non-car based personal transportation.
d. Create public awareness campaigns in partnership with media organisations.

2.1.4 Encouraging & supporting communities of practice

a. Utilise communities of practice as an orienting framework for educators to structure learning opportunities that embed knowledge in both work practices and social relations.
b. Enable students to solve real problems with adults, in real learning situations including apprenticeships, adaptive management challenges, situated learning, and service learning.
c. Design on-going monitoring process, within adaptive management programs based on action-learning processes.
d. Create programs for developing intercultural and inter-faith understanding about eco-settlement goals and priorities for action.
e. Develop partnerships with community organisations and financiers to provide education in micro-financing and co-operative building schemes.

2.1.5 Performance assessment & rating of settlements

a. Develop eco-settlement goals, benchmarks, indicators and monitoring programs that enable community participation. Examples include ecological foot-printing, urban metabolism monitoring, monitoring the local ecological and health impacts of built-environments and integrated triple-bottom-line reporting (profit, health and environment).
b. Ensure that goal-setting and performance monitoring are public processes and that results are always provided as feedback to stakeholders.
c. Ensure the on-going performance monitoring of building stock so that the rights of all people to healthy, accessible and resource efficient human habitat are being upheld;
d. Establish ISO recognised eco-labelling requirements for all building materials and a data-base for sourcing eco-preferred building materials.
e. Ensure that eco-settlement monitoring programs are integrated with policy development.

2.1.6 Lead by example

a. Use government's role as a major developer and procurer of built-environments to lead by example and explain why and how eco-settlement strategies being implemented;
b. Establish each new project as a public (as well as organisational) learning opportunity;
c. Teach people that stewardship is highly valued. Ensure, for example, that economic drivers reward activities that eradicate unsustainable forms of urban settlement and that contributions to eco-settlement goals are publicly recognised and rewarded.
d. Document innovative eco-settlement projects as case studies.

2.1.7 Exemplars

At a local government level, the City of Melbourne in the Australian State of Victoria, has recently developed a new office building known as "Council House 2" (CH2) as an eco-settlement learning process. The building was conceived from the outset to be a world-leading 'green building' which not only achieved high environmental performance, but which would create a healthy and productive working environment for office workers. The project was completed in 2006 and achieved Australia's highest 'Greenstar' rating of six stars. CH2 is an exemplar of eco-settlement education because the local government project initiators used the development process as a public and organisational learning opportunity. Researchers from three Victorian universities were commissioned from the outset to case-study each phase of the project as a process of *reflection-in-action*. A web-site is dedicated to the project so that the knowledge gained on the project can be shared. In addition to researchers the council also commissioned an artist to document the design and construction in public art works, displayed on hoardings around the site. See: (www.melbourne.vic.gov.au/Environment/CH2/Pages/CH2Ourgreenbuilding.aspx)

2.2 STRATEGIES FOR COMMUNITIES

Communities should be seen positively as learning organisations (Senge, 1992) that require environmental and ecological literacy, knowledge of bio-climatic design and building ecology. They therefore need to be involved in monitoring and reporting the environmental performance of their buildings and local environment so that they, the public and private sectors can learn from their experiences. Knowledge gained through these actions can be fed back to the community knowledge base so that locally generated knowledge is as accessible as generic best-practice guidance. They need to know how local and regional planning processes operate so they can become involved in development decision-making.

Communities of low-income and informal settlements will benefit from capacity building programs aimed at developing skills in building and infrastructure construction and maintenance of *health hardware*. Heath hardware (Torzillo *et al*, 2002) refers mainly to toilets and septic systems, hot water services, water supply and washing areas, insect screens and basic safety of electrical systems. Ideally these capacity building programs will be linked to institutions of formal education and lead to recognised trade and professional qualifications.

It is important to recognise the role of traditional knowledge and governance systems within communities as these are often the foundation of social stability. Interfaith and inter-cultural tolerance and understanding can be built around sharing traditional knowledge systems that contribute to common life-quality. Marginalised and welfare-dependent communities should also participate in education that enables more self-determinacy and qualification to tender for aid-based building development projects.

Key role players:

- Community leaders, educators and champions
- Developers of innovative community awareness programs
- Initiators of community engagement projects

Policy goals

- Communities are involved in building development decision-making;
- Community members understand bio-climatic design, building ecology and can maintain health hardware;
- Communities are networked to learn from their experiences of eliminating unsustainability from their settlements;
- Eco-settlement learning is organised in a community sustainability knowledge base that is accessible by all;
- Traditional knowledge and governance systems are incorporated into eco-settlement education programs;
- Interfaith and intercultural tolerance and understanding are continuously fostered through collaboration.

Implementation methods:

- Sustainability monitoring and reporting programs;
- Collaboration;
- Capacity building programs;
- Learning networks and partnerships; and
- Community knowledge base.

Enabling activities:

Communities can contribute to eco-settlement learning aims by undertaking the following learning activities:

2.2.1 Sustainability monitoring and reporting programs

Become involved in developing and monitoring eco-settlement goals, benchmarks, and indicators. For example, engage primary and secondary schools in local ecological foot-printing, urban metabolism monitoring, and monitoring the local ecological and health impacts of built-environments. Programs such as these also help in developing a community's environmental literacy.

2.2.2 Collaboration

a. Conduct community forums to explore and share innovative ideas and exemplary case studies of eco-settlements in local communities
b. Partner with local government, NGO, schools, arts and faith-based organisations to develop and implement intercultural, interdisciplinary and inter-faith eco-settlement programs;
c. Learn methods for group-decision making, visioning, design and conflict resolution;
d. Celebrate eco-settlement activities through special events such as ceremonies and festivals;

e. Develop inter-cultural and inter-faith understandings of each other and ecology through sharing knowledge in basic life-skills such as cooking, shopping and growing food.

2.2.3 Capacity building

a. Learn basic building ecology and the influence of building and urban design on human health and comfort;
b. Learn how to become involved in and influence local and regional planning processes, development controls and building approvals;
c. Learn basic construction and home maintenance skills, ensuring that households have basic knowledge in healthy living practices and home maintenance, with an emphasis on knowing how to maintain the "health hardware[6]" of a house and a community.
d. Learn about the history and traditions of local built environments and ecosystems, and how to raise public awareness of their cultural value through community-based initiatives such as public art, performance and story-telling.
e. Assist the development of eco-settlement knowledge and action competence amongst community leaders and help them become eco-settlement advocates and educators;

2.2.4 Learning networks and partnerships

a. Partner with faith-based and cultural organisations to develop shared eco-settlement values and priorities;
b. Develop partnerships with development, trade and professional organisations and implement community-lead capacity building programs which include train-the-trainer components.
c. Develop partnerships with financial organisations to develop capacity in project funding and financing;
d. Partner with government agencies to develop and participate in school and campus-based initiatives in education for eco-settlements.

2.2.4 Knowledge bases

a. Create local knowledge bases that provide locally appropriate guidance on living sustainably in eco-settlements;
b. Develop eco-settlement knowledge with neighbours and other community members by developing networks of people that learn through trying sustainable life-styles.
c. Feed back knowledge gained through these actions to the community knowledge base so that locally generated knowledge is as accessible as generic best-practice guidance

2.2.5 Exemplars

The Government of the Australian State of Victoria has successfully supported the development of community gardens in public housing estates which are typically home to multi-cultural and disadvantaged communities. The aim of the program is to provide a way for diverse ethnic groups to get involved in community life and interact with each other (Museum of Victoria, 2006). A similar program at the University of New South Wales has been linked to undergraduate education for built-environment professionals (FBE, 2006). The UK charity Global Action Plan, for example, supports the establishment of 'Eco-teams' – groups of approximately 6 households that learn from each other effective ways of changing unsustainable living practices (GAP, 2006).

The Barefoot College in Rajasthan, India provides an exemplar of working with marginalised communities, having educated the rural poor as "Barefoot Architects" since 1986 (Barefoot College, 2006).

A program for learning about and maintaining health hardware in rural communities has been developed in Australia by the organisation Health Habitat, which runs the Housing for Health Program in Australian Aboriginal communities (Torzillo et al, 2002).

[6]'Health Hardware' refers to building materials, strategies and technologies that are essential to providing a healthy living environment in houses. Health hardware includes for example, properly maintained and functioning hot water services and toilets. (Torzillo *et al*, 2002)

2.3 STRATEGIES FOR THE PRIVATE SECTOR

The private sector includes corporations and property development organisations, professional, trade and manufacturing organizations, and their clients. As clients of building and infrastructure projects, corporations and property developers provide a major opportunity for mainstreaming sustainable building practices, and can also drive market demand to implement eco-settlements. However, in order to become proactive they need to learn how to derive financial and professional benefits from these practices. To this end the real-estate industry must also be educated in ways of promoting both the financial and life-quality benefits of sustainable building and property developments.

Professional and trade organisations have an important role to play in influencing the formal, vocational and continuing education of building-industry professionals and trades people. They must be encouraged to ensure that eco-settlement learning aims are embedded in the curricula for these modes of education. They must also recognise the important role that publications and awards play in establishing a social context for learning, and for defining best practice. Publications and awards should promote eco-settlement values and explain and reward innovative design, building and maintenance strategies.

Many professional organisations such as institutes of architects and engineers have made commitments to embed sustainable development values in their professional codes of ethics and in accreditation criteria for courses. Professional organisations should be held accountable for implementing declarations such as the UNESCO/UIA Charter for Architectural Education (2005):

"A decent quality of life for all the inhabitants of human settlements, with a technical application, which respects the social, cultural and aesthetic needs of the people, by showing an ecologically balanced and sustainable development of the built environment. Aiming to provide Architecture, which is valued as the property and responsibility of everyone." (p2)

For example, the Australian Institute of Architects and the Architectural Institute of Japan have adopted the International Union of Architect (UIA) *Declaration of Interdependence for a Sustainable Future* (Majekodumi & Maxman, 1993). The education policy of the Royal Australian Institute of Architects (RAIA) cites the ability to contribute to sustainability as a main aim of architectural education (RAIA, 2005).

Key role players:

- Designers/deliverers of industry training programs and packages;
- Professional accreditation associations in built environment professions such as Architecture, Engineering, Planning, Landscape Architecture, Construction Management, Construction Economists and Interior Architects;
- Project financiers and property developers;
- Building industry professionals;
- Trade unions and industry advocacy organisations.

Policy goals:

- Sustainability learning is embedded into professional education and vocational training curricula;
- Professions are accountable for implementing declarations on sustainable development;
- Continuing demonstration of and education in sustainable building is a requirement for licensure as a building tradesperson or professional;
- Project financiers understand and can determine the financial and life-quality benefits of sustainable building and eco-settlement development;
- There is mainstream market understanding of and demand for sustainable building.
- Sustainable building is widely publicised and awarded. Case studies are always generated as an action-research and community learning process.

Implementation methods:

- Continuing professional development;
- Course, trade and professional accreditation;
- Publications and awards;
- Building performance assessment and rating;
- Public accountability;
- Research and Development.

Enabling activities:

Private sector role players can contribute to eco-settlement learning aims by undertaking the following enabling activities:

2.3.1 Continuing professional development

a. Invest in capacity building programs for 'closed-loop' supply-chain management;
b. Learn how to respect and incorporate traditional knowledge systems in business decision-making;
c. Educate management and workers to develop their ecological literacy and capacity to contribute to sustainable development goals;

2.3.2 Course, trade and professional accreditation

a. Professional organisations must ensure that ecological literacy, industrial and building ecology and ethical inquiry are embedded in core curriculum for accredited education programs;
b. Develop partnerships to develop core curriculum in ecological economics;

2.3.3 Publications and awards

a. Publications and awards should promote eco-settlement values and explain and reward innovative design, building and maintenance strategies.
b. No award recognition should be given to development projects which are unsustainable.

2.3.4 Building performance assessment and rating

a. Participate in the on-going monitoring and public reporting of eco-settlement performance;

2.3.5 Public accountability

a. Establish and operate triple bottom line (social, environmental and financial) business performance monitoring and reporting programs;
b. Implement the *precautionary principle* in development and investment decision-making;
c. Implement and be accountable for existing commitments to and declarations on sustainability education for professionals.
d. Ensure that the administration and management of the organisation adheres to sustainable development principles and is held accountable for triple bottom line performance.

2.3.6 Research and Development

a. Develop partnerships with research organisations to learn the economic value of eco-settlement initiatives;
b. Ensure that the knowledge generated by actions taken to contribute to eco-settlement development is managed and becomes the basis for further education.

2.3.7 Exemplars

The Royal Institute of Scottish Architects recently launched a professional accreditation program for sustainable designers. This is an evidence based scheme in which architects submit built work as evidence of levels of competence. It is a voluntary program at the moment but the vision is for it to eventually be a mandatory requirement for professional re-accreditation (Liddle & Halliday, 2005).

In relation to best practice awards, the Aga Khan Award for Architecture has, since 1977 recognised building developments and architecture that have contributed to social and environmental issues which have more recently become associated with eco-settlements. The award applies internationally on a three year cycle and recognizes:

" ...examples of architectural excellence that encompass contemporary design, social housing, community improvement and development, restoration, re-use and area conservation, as well as landscaping and environmental issues." (Aga Khan Development Network, 2006)

Recipients of the award include Kampung Improvement Programs in Indonesia (1980), low-income urban housing for formerly rural and nomadic people in Dar Lamane, an area of Casablanca, Morocco (1983), a stone building system to replace reinforced concrete construction in rural Syria (1992), a program to transform slum areas of Indore, India into settlements and integrate the poor into the urban population (1998) and the Bibliotheque Alexandrina, a new centre for learning and culture in Alexandria Egypt (2004).

2.4 STRATEGIES FOR THE FORMAL EDUCATION INSTITUTIONS

The formal education sector involves institutions for primary, secondary and tertiary education, their students and teachers, the communities they serve and policy makers that effect curriculum and funding. Each sector has a role to play in developing values consistent with sustainable development and eco-settlement. E.F. Schumacher wrote that education is our greatest resource but warned that unless we "clarified our central convictions it would ultimately be a destructive force" (1973). Given that the design, construction and metabolism of our built environment profoundly affect our values, lifestyle and ecological impact, it is important for schools and universities to decide that education for sustainable development is important enough to become a "central conviction". Fundamentally these organisations should establish programs consistent with the guidelines on education for sustainable development described by the UNESCO/UNEP working paper: *Asia-Pacific Regional Strategy for Education for Sustainable Development* (UNESCO, 2005).

Focussing on the built-environment, primary and secondary school teachers should be supported in developing curricula for eco-settlements. Local, regional and national education policies should ensure that eco-settlement learning aims are embedded in formal curricula. Teachers should be networked into communities of practice in order to improve teacher's awareness of eco-settlement issues and the effectiveness of their courses and teaching methods.

Universities are uniquely placed to develop strategies for eco-settlement through the nexus of research and teaching. They can also be encouraged to implement commitments to international declarations such as the Talloires Declaration for University Leadership in Sustainable Development. Campuses can also be written into curricula as '*learnscape* laboratories' (Booth, 2002) for understanding both sustainable and unsustainable building and settlement design, construction and operation. Curricula should involve students in assessing, planning and redesigning campuses so that they evolve into examples of eco-settlement. Curricula should also be designed to foster strong links with local communities, and engage students in '*service-learning*' (see also 1.3.1) with communities. This approach, set within an **engagement**[7] research and teaching approach enables engagement itself to be an initiating process of eco-settlement.

Key role players:

- Educators;
- Students and student organisations;
- Accreditation, professional and trade organisations;
- Policy makers and funding organisations;
- School and university communities.

Policy goals:

- Sustainability education is a core-conviction and ethos of institutions for formal education;
- Campus and other settings for education are eco-settlement learning laboratories and building procurement, design, construction, maintenance and refurbishment are best-practice exemplars;
- Research, teaching and community engagement reinforce eco-settlement learning and development;

Implementation methods:

- Curriculum review and reform;
- Networks and partnerships;
- Student involvement;
- Community engagement;
- Campus eco-redesign and performance monitoring.

Enabling activities:
Role players in formal education can contribute to eco-settlement learning by undertaking the following activities:

2.4.1 Curriculum review and reform

a. Work with curriculum authorities, study boards, education and training departments and industry training organizations to identify and develop new teaching modules, support materials and learning activities.
b. Rate, revise and audit existing curricula and teaching training programs, identify gaps and learning opportunities, then develop new programs to educate for eco-settlements
c. Develop and promote new methods of teaching to reflect the holistic character of sustainability

[7]Engagement can be used as an educative practice in which the community, students, teachers and research are involved in a dialogue about the context they are in, and the values and worldviews they use to understand relevant problems, knowledge and solutions.

education and to highlight the interdependent factors of eco-settlements [exemplars from UNEP Knowledge Base white paper in 2.3.2]

d. Develop continuous cycles of monitoring and evaluation to improve the design, delivery and auditing of sustainability education programs and projects.
e. Design eco-settlement curricula as action-research projects and share outcomes through journals and the media;
f. Ensure progressive reinforcement of eco-settlement values, knowledge and skills between subjects and through each stage of programmes of study.

2.4.2 Networks and partnerships for teaching, research and community engagement

a. Form new national and international teaching and learning partnerships with educational institutions from both developing and developed nations, and re-energise old alliances, to clarify common visions and aims for achieving eco-settlements within the Asia-Pacific region
b. Become important "initiators of activity" by cooperating with local governments and/or community facilitators and other partners to initiate community engagement /action learning projects that mutually build capacities
c. Encourage inter-disciplinary research and teaching in eco-settlement issues in order to build networks of "critical colleagues and advocates" (UNESCO, 2005).
d. Build capacity in service learning curriculum development and engaged research and learning methodology in order to strengthen links between teaching, research and community engagement;
e. Identify, network and partner with schools and universities in order to share eco-settlement curriculum and research findings;

2.4.3 Student Involvement

a. Involve students in curriculum design and review;
b. Engage students in hands-on action projects that enable them to develop skills, knowledge, inspiration and self-motivation to create positive changes
c. Engage young professionals in *action competence* projects to enable them to develop skills, knowledge and inspiration to create changes

2.4.4 Community Engagement

a. Prioritise community based engagement projects that build up contextualised knowledge
b. Incorporate Service-Learning and community engagement programs in tertiary courses
c. Develop service learning and action-learning curriculum which investigates unsustainability through auditing and environmental improvement of school buildings and campuses, and student and teacher life-styles.

2.4.5 Campus eco-redesign and performance monitoring

a. Practice what is being preached - promote ***sustainable campuses*** in schools and universities and actively involve students in devising and implementing sustainable design projects
b. Showcase leading edge case studies and research projects at conferences, forums and seminars; and in publications, networks, data bases and websites
c. Build teacher's and academic's capacity and willingness to practice what is preached and lead by example;
d. Write curricula that establishes campuses as 'learn-scape' laboratories, creating a rich environment for eco-settlement analysis and learning;
e. Make a commitment to identify and strive to eliminate unsustainabiility from all academic and administrative programs, facilities and activities as an on-going learning-cycle.
f. Reward good practice in education for sustainable development and implementation of service learning curriculum.

2.4.6 Capacity building and continuing education

a. Cooperate with relevant professional associations to develop continuing professional development courses, work-placements, training programs and resources for educators
b. Mentor other educators to attain the competency to incorporate key concepts in their teaching programs [Knowledge Networks exemplar in Part 3]
c. Build teacher and academic capacity in ecological literacy, industrial and building

ecology and ethical enquiry through continuing education.

d. Ensure processes for monitoring learning goals and outcomes are incorporated in program curriculum and administration.

2.4.7 Exemplars

In many countries state-based or national 'Green' schools programs are in place. These programs encourage schools to involve students and staff in improving environmental curricula, the environmental performance of school buildings and grounds, and imagining sustainable design opportunities for further eco-settlement. One such program is the National Green Schools Program in China which was established in 1996 to help foster environmental education. A component of the program is a national commendation awarded each year by The State Environmental Protection Bureau and Education Commission to the most innovative Green Schools in China (Wu, 2002).

University and school campuses provide unique opportunities to be progressively developed as microcosms of eco-settlement. Leading exponents of this approach to sustainability education include Oberlin College, Ohio USA and Charles Sturt University, NSW Australia. These universities link sustainability curriculum to planning, design, construction operation and refurbishment of campus grounds and buildings. This provides opportunities for students and staff to learn together by participating in an eco-settlement process. More information in these programs is provided in Part Three.

Figure 4: Thurgoona Campus - CHARLES STUART UNIVERSITY, NEW SOUTH WALES, AUSTRALIA. This Campus building incorporates sustainable construction, bio-climatic and water-sensitive design in an integrated "learnscape" - a physical example of and setting for education in sustainable development.

2.5 STRATEGIES FOR CIVIL SOCIETY AND NGOs

Civil society and non-government organisations play important roles in lobbying governments at all levels for changes in policy that assist eco-settlement objectives, and in supporting the transformation of the private sector. The important role of national 'Green Building Councils' and other green building advocacy groups in engaging with the re-education of the private sector must be recognised. Programs such as environmental rating schemes for buildings establish benchmarks that define the environmental value of 'green-building' and provide a basis for research into the costs and benefits of such development.

Rating schemes provide a basic framework for defining and learning about 'green building'. Assessor accreditation courses also improve the environmental literacy of building industry professionals. International non-government organisations such as the World Green Building Council and the International Initiative for Sustainable Built Environments (iiSBE) need to be recognised and supported for their roles in networking national NGOs and disseminating research and information about 'green-building' to the public and private sectors.

It should be also be noted that rating schemes do not deal comprehensively with sustainability issues and generally focus on environmental issues relating to the use-phase of new buildings. They are not commonly designed to provide frameworks that integrate social and economic issues, nor deal with the total life-cycle of buildings.

Humanitarian groups such as Architects Without Frontiers and Engineers Without Borders can also play an important role in capacity building within communities, particularly in areas where disaster relief and recovery is required. By partnering with local communities, they can offer a vehicle for securing private and public sector funding for community eco-settlement education programs that respond to local education needs and the cultural context. Specifically, civil society and NGOs can contribute to eco-settlement learning objectives in the following ways:

Key role players:

- Green building advocacy groups;
- Humanitarian and Aid organisations;
- Local community advocacy organisations;
- Research organisations and networks

Policy goals:

- Mainstreaming eco-settlement learning in the private sector;
- International exchange of eco-settlement knowledge and curricula;
- Networking private, public and community stakeholders to facilitate eco-settlement activity and education;

Implementation Methods:

- Performance monitoring, assessment and rating schemes;
- Networks and partnering;
- Community engagement project development and grant applications;
- Capacity building.

Implementing activities:

Civil Society and NGO role players involved can contribute to eco-settlement learning by undertaking the following activities:

2.5.1 Performance monitoring, assessment and rating schemes

a. Develop definitions of eco-settlements and 'green' buildings through assessment and rating schemes and using these schemes as a basis for community education and market transformation;
b. Ensure that 'as-built' and 'in-operation' performance monitoring of buildings is conducted to augment initial building design ratings and that this post-occupancy review data is publicly available;
c. Monitor indicators of corporate social and environmental responsibility for publicly listed property development, construction and material supply companies.

2.5.2 Community engagement project development and grant applications

a. Assist community organisations in developing and implementing eco-settlement monitoring programs.
b. Assist the formal education sector to establish school and campus eco-redesign and performance monitoring schemes.
c. Assist communities in needs analysis, project definition and grant writing.

2.5.3 Networks and partnering

a. Network with other NGOs, civil organisations and stakeholders to maintain awareness of eco-settlement education initiatives;

b. Partner with other stakeholders and donors to secure funding for eco-settlement education programs;
c. Enhance co-operation by linking with other organisations to facilitate interdisciplinary, inter-faith and inter-cultural eco-settlement education;

2.5.4 Capacity building

a. Help to foster an understanding of building ecology and environmental performance of buildings through local capacity building programs;
b. Facilitate training in basic infrastructure and building design, construction and maintenance;
c. Facilitate the implementation of local environmental monitoring programs;
d. Facilitate capacity building and train-the-trainer programs in eco-settlement planning, design, construction and maintenance;
e. Facilitate building and 'health infrastructure' auditing programs within communities and providing training in on-going auditing and maintenance and repair projects;
f. Facilitate professional development courses in building performance assessment and rating;

2.5.5 Exemplars

Deforestation due to fuel-wood collection in the Yunan province of north western China is impacting on biodiversity in the region. To address this a partnership between the US NGO The Nature Conservancy, the Diqing Prefecture government and the Kunming University of Science and Technology's (KUST) Institute for Green Vernacular Building has been established to work with communities to improve the environmental performance of local housing and public buildings. One such program is undertaking eco-settlement work in the town of Shangri-la (Zhongdian) where KUST masters students, staff and international experts have completed design and construction of an office building for the Shangri-la Botanic Garden (Wen Feng, 2006). The new building combines local construction techniques with bio-climatic design thus eliminating the need for solid fuel heating and is an important demonstration of the role green vernacular buildings, interdisciplinary partnerships and education can play in eco-settlement.

PHOTO: GRAHAM, 2006

Figure 5: Offices for the Zhongdian (Shangri-La) Botanic Gardens.

2.6 POLICY STRATEGIES FOR MEDIA

The media and advertising is a powerful generator and distributor of information which reinforces dominant value-systems. In many ways the messages contained in media and advertising establish the informal or social learning context within which all stakeholders in built-environments are immersed. It is therefore essential to the learning aims of eco-settlement that media be harnessed to reinforce enabling value-systems, create demand for and distribute knowledge of, eco-settlement strategies.

The increasing decentralisation of media through internet and other forms of ICT provides an opportunity for local, regional and global communities to directly inform each other about issues of urban unsustainability and strategies for innovation. This emerging capacity has the potential to increase the potency of initiatives which seek to provide basic tools and knowledge for eco-settlement without prescribing the form of development required to achieve this aim.

Key role players:

- Print and broadcast media organisations;
- Advertising agencies;
- ICT providers;

Policy goals:

- Create demand for eco-settlement strategies;
- Eco-settlement knowledge and exemplars are freely and widely distributed and promoted;
- Eco-settlement values and ethics are demonstrated and promoted;
- Local, regional and global communities directly inform each other using ICT.

Implementation methods:

- Network initiatives;
- Promotion and awareness raising;
- Dissemination and distribution.

Enabling activities:

Media role players involved can contribute to eco-settlement learning by undertaking the following activities:

2.6.1 Network initiatives

a. Engage with sustainability professionals to develop media resources that explain and exemplify systems thinking and understanding relevant to eco-settlement;
b. Link with networks of sustainability educators to distribute curricula for eco-settlement learning;
c. Collaborate with government, NGOs and educational institutions to promote eco-settlement activities and outcomes.
d. Provide opportunities within media groups and organisations to allow leading edge practitioners to share experiences of successful eco-settlement and sustainability education programs.

2.6.2 Promotion and awareness raising

a. Promote the eco-settlement work of community leaders and other eco-settlement champions;
b. Promote broader community understanding of strategies and priority actions to achieve sustainable lifestyles and protect environments;
c. Promote inter-faith and inter-cultural tolerance and understanding through the common goals of eco-settlement development.
d. Promote locally developed eco-settlement strategies, telling stories of traditional as well as appropriate application of new ideas and strategies;
e. Don't promote consumer life-styles as a means of well-being or happiness.

2.6.3 Dissemination and distribution

a. Promote and disseminate research and development in eco-settlement education.
b. Showcase effective and innovative examples of both professional and community-led sustainability initiatives;
c. Support community knowledge bases;

2.6.4 Exemplars

The potential of the internet as a new platform for interactive media is beginning to be explored by groups involved in sustainability education and action. For example, the 'Taking IT Global' (TIG) initiative is creating an on-line youth-based community focussed on local eco-settlement and other sustainability initiatives. TIG "connects youth to find inspiration, access information, get involved and take action in their local and global communities" (TIG, accessed on-line, 19/10/06) TIG members are using this as a platform for campaigns to implement the Millennium Development Goals and are partnering with NGOs on humanitarian and environmental issues.

Another internet-based media initiative is TeachSustainability.com. This web-portal serves as an interactive database for Australian high-school teachers and students to share curriculum and sustainability education resources. Users can load curriculum, search the data-base for materials and network with other educators in their field (www.teachsustainability.com). See Section 3.2 for more information.

2.7 STRATEGIES FOR YOUNG PEOPLE

"…we have to get in there and energise adults with our ideas and action so that we do change our habits and save Mother Earth for our children and grandchildren." (UNEP, 1999 p8)

Young people have the greatest stake in the future and should have the opportunity to learn through participation in eco-settlement development. More importantly they need to be encouraged to develop values and aspirations that enable eco-settlements to develop. The importance of fostering ethics and holistic ways of thinking consistent with sustainable development is amplified because in many countries scholars are no longer in control of information. The information and ICT literacy of young people therefore needs to be facilitated and harnessed in eco-settlement processes and projects.

Schools and universities which provide the formal settings for educating young people obviously play an important role in terms of the structure and content of their curricula and in examples set by their campus design and operation. However, peer groups and youth networks are playing an increasingly important role in forming the value-systems of young people. Recent research into the socio-political orientations of Australian University students (Hastie, 2005) for example, reinforced the findings of many studies conducted over the past 30 years, that the values students learn at university is highly dependent on their orientation upon entry into university, and the socializing effects of the courses they take. The former she describes as 'self-selection' where students choose a course of study which accords with their initial value system, which is predominantly influenced by the value systems of their parents. The latter socialization effect is influenced by the dominant values held by their peer groups and what is rewarded by academics. Media too plays a key role in validating and promoting sustainable knowledge and behaviour.

Young people may have the best minds, but perhaps the least power to instigate eco-settlement. It is therefore essential to sustainability education that emerging environmental perspectives of young people are listened to and respected. Young people must be empowered to participate in eco-settlement decision-making, curriculum development and review, media production, networking and advocacy. This not only means inviting young people to the table, but also to provide capacity-building in advocacy and change processes so that they are able to contribute.

Key role players:

- Media groups focussing on marketing to young people;
- Student organisations;
- Families and community groups;
- Youth advocacy organisations;
- Youth clubs and societies;
- Youth media organisations;
- Schools and Universities.

Policy goals:

Young people are empowered to participate in

- Eco-settlement decision-making,
- Curriculum development and review,
- Media production,
- Networking and advocacy.

Implementation methods:

- Networks and Partnering
- Involvement
- Empowerment

Enabling activities:

Young people can contribute to eco-settlement learning by undertaking the following enabling activities:

2.7.1 Networks and partnering

a. Youth are already networked and systems thinkers…don't dumb them down. Ensure that interaction is based on dialogue;
b. Provide venues and events for inter-faith and inter-cultural creative re-imagining of sustainable futures and eco-settlement design;
c. Support ICT infrastructure to enable young people to directly communicate, share stories and knowledge and collect information.
d. Link with existing youth environment networks and encourage capacity building in eco-settlement visioning, advocacy and strategy implementation;
e. Partner young people with elders in order to maintain connection with, and validation of traditional knowledge.

2.7.2 Involvement

a. Become involved in monitoring the sustainability and/or unsustainability of their built environment;
b. Become involved in settlement design and governance processes;
c. Become involved in environmental regeneration projects linked with educational, faith-based and cultural organisations;
d. Include youth and student organisations in school and university curriculum development and review processes.

2.7.3 Empowerment

a. Encourage the development of youth media projects and organisations that provide a voice for eco-settlement advocacy;
b. Enable students to become teachers and mentors for eco-settlement strategies and projects;
c. Enable youth to identify unsustainability and learn through reflecting on eradication attempts;
d. Reward youth activity in eco-settlement development projects, including rewards for visioning, citizenship, advocacy and design.

2.7.4 Exemplars

Good examples of global, regional and local youth-led initiatives. Examples include The World Youth Congress' Youth Lead Development Tool Kit (Gainsbury *et al* eds., 2005) produced by Peace Child International, and Cultivating Peace curriculum toolkits (www.cultivatingpeace.ca). Other important initiatives include the Global Youth Action Network www.youthlink.org/gyanv5/index.htm. The Youth Employment Summit . www.yesweb.org/, Pioneers of Change http://pioneersofchange.net/ and UNEP's TUNZA programme www.unep.org/Tunza/

PHOTO: UNEP UNESCO YOUTHXCHANGE 2008/YOUNG ARTISTS FELLOWSHIP FOR THE ENVIRONMENT

Figure 6: "The Young Artists Fellowship for the Environment (UNEP UNESCO YouthXchange Partners in the Philippines) ran a Sustainable Lifestyles bike tour to rural areas in the Philippines reaching out to 20,000 people through arts and workshops on sustainable consumption and lifestyles. In this picture, sustainable lifestyles had been presented to children through story-telling and they were then asked to draw their vision of a sustainable environment/community."

2.8 STRATEGIES FOR INTERNATIONAL AGENCIES

International agencies can play an important role in assisting civil society and NGOs lobbying governments to continue to implement eco-settlement education across the region. Given that the Asia-Pacific region is the most populous, culturally and ethnically diverse region of earth, the tasks of defining, designing and implementing universally relevant eco-settlement education policy is daunting. International agencies must work to network key stakeholders in the built-environment and establish a co-ordinated social change agenda. International agencies should assist in clarifying and promoting definitions of eco-settlement, raising the profile of this effort, and establishing conferences and other events designed to disseminate stories of progress.

Key role players:

- United Nations programs;
- International research agencies and networks;
- International development banks & trade organisations.

Policy goals:

- Network key stakeholders in the built-environment and establish a co-ordinated social change agenda;
- Clarify and promote definitions of eco-settlement education;
- Raise the profile of eco-settlement education and disseminate stories of progress.

Implementation methods:

- Networks and partnering
- Co-operation
- Dissemination

Enabling activities:

International agencies can contribute to eco-settlement learning by undertaking the following enabling activities:

2.8.1 Networks and partnering

a. Network with the UN International Steering Committee and Asia-Pacific Consultative Group for the Decade for Education for Sustainable Development (DESD);
b. Network with other international organisations and stakeholders to maintain awareness of eco-settlement education initiatives (see section three);
c. Partner with other stakeholders and donors to secure funding for eco-settlement education programs;

2.8.2 Cooperation

a. Enhance inter-agency co-operation by linking with other UN Agencies such as UNESCO, UNDP and the UN University;
b. Incorporate sustainability education into existing eco-settlement initiatives before developing new programs;
c. Identify and reform overlapping and mismatching eco-settlement education activities between and within countries;

2.8.3 Dissemination

a. Develop an on-line 'clearinghouse' for dissemination of global eco-settlement education activity during the DESD;
b. Develop Action-research projects around eco-settlement education initiatives in association with the DESD Steering Committee.
c. Share outcomes of eco-settlement education initiatives internationally through networks such as the UNEP Sustainable Buildings & Climate Change Initiative, World Green Building Council and International Initiative for Sustainable Built Environments – Sustainable Building Educators Network (SBEN) and through DESD web-sites.

2.8.4 Exemplars

The United Nations Environment Programme has established the Sustainable Buildings & Climate Change Initiative which provides a partnership between building sector stakeholders from private companies, public authorities and civil society. The programme provides a common platform for these diverse stakeholders to

- Reach consensus on definitions of sustainable building, key global issues, indicators and priorities for action.
- Generate base-line performance guidelines and progress reports;
- Develop tools and strategies for implementing sustainable building policies and practices
- Implementation of pilot projects and dissemination of knowledge in and between developing countries.

For more information: www.unep.org/sbci

2.9 FRAMEWORK FOR ECO-SETTLEMENT EDUCATION

This section tabulates the learning aims for stakeholders in eco-settlement education. The following tables provide an overview of learning aims relevant to each stakeholder and enables comparison of the learning aims across stakeholder groups.

2.9.1 Governments and Inter-Governmental Bodies

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES					
	Education Policy Review & Reform	**Continuing Professional Development**	**Capacity Building Programs**	**Communities of Practice**	**Assessment & Rating**	**Leading by Example**
- Ministers, elected officials and representatives; - Senior administrators of government departments or bureaus of education. **Policy goals:** - Public sector role players understand and can implement eco-settlement principles, practice and education; - Eco-settlement learning is core in formal education curriculum; - Communities are engaged in developing and monitoring indicators of sustainable development; - Communities are empowered and encouraged to participate in learning through adaptive management to eliminate unsustainable policy & practice. - Government procurement practices for eco-settlement lead by example.	a. Review and reform formal education systems so that eco-settlement learning is a core requirement of curriculum; b. Eco-settlement education policy development should be inclusive of traditional knowledge systems and governance practices, especially in village contexts; c. Education policy for eco-settlement curriculum should emphasise ecological welfare as a common good and encourage intercultural and interfaith dialogue about moral responsibilities for environmental stewardship. d. Ensure that eco-settlement education policy enables learning *from* as well as *of* local indigenous knowledge; e. Ensure that education policy enables learning how to integrate traditional and modern systems and technologies in eco-settlement planning, design, development and operation; f. Encourage 'sustainable schools' development – subsidising the retrofitting of campuses as exemplars of eco-settlement strategies	a. Establish requirements for bureaucrats and professionals to develop basic environmental literacy and knowledge of sustainable construction through continuing professional development; b. Educate policy makers in principles of closed loop design and management such as industrial ecology, building ecology, permaculture and product ecology, and life-cycle assessment. c. Develop education programs for the finance industry to encourage entrepreneurial engagement with eco-settlement.	a. Develop community capacity building programs in sustainable design and construction, accessing funding for eco-development, monitoring programs, home maintenance, citizenship, consensus building and conflict resolution. b. Develop community education that supports recycling programs, waste minimisation and management, and non-car based personal transportation. c. Create public awareness campaigns in partnership with media organisations.	a. Design on-going monitoring process, within adaptive management programs based on action-learning processes. b. Create programs for developing intercultural and inter-faith understanding about eco-settlement goals and priorities for action. c. Develop partnerships with community organisations and financiers to provide education in micro-financing and co-operative building schemes.	a. Develop eco-settlement goals, benchmarks, indicators and monitoring programs that enable community participation. b. Ensure that goal-setting and performance monitoring are public processes and that results are always provided as feedback to stakeholders. c. Ensure the on-going performance monitoring of building stock to so that the rights of all people to healthy, accessible and resource efficient human habitat are being upheld; d. Establish ISO recognised eco-labelling requirements for all building materials and a data-base for sourcing eco-preferred building materials. e. Ensure that eco-settlement monitoring programs are integrated with policy development.	a. Use government's role as a major developer and procurer of built-environments to lead by example and explain why and how eco-settlement strategies being implemented; b. Establish each new project as a public (as well as organisational) learning opportunity; c. Teach people that stewardship is highly valued. Ensure, for example, that economic drivers reward activities that eradicate unsustainable forms of urban settlement and that contributions to eco-settlement goals are publicly recognised and rewarded. d. Document innovative eco-settlement projects as case studies

2.9.2 Strategies for Communities

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES				
	Sustainability monitoring & reporting	**Collaborations**	**Capacity Building Programs**	**Learning networks & Partnerships**	**Community Knowledge Bases**
- Community leaders, educators and champions - Developers of innovative community awareness programs - Initiators of community engagement projects **Policy goals** - Communities are involved in building development decision-making; - Community members understand bio-climatic design, building ecology and can maintain health hardware; - Communities are networked to learn from their experiences of eliminating unsustainability from their settlements; - Eco-settlement learning is organised in a community sustainability knowledge base that is accessible by all; - Traditional knowledge and governance systems are incorporated into eco-settlement education programs; Interfaith and intercultural tolerance and understanding are continuously fostered through collaboration.	a. Become involved in developing and monitoring eco-settlement goals, benchmarks, and indicators. For example, engage primary and secondary schools in local ecological foot-printing, urban metabolism monitoring, and monitoring the local ecological and health impacts of built-environments. Programs such as these also help develop a community's environmental literacy.	a. Conduct community forums to explore and share innovative ideas and exemplary case studies of eco-settlements in local communities b. Partner with local government, NGO, schools, arts and faith-based organisations to develop and implement intercultural, interdisciplinary and inter-faith eco-settlement programs; c. Learn methods for group-decision making, visioning, design and conflict resolution; d. Celebrate eco-settlement activities through special events such as ceremonies and festivals; e. Develop inter-cultural and inter-faith understandings of each other and ecology through sharing knowledge in basic life-skills such as cooking, shopping and growing food.	a. Learn basic building ecology and the influence of building and urban design on human health and comfort; b. Learn how to become involved in and influence local and regional planning processes, development controls and building approvals; c. Learn basic construction and home maintenance skills, ensuring that households have basic knowledge in healthy living practices, home maintenance, and maintaining the "health hardware" of a house and a community; d. Learn about the history and traditions of local built environments and ecosystems, and how to raise public awareness of their cultural value through community-based initiatives. e. Assist the development of eco-settlement knowledge and action competence amongst community leaders and help them become eco-settlement advocates and educators.	a. Partner with faith-based and cultural organisations to develop shared eco-settlement values and priorities; b. Develop partnerships with development, trade and professional organisations and implement community-lead capacity building programs which include train-the-trainer components; c. Develop partnerships with financial organisations to develop capacity in project funding and financing; d. Partner with government agencies to develop and participate in school and campus-based initiatives in education for eco-settlements.	a. Create local knowledge bases that provide locally appropriate guidance on living sustainably in eco-settlements; b. Develop eco-settlement knowledge with neighbours and other community members by developing networks of people that learn through trying sustainable life-styles; c. Feed back knowledge gained through these actions to the community knowledge base so that locally generated knowledge is as accessible as generic best-practice guidance.

2.9.3 Strategies for the Private Sector

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES					
	Continuing Professional Development	**Course, Trade and Professional Accreditation**	**Publications and Awards**	**Assessment & Rating**	**Public Accountability**	**Research & Development**
- Designers/ deliverers of industry training programs and packages; - Professional accreditation associations for built environment professions; - Project financiers and property developers; - Building industry professionals; - Trade unions and industry advocacy organisations. **Policy goals:** - Sustainability learning is embedded into professional education and vocational training curricula; - Professions are accountable for implementing declarations on sustainable development; - Continuing demonstration of and education in sustainable building is a requirement for licensure as a building tradesperson or professional; - Project financiers understand and can determine the financial and life-quality benefits of sustainable building and eco-settlement development; - There is mainstream market understanding of and demand for sustainable building. - Sustainable building is widely publicised and awarded. Case studies are always generated as an action-research and community learning process	a. Invest in capacity building programs for 'closed-loop' supply-chain management; b. Learn how to respect and incorporate traditional knowledge systems in business decision-making; c. Educate management and workers to develop their ecological literacy and capacity to contribute to sustainable development goals.	a. Professional organisations must ensure that ecological literacy, industrial and building ecology and ethical inquiry are embedded and integrated in core curriculum for accredited education programs; b. Develop partnerships to develop core curriculum in ecological economics.	a. Publications and awards should promote eco-settlement values and explain and reward innovative design, building and maintenance strategies. b. No award recognition should be given to development projects that do not address sustainability issues.	a. Participate in the on-going monitoring and public reporting of eco-settlement performance.	a. Establish and operate triple bottom line (social, environmental and financial) business performance monitoring and reporting programs; b. Implement the *precautionary principle* in development and investment decision-making; c. Implement and be accountable for existing commitments to and declarations on sustainability education for professionals; d. Ensure that the administration and management of the organisation adheres to sustainable development principles and is held accountable for triple bottom line performance.	a. Develop partnerships with research organisations to learn the economic value of eco-settlement initiatives; b. Ensure that the knowledge generated by actions taken to contribute to eco-settlement development is managed and becomes the basis for further education

2.9.4 Strategies for Formal Education Sectors

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES					
	Curriculum Review & Reform	**Networks and Partnerships**	**Student Involvement**	**Community Engagement**	**Campus and Schools Eco-redesign & monitoring**	**Capacity Building & Further Education**
- Educators; - Students and student organisations; - Accreditation, professional and trade organisations; - Policy makers and funding organisations; - School and university communities. **Policy goals:** - Sustainability education is a core-conviction and ethos of institutions for formal education; - Campus and other settings for education are eco-settlement learning laboratories and building procurement, design, construction, maintenance and refurbishment are best-practice exemplars; - Research, teaching and community engagement reinforce eco-settlement learning and development.	a. Work with curriculum authorities, study boards, education and training departments and industry training organizations to identify and develop new teaching modules, support materials and learning activities; b. Rate, revise and audit existing curricula and teaching training programs, identify gaps and learning opportunities, then develop new programs to educate for eco-settlements; c. Develop and promote new methods of teaching to reflect the holistic character of sustainability education and to highlight the interdependent factors of eco-settlements; d. Develop continuous cycles of monitoring and evaluation to improve the design, delivery and auditing of sustainability education programs and projects; e. Design eco-settlement curricula as action-research projects and share outcomes through journals and the media	a. Form new national and international teaching and learning partnerships with educational institutions from both developing and developed nations, and re-energise old alliances, to clarify common visions and aims for achieving eco-settlements within the Asia-Pacific region; b. Cooperate with local governments and/or community facilitators and other partners to initiate community engagement /action learning projects that mutually build capacities; c. Encourage inter-disciplinary research and teaching in eco-settlement issues in order to build networks of critical colleagues and advocates. d. Build capacity in service learning curriculum development and action-research methodology in order to strengthen links between teaching, research and community engagement; e. Identify, network and partner with schools and universities in order to share eco-settlement curriculum and research findings.	a. Involve students in curriculum design an review; b. Engage students in hands-on action projects that enable them to develop skills, knowledge, inspiration and self-motivation to create positive changes; c. Engage young professionals in *action competence* projects to enable them to develop skills, knowledge and inspiration to create changes.	a. Prioritise community based action research projects that build up contextualised knowledge; b. Incorporate Service-Learning and community engagement programs in tertiary courses; c. Develop service learning and action-learning curricula.	a. Practice what is being preached - promote green campuses in schools and universities and actively involve students in devising and implementing sustainable design projects; b. Showcase leading edge case studies and research projects; c. Build teacher's and academic's capacity and willingness to lead by example; d. Write curricula that establishes campuses as 'learn-scape' laboratories; e. Make a commitment to identify and strive to eliminate unsustainable practice from academic and administrative programs, facilities and activities as a learning-cycle; f. Reward good practice in education for sustainable development and implementation of service learning curriculum.	a. Cooperate with relevant professional associations to develop continuing professional development courses, training programs and resources for educators; b. Mentor other educators to attain the competency to incorporate key concepts in their teaching programs; c. Build teacher and academic capacity in ecological literacy, industrial and building ecology and ethical enquiry through continuing education; d. Ensure processes for monitoring learning goals and outcomes are incorporated in program curriculum and administration.

2.9.5 Strategies for Civil Society and NGOs

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES			
	Monitoring, assessment and rating schemes	**Networks and partnering**	**Community engagement project development and grant applications**	**Capacity Building**
- Green building advocacy groups; - Humanitarian and Aid organisations; - Local community advocacy organisations; - Research organisations and networks **Policy goals:** - Mainstreaming eco-settlement learning in the private sector; - International exchange of eco-settlement knowledge and curricula; - Networking private, public and community stakeholders to facilitate eco-settlement activity and education.	a. Develop definitions of eco-settlements and 'green' buildings through assessment and rating schemes and using these schemes as a basis for community education and market transformation; b. Ensure that 'as-built' and 'in-operation' performance monitoring of buildings is conducted to augment initial building design ratings and that this post-occupancy review data is publicly available; c. Monitor indicators of corporate social and environmental responsibility for publicly listed property development, construction and material supply companies.	a. Network with other NGOs, civil organisations and stakeholders to maintain awareness of eco-settlement education initiatives; b. Partner with other stakeholders and donors to secure funding for eco-settlement education programs; c. Enhance co-operation by linking with other organisations to facilitate interdisciplinary, inter-faith and inter-cultural eco-settlement education.	a. Assist community organisations in developing and implementing eco-settlement monitoring programs; b. Assist the formal education sector to establish school and campus eco-redesign and performance monitoring schemes; c. Assist communities in needs analysis, project definition and grant writing.	a. Help to foster an understanding of building ecology and environmental performance of buildings through local capacity building programs; b. Facilitate training in basic infrastructure and building design, construction and maintenance; c. Facilitate the implementation of local environmental monitoring programs; d. Facilitate capacity building and train-the-trainer programs in eco-settlement planning, design, construction and maintenance; e. Facilitate building and 'health infrastructure' auditing programs within communities and providing training in on-going auditing and maintenance and repair projects; f. Facilitate professional development courses in building performance assessment and rating.

2.9.6 Strategies for Media

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES		
	Networks and partnering	**Promotion and awareness raising**	**Dissemination & Distribution**
- Print and broadcast media organisations; - Advertising agencies; - ICT providers; **Policy goals:** - Create demand for eco-settlement strategies; - Eco-settlement knowledge and exemplars are freely and widely distributed and promoted; - Eco-settlement values and ethics are demonstrated and promoted; - Local, regional and global communities directly inform each other using ICT.	a. Engage with sustainability professionals to develop media resources that explain and exemplify systems thinking and understanding relevant to eco-settlement; b. Link with networks of sustainability educators to distribute curricula for eco-settlement learning; c. Collaborate with government, NGOs and educational institutions to promote eco-settlement activities and outcomes.	a. Promote the eco-settlement work of community leaders and other eco-settlement champions; b. Promote broader community understanding of strategies and priority actions to achieve sustainable lifestyles and protect environments; c. Promote inter-faith and inter-cultural tolerance and understanding through the common goals of eco-settlement development; d. Promote locally developed eco-settlement strategies, telling stories of traditional as well as appropriate application of new ideas and strategies.	a. Promote and disseminate research and development in eco-settlement education; b. Showcase effective and innovative examples of both professional and community-led sustainability initiatives; c. Support community knowledge bases.

2.9.7 Strategies for Youth

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES		
	Networks and partnering	**Involvement**	**Empowerment**
- Student organisations; - Families and community groups; - Youth advocacy organisations; - Youth clubs and societies; - Youth media organisations; - Schools and Universities. **Policy goals:** Young people are empowered to participate in: - Eco-settlement decision-making; - Curriculum development and review; - Media production, Networking and advocacy.	a. Youth are already networked and systems thinkers Ensure that interaction is based on dialogue; b. Provide venues and events for inter-faith and inter-cultural creative re-imagining of sustainable futures and eco-settlement design; c. Support ICT infrastructure to enable young people to directly communicate, share stories and knowledge and collect information; d. Link with existing youth environment networks and encourage capacity building in eco-settlement visioning, advocacy and strategy implementation; e. Partner young people with elders to maintain connection with, and validate traditional knowledge..	a. Become involved in monitoring the sustainability and/or unsustainability of their built environment; b. Become involved in settlement design and governance processes; c. Become involved in environmental regeneration projects linked with educational, faith-based and cultural organisations; d. Include youth and student organisations in school and university curriculum development and review processes.	a. Encourage the development of youth media projects and organisations that provide a voice for eco-settlement advocacy; b. Enable students to become teachers and mentors for eco-settlement strategies and projects; c. Enable youth to identify unsustainability and learn through reflecting on eradication attempts; d. Reward youth activity in eco-settlement development projects, including rewards for visioning, citizenship, advocacy and design.

2.9.8 Strategies for International Agencies

Role Players	IMPLEMENTATION & ENABLING ACTIVITIES		
	Networks and partnering	**C-operation**	**Dissemination**
- United Nations programs; - International research agencies and networks; - International development banks & trade organisations **Policy goals:** - Network key stakeholders in the built-environment and establish a co-ordinated social change agenda; - Clarify and promote definitions of eco-settlement education; - Raise the profile of eco-settlement education and disseminate stories of progress.	a. Network with the UN International Steering Committee and Asia-Pacific Consultative Group for the Decade for Education for Sustainable Development (DESD); b. Network with other international organisations and stakeholders to maintain awareness of eco-settlement education initiatives (see section three); c. Partner with other stakeholders and donors to secure funding for eco-settlement education programs.	a. Enhance inter-agency co-operation by linking with other UN Agencies such as UNESCO, UNDP and the UN University; b. Incorporate sustainability education into existing eco-settlement initiatives before developing new programs; c. Identify and reform overlapping and mismatching eco-settlement education activities between and within countries.	a. Develop an on-line 'clearing-house' for dissemination of global eco-settlement education activity during the DESD; b. Develop Action-research projects around eco-settlement education initiatives in association with the DESD Steering Committee; c. Share outcomes of eco-settlement education initiatives internationally through networks such as the International Initiative for Sustainable Built Environments–Sustainable Building Educators Network (SBEN) and through DESD web-sites.

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PART 3

PART 3:

BEST PRACTICE MODELS OF CURRICULA & PROGRAMS

Intent: Presents examples of international best practice in implementing curriculum and education policy for eco-settlement and sustainable building.

Overview

In Part 3, opportunities for interdisciplinary and multi-stakeholder sustainability education for eco-settlements and sustainable buildings are identified in the context of common needs, actions and challenges for sustainability education. Best practices and regional exemplars of innovative programs and projects in universities are presented, with a case study of an approach to greening campuses and schools known as *learnscaping*. An exemplar of a faculty's community engagement program is also presented.

Regional exemplars of innovative programs and projects in **schools** are also presented, with a case study of a new professional development model for teachers developed in a special project at the Faculty of Built Environment at University of New South Wales called "Knowledge Networks".

A case study of urban transformation in Curitiba, Brazil provides an exemplar of innovative **community** awareness and capacity building programs.

3.1 BEST PRACTICES IN UNIVERSITIES

The UNESCO Working Paper on the Asia-Pacific Regional Strategy for Education for Sustainable Development has identified important roles for universities and research centres, including:

- Educating and training school teachers;
- Educating future leaders through undergraduate and postgraduate programs; and
- Initiating action-oriented research for sustainable development at masters, doctoral and post-doctoral levels.

Leading edge institutions will also play a vital role in accepting and/or sponsoring scholarships to encourage participation and equity from neglected regions across the Asia-Pacific. For example, the Australian Vice Chancellors Committee has agreed to collaboratively apply a top-down driver to implement ESD in all universities.

3.1.1 Best Practice for Architectural Education

Sustainable development requires practising designing and testing mutually beneficial social, economic and ecological relationships in built environments, rather than simply limiting our vision to creating 'less-harmful' designs.

Students learn as much from their surroundings and their social context than they do in class. In order for students to receive a sustainable education in architecture, the learning culture that they experience must be one of sustainability. What we teach will need to change with both time and place, but how we teach should be an example of sustainability. The current issues for curricula reform are therefore not only in content, but in the process and context of education in architecture. How might this be done?

To begin with, architectural programs must decide that sustainability is a core conviction and therefore, a principle reason for the education offered. Sustainable design education must be fully integrated into curricula. This requires developing a vision that establishes a philosophy of and direction for education, an image of that desired state in terms of the core values of the program, and a design that allows the realisation of the image. The commitment of all the staff and students to the exploration of the issues of sustainability in core streams of study is required so a curriculum model for sustainable education can be developed. It will be important to be mindful of both the process and context of learning and the need for continually evolving content.

An architecture program re-orienting itself for sustainability might begin developing a Vision that articulates their intention to empower students and design professionals to be life-long learners with "the skills and attitudes that will allow all people, present and future, to have fair and equitable access to the earth's resources, have a decent quality of life and preserve the biologically diverse ecosystems on which we all depend" (Benn, 1999).

The program will have adopted sustainable education as an organising principle with an Image of the curricula as an ethos that orients their minds toward whole-systems thinking, developing in students and staff the ability to identify and comprehend "patterns that connect" (Bateson, 1980) human designs and nature's designs. The curricula would be focused on developing the necessary analytical skills to think clearly about the systemic effects of designing, teaching and course administration. It would be implemented as a continual experiment in re-thinking the physical settings for teaching and learning. Curriculum development would be informed by environmental monitoring and reflecting on actions taken to contribute to the health of the biosphere and the equity of society. This process would be integrated into all aspects of program administration, curriculum and courses so that as far as possible the program is a "microcosm of the emerging sustainable society." (Sterling, 2001p33)

The process of developing and implementing curricula needs to be designed and therefore requires a comprehensive brief. For example the brief for program administration and process could be to design a system that:

- Helps staff develop their awareness of sustainability and support their actions to live and work to achieve an equitable ecological footprint[8].

- Help students and staff foster a sense of connection with the university and wider community. Through collaborative projects student's ability to understand how to engage and communicate with the community will develop. The curriculum will encourage the study of languages and cultures, promote travel by appropriate means, overseas exchange, and value volunteer community work.

- Provide opportunities for participating in sustainability projects with other disciplines in the built environment, natural and social sciences including teaching and research activities.

- Seek opportunities to facilitate learning sustainability by trying to improve the campus and buildings that we teach and learn in so that they at least do no harm.

- Encourage learning sustainability through critical analysis and improvement of teaching and studio work practices so that they eventually become examples of sustainable practice.

In history and theory the brief might include designing curricula that:

- Reinforce student and staff historical and theoretical understanding of relationships between human use of land and resources and architects' response to environmental and cultural context.

- Discuss the regenerative capacity of architecture and the analysis of buildings in "integrated cultural and ecological processes" (Moor, 2001 in Wright, 2003p104).

- Provide frameworks for comparing the influence of architectural movements on sustainable development in their historical social and cultural contexts.

The brief for design and technology might include designing curricula that can:

- Continually foster student and staff awareness of and sensitivity to natural systems and forces (ecological literacy) as a basis for design and technical education. To this end, all students and staff will learn in different climate zones, light and weather conditions and learn ways of analysing and documenting natural phenomena as an essential design skill.

- Foster and demonstrate life-cycle thinking and a "deep commitment to understanding how buildings work" (Fraker, 2000) interact with their environment, how they change, and what they are made from (eg Building Ecology).

- Find a place in every studio to reinforce holistic thinking and techniques for responding to context in sustainable ways.

- Use the goal of designing regenerative systems as a framework for design thinking, always challenging students to meet design briefs in ways which consume no more resources than can be regenerated, protect and enhance diversity, eliminate waste and encourage learning and innovation.

The ideas and ideals listed above are speculations on how architectural education as a sustainable development process might be described. The emphasis is on educational process, and framing sustainability as a way of thinking and acting and as a quality of the mind of the designer. This way of thinking is best developed through active engagement in sustainability activities, leading by example, learning to identify and change our own unsustainable practice and in the process, participating in sustainable education. Implementing this vision requires that teaching staff, are willing to engage in the sustainability debate and develop the environmental literacy required to lead students in designing sustainability into the systems and relationships that keep us alive and learning in equitable ways.

[8]Calculate your 'Ecological Footprint at: http://www.myfootprint.org/ For all humans on earth to enjoy a typical Australian Life-style – we'd need at least another two Earth's worth of resources.

Example 1: the bioclimatic design matrix
The bioclimatic matrix of design strategies, practices and recommendations (see Figure 7) provides a check list of basic design components for building types and urban streetscape parameters. These are paired with climatic principles and concepts. The matrix is an excellent teaching and learning tool for formal, industry and community education sectors, and for continuing professional learning. Correlating design strategies, practices and recommendations are presented for each paired design component/ principle in a comprehensive table format.

The complete matrix and table are available as a web link to teaching-professional packages (CLEAR) developed by the School of Planning and Architecture (SPA) New Delhi, in collaboration with the University of East London and the University of Athens. The web link is www.learn.londonmet.ac.uk/portfolio/2002-2004/clear.shtml

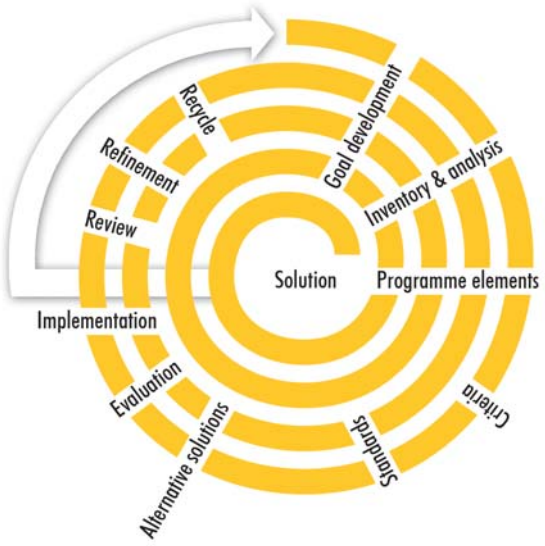


Figure 7: Graphic representation of the bioclimatic design matrix

Example 2: A Phenomenological approach to sustainable design education.
A recent collaboration between the Architecture Programs at the University of Dundee and the Robert Gordon University in Scotland explored the potentials of sustainable design education that emphasised phenomenological[9] and place-making design process[10] rather than technical design and environmental science based strategies (Stevenson and Cotton, 2000).

The authors of this curriculum emphasise the need for sustainable design education to be grounded in developing rich understandings of place arguing that "sustainable design has to finally ground itself in the real experience of real buildings" (p4).

To this end they designed a post-graduate ecological design course involving two sessions of work to first analyse and richly describe user perceptions and environmental performance of the Scott Sutherland School of Architecture building, and then propose design interventions that would transform it into a School for the Environment. The building was studied holistically within the context of the bioregion of Aberdeen fostering a design process considerate of:

- Place
- History
- Resource flows
- Social & Cultural Patterns
- Materials and Energy

The course was structured around an action-reflection process of ten "Transitions" or structured stages through which the students collectively progressed. These are shown in Table 3.1

1. **Gather Local knowledge** relating to national, regional, local, site and building scales. Data collection included surveys of building users, students and the local community.
2. **A Field Trip** to experience an exemplar campus greening project and to develop group dynamics

[9]"Phenomenology' is often restricted to the characterization of sensory qualities of seeing, hearing, etc.: what it is like to have sensations of various kinds. However, our experience is normally much richer in content than mere sensation. Accordingly, in the phenomenological tradition, phenomenology is given a much wider range, addressing the meaning things have in our experience, notably, the significance of objects, events, tools, the flow of time, the self, and others, as these things arise and are experienced in our "life-world" (Stanford Dictionary of Philosophy).

[10]Place making in architecture refers to "the design of places, the experiences they make possible and the consequences they have in our lives." (www.places-journal.org)

3. **Physical Survey** – a phenomenological survey of how the existing building 'feels'.
4. **Report writing** – students all contribute to the same document having developed a critical perspective on sustainability
5. **Develop a brief** for the transformation of the existing building
6. **Design development** – reinforcing the phenomenological process of responding to observed sensations of the building, rather than relying solely on reasoning.
7. **Gaining a wider perspective** – by presenting conceptual design work to students from another university
8. **External Examination** – student design process work and outcomes were presented to an external examiner for review against both phenomenological and scientific criteria
9. **Turning project outcomes into a community resource** – by revising the project report into a format and technical language more easily understood by University decision-makers
10. **Validation of Students Contribution** – by presenting their work in an acceptable format to the university and having it recognised as useful validated the learning process for the students.

Table 3.1 – Phenomenological sustainable design praxis applied to the improvement of the sustainability of a real building on a university campus – (Stevenson & Cotton, 1998)

Stevenson and Cotton (2000 pp 7-8) developed some principles to guide the development of sustainable design curriculum. These are:

Working with Place:
- Start with a real site, one you can touch
- Work with the users, not just the client
- Engage with the local community both in and around the site
- Engage with the site and its architectural precedent with *all* your senses

Values for Sustainable Design:
- Adopt an ethic of caring
- Develop teamwork
- Value everyday experience as an informant of design
- Accept subjective and objective analysis with equal merit
- Engage with complexity and flexibility in design
- Adopt inclusive thinking rather than exclusive thinking in relation to design and analysis
- Present work relationally in a way that meets and dialogues with other people's standpoints: this can shift boundaries

Methodology for Sustainable Design:
- Rely on continuous feedback from everyone and everything associated with the site and building
- Understand the human and physical resource flows of the site and building
- Allow compartmentalised taught subjects to integrate via project work
- Encourage more conscious sensual engagement and reflection on the environment
- Use field trips as an essential ingredient of group work
- Exchange teaching with other schools: expose students to different ideas which transcend their own framework

This exemplar shows how sustainability education for eco-settlements must be locally relevant and respond to the unique issues of a place. A 'place' in this case is considered from a bioregional perspective. However, as the next case studies show, places can also be created or developed as a process of ecosettlement education by applying 'learnscaping' methodologies.

3.1.2 Best Practice for Campuses–'Learnscaping'

The most urgent challenge is for educational institutions to make a conscious shift from their guiding metaphor of 'factory', and move to the metaphor of a 'living system'. (Sterling, 2002: 48)

This case study presents an educational innovation[11] known as ***learnscapes*** **-** an abbreviation of 'learning through landscapes' (Adams et. al, 1990; Booth, 2002) – which engages students and educators in the design and management of sustainable learning places, including:

- Reconfiguring grounds and buildings so that they incorporate sustainable design principles and sustainable management practices
- Involving youth in these sustainable design and management processes directly through hands-on learning
- Providing urban students with new experiences in sustainable resource management (water, soils, renewable energies, biodiversity) to match experiences that are more accessible to rural students
- Familiarising urban and rural students with the key principles of eco-design.

[11] 'Learnscapes' began in the 1990s as an innovative strategy to involve school students and educators - working together with other stakeholders including parents, design professionals, and community residents - to identify and resolve environmental design problems ranging across ecological, health and social issues in their school grounds and built facilities. This innovation emerged from environmental education initiatives in Australian schools, with parallels to the Learning through Landscape program in Britain, the ENSI program in the EU and related initiatives in North America.

Features of learnscapes:
Learnscape projects challenge educators and students (depending on their age and range of experiences) to break the barriers that confine curricula and teaching and learning programs within classroom walls. They provide 'real world' stimuli for student centred learning strategies correlated with key learning areas in curricula including Sustainable Agriculture, Biology, Geography, Environmental Management, Environmental Design, Art and so forth. Hands-on teaching and learning can occur through each stage of a project design and implementation including:

- site analyses involving sensory mapping, surveys and mind maps of students perceptions of good and bad aspects of their grounds and buildings;
- brainstorming improvements to neglected areas to enhance social and ecological interactions;
- refining concept plans and reporting these to other stakeholders including school/university administrators and fellow students;
- strategies to maximise students' hands-on involvement ('Do it, and I understand!");
- devising an ongoing maintenance program;
- evaluation and reflections on participants' 'learning journeys'.

Learnscape projects include growing organic food, restoring damaged soils with composts and mulches, regenerating native flora to provide habitat for fauna, rainwater harvesting and recycling grey water, and exploring alternative technologies such as wind power. Good learnscape projects resolve site-specific problems by utilising multi-functional design processes that provide habitats for insects, birds and animals. Environmental degradation in busy places of learning - soil compaction, wear and tear on vegetation, dust and dry winds, mud, wet weather erosion and flooding – are concerns for designers and site managers (Stine, 1997: 80-84). These concerns can become problem-solving tasks for students and their educators, providing new opportunities to engage in experiential teaching and learning journeys.

Incorporating eco-design principles:
Learnscaping has expanded from its initial foundations in schools and environmental education centres to include botanic gardens, community projects in neighbourhood parks, and regeneration projects along river riparian zones, coastal dunes, rainforest edges and so forth. These projects incorporate eco-design principles, sustainable resource management strategies, biodiversity regeneration and habitat protection[12]. They can involve school students and tertiary students in landscape architecture, architecture and urban planning; and also engage a wider range of community stakeholders, as shown in two case studies below.

Middle and senior school students can conduct audits of physical disturbances to water catchments and soils; audit species that continue to survive in, or invade a disturbed ecosystem vis-à-vis species that have disappeared because their habitat is destroyed; then progress to identifying key endemic plant species for habitat restoration, seed-collecting and propagation. These activities provide rich teaching and learning opportunities for site analyses and concept planning stages.

Senior secondary and tertiary students can identify significant gaps in biological diversity by utilising vegetation types, vertebrates or butterfly species as indicators (Aberley (1994: 61). This may lead on to a study of bird migration patterns, local flora/fauna and comparisons with other migratory breeding/ feeding sites. Bird breeding projects regenerate appropriate endemic plants for nesting sites and foods (nectar, pollen, leaves and insects) for young birds. This requires an **ecological design rationale:** when trees, understorey shrubs and groundcovers are planted in naturalistic clusters they provide more suitable habitat for smaller forest birds. Dawson (1990: 139) has noted that urban-based landscape designers tend to:

…favour one layer of simplified, neat plantings that produce an expansive visual effect. Street trees and foundational plantings are examples of this. However, forest bird species tend to prefer layered clumps of vegetation instead of linear bands. The benefits of clusters are the minimising of territory perimeter to be defended, travel distance, energy costs of locating food, and the time nestlings must be left unattended.

Key outcomes:
Key outcomes of learnscape projects include significantly improved landscapes for learning, regeneration of important local habitats, introductions to key elements in designing sustainable built environments. Most importantly, 'hands-on' teaching, mentoring and learning can encompass environmental management skills and knowledge, team building and collaborative actions that enable students to build up their skills and confidence through working with people outside their normal locus of interactions.

[12]*Environmental Education Policy for Schools* – Curriculum Support Directorate, New South Wales Department of Education and Training, Sydney, 2001.

Educators in tertiary institutions can transform buildings and grounds into models of building ecology and landscape ecology. This may include utilising virtual technologies for designing 'smart buildings' and embedded building information systems (BIMs). These technologies help to shift sustainable buildings from 'passive communicators' into 'active and intelligent communicators'.

Learnscaping incorporates the fundamentals of action research: identifying and engaging with a real world problem, testing solutions, critiquing actions and reflecting on outcomes, and building up both individual and collaborative action competence skills to take on more complex problems or issues. Indeed, 'learning how to learnscape' is a higher order of reflexive teaching and experiential learning which encompasses many dimensions of sustainability education in the design of green schools and college/ university campuses.

Professional development of educators is essential: Learnscaping design processes pose new challenges to educators – especially urban educators - who may be keen to engage with this innovation but have limited experiences or convey a lack of confidence in core skill areas such as gardening or landscaping, and conducting site analyses and fieldwork surveys. Research and evaluations of trial programs in Australia, Britain and the USA confirm that these educators require specialised professional development and resourcing in these key areas:

- exploring appropriate strategies and methods to engage students in action based sustainability projects;
- managing design processes;
- building up networks with colleagues and design professionals;
- creating school/campus environmental management plans.

Roles of the 'learnscaper' as a design mentor and facilitator:
Educators will benefit from the skills of a learnscape facilitator *or 'learnscaper'* who provides mentoring, expertise and leadership in all stages of project design and implementation. This needs to be done in an inclusive manner that empowers stakeholders to develop know-how in conducting comprehensive site analyses, mapping, developing a coherent brief with clear purposes, and so forth. In addition, a learnscaper can guide educators to pace events so as to optimise student participation; negotiate with design professionals and other community stakeholders; assist in producing grounds management strategies; and liaise with executive decision makers (Booth, 2002).

3.1.3 Case Studies of Learnscapes

Oberlin College, Ohio, USA
The design of schools and campus buildings has tended to ignore sustainable design principles. Orr (1994: 68) critiques the lack of ecological design in campuses: "Most colleges and universities intend their campuses to look like country clubs, weedless and biologically sterile places, maintained by an unholy array of chemicals".

Thus, as graduates, educators are usually ill-equipped to participate in learnscape design processes. Reflecting on the old building in which he taught environmental education at Oberlin College, Ohio, Orr (1999a: 229) concludes that a major change in the philosophy of landuse management, throughout the education sector, is overdue. This change must address issues such as the conceptual 'blind spot' which fails to see the irony of teaching in an unsustainable building that students know nothing about:

How it is cooled, heated, and lit and at what true cost to the world is an utter mystery to its occupants. It offers no clue about the origins of the materials used to build it. It tells no story. With only minor modifications, it could be converted to a factory or prison.

The paradox of teaching about and for the environment in ecologically dysfunctional buildings and grounds is part of a hidden curriculum of disconnection. Orr identifies four aspects of this hidden curriculum. First, an ecologically dysfunctional design 'tells' users that "locality, knowing where you are, is unimportant". Second, where energy and water are used wastefully, it tells users that these resources are "cheap, abundant, and can be squandered with no thought for the morrow". Third, students may be given no information about where the materials used in construction came from or the 'knock-on' effects "downwind or downstream from the wells, mines, forests, and manufacturing facilities where those materials originated or where they eventually will be discarded". Fourth, wastes are dumped into ecosystems in ways that say to students "…the world is linear and we are no longer part of the larger web of life… Students begin to suspect, I think, that those issues are unreal or unsolvable in any practical way, or that they occur elsewhere". (Orr, 1999a: 229)

At Oberlin College, Orr collaborated with students, architects and other professionals to clarify a congruent design rationale for a new ecological education centre. This project generated new modalities of learning for Orr (1999c: 4) and his students, who gained first-hand experiences

working alongside "some of the best practitioners in the world". During a year-long series of meetings, twenty-five students and a team of architects defined the design criteria. They began:

"…by asking what students would need to know in order to help make a sustainable and sustaining world in the 21st century. The answer that students themselves gave included such things as knowledge of solar technologies, ecological design, full-cost accounting and practical skills of restoration ecology, gardening, horticulture and forestry."

Reflecting on his experiences during the design and construction phases, Orr (1999c: 7) concluded that the mental blocks in a 'non-learning organisation's' attitude towards sustainable design are a major obstacle:

For a variety of reasons having to do with turf protection, divisions of labour, and the low priority assigned to the environment, college planning tends to be fragmentary and short term… Budgetary planning tends to be short term, precluding life-cycle costing. The alternative, which Peter Senge (1990) calls the "learning organisation", is a more fluid, open, adaptable, far-sighted and forgiving kind of organisation. It would be ironic indeed if academic institutions had to **learn how to learn** from the more progressive part of the business world. (Emphasis added.)

Charles Sturt University Thurgoona Campus, Albury, Australia

Charles Sturt University's Thurgoona Campus near Albury-Wodonga on the NSW-Victoria border showcases buildings and surroundings that display evolving concepts in sustainable design for the local environment[13]. In fact, the campus and its buildings represent a developing, dynamic model that demonstrates how architecture can relate to lifestyles and the land, based on responsible use of resources and intelligent responses to the local climate.

Architect Marci Webster-Mannison led the innovative team of designers who created the new campus to comprehensively embody eco-design principles and practices. Webster-Mannison (1999: 174) outlines some imaginative ways in which the landscape ecology at Thurgoona was designed to offer a new modality of integrated learning:

The landscape character of the campus reflects both the rural and social environments of the region, and is laden with teaching and demonstration opportunities for the Environmental and Park Management courses offered by the university. The vegetation of the major climatic regions down the Murray Valley is being established on the waste-ways that collect the stormwater. This represents a live version of the collection in the herbarium that is also being made electronically on the web. An arboretum of trees from the regions of Eurasia and Gondwana that are ecologically similar to the Murray Valley, are being planted along the main pedestrian spine, presenting a phyto-geographic tour of the world.

Other eco-design features of the Thurgoona Campus include:

- Siting buildings either side of a pedestrian walk, which, together with a road and services follows the contours of a hill according to soil conservation principles
- Buildings constructed with rammed earth walls and concrete floors, which provide thermal mass to store the sun's heat in winter and keep buildings cool in summer; their passive solar design minimises energy use and eliminates the need for air conditioning
- Earth berm construction of some building areas, effectively placing them below ground to stabilise temperature
- Convection towers to vent heat from the tops of buildings
- Large, shaded windows for ample ventilation, natural lighting and views.
- Recycled materials, e.g., timber in window frames
- Solar photovoltaic power generation and solar hot water systems
- Water collection from buildings in tanks that are integral to the building structure and also help to stabilise temperature.
- Management of stormwater and wastewater in constructed wetland ecosystems within the 87-hectare site
- Waste management on site
- Landscaping with low-input native plantings

Environmental benefits of the project address local, regional and national concerns for global warming, ozone depletion, genetic diversity and air and water pollution. Future decision makers - the students of today – are living and studying in a beautiful, efficient, low-impact environment that is also technologically advanced. Financial savings in terms of electricity and water management are also a valuable lesson. Aiming for sustainability principles rather than least-cost options will pay major dividends into the future.

[13]The Thurgoona campus is featured in the CSIRO Sustainability Network Newsletter # 56: www.bml.csiro.au/sustnet.htm Visit this web site to view images of the campus. Additional information and illustrations are available from the Charles Sturt University Thurgoona web site at: www.csu.edu.au/division/marketing/thur/index.htm.

3.1.4 Best practice in community engagement - *FBE Out There!*

This case study presents an emerging relationship between universities and communities that builds community capacity and social capital for sustainable development. This emerging relationship is based on a nexus of innovative educational concepts – *community engagement*, *rich learning,* and *service-learning* – described in Appendix A. Utilising these learner-centred concepts, universities can re-focus their involvement in the DESD as key "initiators of activity"; and faculties of design disciplines can engage with communities to promote eco-settlements.

Vision:

The Faculty of Built Environment at the University of New South Wales (Sydney, Australia) has formed a new unit called FBEOutThere! It offers students and staff new opportunities to become involved in interdisciplinary teaching and 'rich learning' projects, which have a strong focus on sustainability. These activities contribute to the achievement of the Faculty's goals:

- Achieving community engagement with key stakeholder groups
- Developing *communities of practice* among staff, students and community stakeholders
- Creating new opportunities for collaborations across faculties and disciplines, and more broadly through international connections.

Aims and Outcomes:

1. Collaborate in the development of interdisciplinary programs within and across the Faculty Schools of Architecture, Interior Architecture, Landscape Architecture, Planning and Urban Development, and Industrial Design.
2. Champion 'real world' teaching and learning that combines service learning, community engagement and education for sustainable development within cohesive frameworks.
3. Link undergraduate and post graduate students to projects that create opportunities for rich learning experiences, locally and internationally.
4. Build an interdisciplinary communities of practice within the Faculty, which generate project enterprise and ownership.
5. Develop continuing professional learning workshops for staff and innovative training for community stakeholders.
6. Act as a hub/clearing house for new project proposals and activities, and a catalysts for inter-faculty and multi-university collaborations of staff, students and community stakeholders.

Community engagement:

FBEOutThere is modelled on the concept of an **engaged university:** engaged at the faculty level with various communities to build capacities in mutually beneficial ways. FBEOutThere! is also a member of the Australian Universities Community Engagement Alliance[14] **(**AUCEA**)** which links 28 Australian Universities, each committed to promoting the sustainable social, environmental, economic and cultural development of communities and regions. AUCEA views community engagement as an educative process that acts to strengthen the core functions of universities – research and teaching. AUCEA members acknowledge that teaching institutions have a dual responsibility to prepare students for future employment and also prepare them to become fully functioning members of their community:

"This underlines the importance of university community engagement in developing attributes in graduates that will enhance citizenship and community sustainability and foster lifelong learning." (Temple et al., 2005:3)

Temple *et al.* (2005: 3) also describe how an 'engaged' university positions its intended learning and research outcomes to respond to emerging social, environmental and cultural issues. This involves:

- responding to needs identified by communities, and actively partnering with communities to address their needs;
- a commitment to engage with communities' visions and strategic plans, and their efforts to build new worlds;
- show evidence of these engagements in the fabric of teaching, learning and research outputs.

Communities of practice:

Academics' and practitioners' teaching and research interests, and students' learning and research activities are linked with innovative 'real world' projects that strengthen relationships between the University and the wider community. Dean of the Faculty of the Built Environment, Professor Peter Murphy, identifies how this mission expands its core business: "FBEOutThere! seeks to build synergies around the three pillars of what we do as a Faculty in the community. This is through community focused research, learning and engagement." At a minimum level, each project needs to generate outcomes in two of these pillars.

[14] http://www.uws.edu.au/about/adminorg/devint/ord/aucea

Interdisciplinary collaborations:
The Convenor of the FBEOutThere! Reference Group, Associate Professor Linda Corkery, oversees how the program of new electives and innovative projects provide rich opportunities for off-site experiential learning in design and construction that are part of UNSW students' coursework undertakings:

Students in their later years of undergraduate study gain a deep understanding of real world issues related to a specific locale, and expand their understanding of civic responsibility and ethical practice relevant to their discipline. They also apply specialised knowledge in a service-learning context in which they work with a real client, on a real site, to develop a built environment response. Additionally, there are opportunities to develop a capacity for enterprise and initiative through dealing with community leaders, individual experts and interest groups.

The current suite of activities underway include the:

- The UNSW Community Development Project
- The Sustainable Living Challenge, a popular program that engages high schools
- Indigenous Programs in partnership with the Nura Gili Centre
- Service learning electives, such as the Wollongong Clubhouse Project with Wollongong Council (a local government area south of Sydney) that engages FBE students through a series of linked design studios in designing a community facility for young people with schizophrenia.

Most recently FBE and *Architects Without Frontiers* formed a collaboration that will involve the University with projects in communities that are socially disadvantaged or that have been devastated by war, social conflict or natural disasters in Australia and abroad. Architects Without Frontiers are currently working on projects in Sri Lanka, Nepal, East Timor, Indonesia and locally in Palm Island. The Sri Lankan project is working in the Southern areas badly affected by the Tsunami disaster to assist rebuilding schools and providing access to education materials through providing mobile libraries.

Commitment to Engaged Scholarship, Action Learning and Reflective Practices:
Staff and affiliates of FBEOutThere are committed to engaged scholarship based on 'Type 2 research' (Gibbons et al. 1994) whose outcomes "often include changes in policy, practice or in management plans – as opposed to refereed journal articles… Engaged scholarship integrates discovery and student learning in partnership with the community." (Funding Australian Universities for Community Engagement, AUCEA, 2005: 5)

FBEOutThere staff and affiliates conduct community based action research, action learning and reflective practices based on the following protocols:

- Thoroughly document and evaluate all phases of project design and implementation
- Be respective and inclusive of different stakeholders' points of views by workshopping project briefs
- Regularly convene progress meetings to keep in touch with everyone's contributions
- Systematically appraise the impacts of staff-community engagements and student interactions.

3.2 BEST PRACTICE FOR SCHOOLS & TEACHERS

Sustainable housing designs and sustainable lifestyles are becoming key themes in Design and Technology curricula. Excellent teaching resources are being produced globally and regionally in for example, The Centre for Environmental Education (CEE) India. Likewise, the Intermediate Technology Development Group http://pratcticalaction.org has produced two resources with case studies from many countries:

- *Wall to Wall Design: A sustainable housing pack for Key Stage 3 Design and Technology*
- *Sustainable Lifestyles? Exploring economic and cultural issues in Design and Technology*

Designers of innovative school programs are, generally speaking, adept at working with teacher education institutions, professional associations, teacher employer groups, and teacher registration authorities. To achieve sustainability education for eco-settlements, they will also need to engage with planning and construction industry decision makers and leaders; and also liaise with private training providers to embed ESD in their education and training courses. A case study from NSW, Australia is presented below.

3.2.1 The Knowledge Networks Professional Development Model

The Knowledge Networks pilot project is an exemplar of an innovative approach aimed at incorporating ESD into high school Technology, Science and Geography syllabi. The project team have piloted and evaluated a leading edge model of continuing professional development for secondary teachers, which has been acclaimed by the NSW Department of Education and Training (DET), and the NSW Department of Environment and Conservation (DEC). Knowledge Networks is headquartered in

FBEOutThere! It is a community engagement program within the Faculty of Built Environment at the University of New South Wales (FBE-UNSW) in Australia.

At all times, the approach by the project team remained consistent with state, national and international thinking on Education for Sustainability (EfS). The project also frames a 'futures perspective' as outlined in the UN-DESD. There is significant potential to leverage Knowledge Networks as an international program to engage secondary teachers and students in key concepts and issues in the design of sustainable built environments; and as a leading provider of professional development during the UN-DESD.

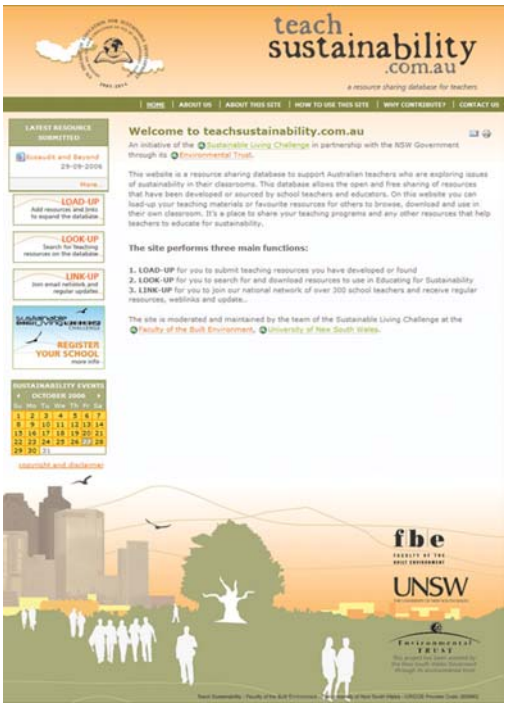
Outline of the pilot project:
Knowledge Networks project has successfully explored pathways for supporting NSW teachers to integrate EfS into their practice. This project centred on the development, trialling and evaluation of an *action learning* based model for continuing professional learning with NSW secondary teachers, based on contextualised approaches and a precise step-by-step process.

Participating teachers focused on developing teaching and learning projects for their own use, which were edited to a useable level as curriculum-linked resources distributed via an online database freely accessible to teachers, which was developed as a key output of this project: <teachsustainability.com.au> which is supported by an ongoing relationship with the annual Sustainable Living Challenge, a popular national EfS program for schools hosted by FBEOutThere!

The need for an online resource sharing database, as a tool for building the capacity of a broader audience of teachers, was identified through the Sustainable Living Challenge. Many teachers were identified as champions for sustainability in their schools but without avenues for sharing their learning with other teachers in the wider EfS community. Some of these teachers had developed their own highly innovative teaching programs. Thus, an online resource sharing database where teachers can upload their teaching programs provides an opportunity to build and capture over time a highly valuable body of knowledge that is emerging within the NSW community of teachers.

The project ran three sequential focus groups of teachers from different schools, each teaching in the same Key Learning Areas (KLAs) of the NSW curriculum. Each group focused on a different KLA – Technology, Human Society and Its Environment (HSIE), and Science respectively.

The Professional Development Model (PDM) has six characteristic themes:



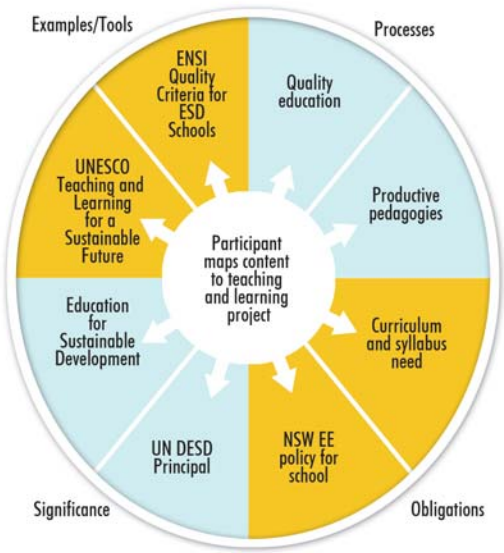
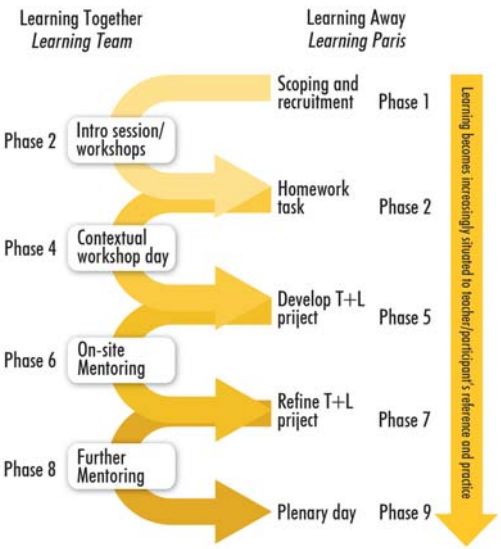


Figure 8: Professional learning context of Knowledge Networks

Theme 1 - Commitment:
High commitment levels from participants are crucial to ensure their full engagement. Development of a teaching and learning project is situated in teachers' existing obligations, not as an added commitment. Teachers develop a program for their own use and the requirements of their school. The PDM assists the teacher to achieve this.

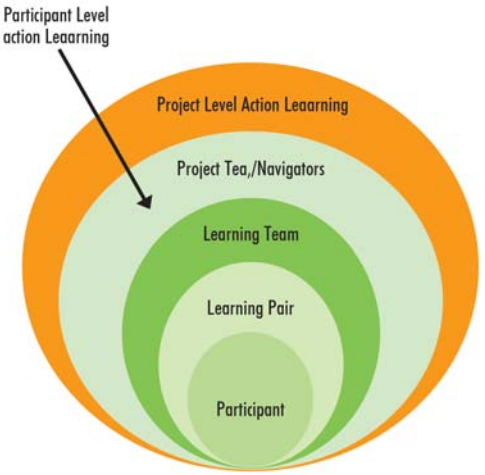
Theme 2 - Relief time management:
Efficient use of relief time by participants, combined with an extended time span over which the PDM operates improve effectiveness of the model.

Theme 3 - Phased PDM:
The PDM action learning process is iterative, initiated by group workshop sessions and supported by external university and curriculum mentors. This is expanded into a series of cycles or phases of learning as the framework of the PDM, as shown above in Figure 8: Professional learning context of Knowledge Networks



Theme 4 - Mentoring and Facilitation:
The roles of mentors and facilitators perform critical support roles in assisting and guiding participants on their learning journeys, whether 'learning together' in focus groups or 'learning away' in pairs during/ after school. For simplicity these mentors have been termed 'navigators'. Two key navigator roles were identified with distinct functions performed by separate individuals:

- *Sustainability Navigator* – facilitates and mentors to assist in contextualising concepts in sustainability and EfS.



- *Curriculum Navigator* – facilitates and mentors to assist teachers to navigate syllabus needs, Quality Teaching elements and coherent writing and communication of ideas into a teaching and learning sequence.

Theme 5 – Outputs:
Situating the action learning: Personal projects assist the teachers to achieve a professional goal and/or ease their existing workload. Often the easiest way to do this is to actively program for an upcoming class with a view to permanent inclusion in the teachers own annual program.

Publishing in hard copy and on line: Removing the pressure to fully produce a resource for public consumption makes involvement less daunting and more attainable for participants. The support of editors is offered as a final step in the process. This provides a means of striking a balance between the need to challenge and extend participants and the need to avoid de-motivating them with excessive and daunting expectations.

Theme 6 - Learning Dynamics:
Teachers work in learning pairs as part of a larger learning team or community of practice. This community of practice is focussed on sharing experiences and learning for sustainability. Structured group processes facilitate these outcomes. The learning pairs operate as co-critical friends within the action learning experience and can make a significant difference to motivation - especially during learning away sessions. Teacher pairing is a keystone of the PDM. Evidence from evaluation confirmed that participants without pairs found it very difficult to devote time to the project outside of the learning together group workshop days. Figures above illustrate the learning dynamics as a nested system of learning cycles within the project.

Evaluating the pilot project:
A comprehensive evaluation process was undertaken to enhance the outcomes of the pilot project's main focus of developing a Professional Development Model (PDM) for EfS. This external evaluation:

- Delivered an understanding of the critical success factors;
- Enhanced the action learning outcomes and processes of the project;
- Evaluated the methodologies used in the model; and
- Reconstructed and refined the professional development model.

Action learning was chosen as the methodological basis for this project on strong evidence that the characteristics embedded within its approach are highly effective at changing practice. For example, characteristics such as collaborative learning groups, critical friends, mentoring, reflective practice and task oriented learning have been recently incorporated into the Australian Government Quality Teacher Program[15] as a preferred model of PD for improving practice.

Adapting the PDM as a community engagement tool for educators:
Action learning and mentoring have been demonstrated as effective tools for local government environmental educators in EfS in NSW[16]. The PDM could also be adapted as a context for collaboration between local government and schools through the active development of locally relevant teaching and learning projects. The PDM provides a platform for the development of action based student projects while building the capacity of participating teachers through mentoring and support provided by local government educators as well as curriculum and sustainability 'navigators'. This application can facilitates tangible local outcomes in schools and provide councils and other agencies with an alternative to the production of educational materials and kits.

3.3 BEST PRACTICE FOR COMMUNITY EDUCATORS

Important issues to address include engaging community sectors in **lifelong learning** and **empowerment,** through culturally appropriate methods and techniques for effective community-wide behaviour changes. A framework of key drivers for community-based education and capacity building was clarified at a Sustainability Education Roundtable convened in the Australian State of Victoria in October 2005:

A framework of key drivers for community-based Sustainability Education

1. Recognise, acknowledge and work with the paradox between sustainability and consumerism
2. Create immediate, pervasive and lasting cultural change as a pre-requisite for a move to sustainable living
3. Establish transformative education/learning as a vital process in changing society towards living more sustainably
4. Develop methods and resources to move from transmissive to transformative models of education
5. Legitimise a 'bottom-up' approach to sustainability education: support and enhance grass roots initiatives to encourage and advance 'ownership'
6. Develop a 'whole of society' framework for sustainability education including household, workplace, government, recreation, community, business, formal and informal education
7. Recognise that sound research from a variety of sectors underpins knowledge and leads to behavioural change
8. Facilitate collegiality, networking and shared visions for all practitioners of sustainability education.
9. Publicise and highlight successes: display and promote flagship programs, 'lighthouse' change leaders, hubs and partnerships.
10. Consolidate the state government role of determined leadership, leading by example and developing a whole-of-government approach
11. Create transparent and predictable resourcing systems for sustainability education.

Each Process or Driver identifies:
- Key theme
- Issues and key lessons learnt
- Resources and experiences
- Key stakeholders
- Communications
- Priorities and recommendations.

Learning to Live Sustainably Strategy – Dept of Sustainability and Environment, Victoria, pp 7-12].

[15]Australian Government Quality Teacher (AGQTP) http://qualityteaching.dest.gov.au/
[16]Tilbury, Garlick Henderson & Calvert (2005) *Mentoring as a tool for workplace change: outcomes and lessons learned from the "It's a Living Thing" education for sustainability professional development program* http://www.environment.nsw.gov.au/

3.3.1 Curitiba – a case study of holistic policies, planning frameworks, education & capacity building

This case study of Curitiba, an innovative regional city in Brazil, provides sustainability educators with a very good example of the mutual benefits that flow from close correlations of sustainability education with pro-active eco-city policy and planning frameworks.

Alan Jacobs, Professor of Planning at Berkeley and former Planning Director of San Francisco argues that Curitiba has displayed the best eco-city planning and development in the world, one from which all stakeholders can learn (Lloyd-Jones 1996). Indeed, Curitiba is a frequently cited exemplar of urban sustainability. This case study sheds light on five core issues in urban sustainability, frequently referred to in the literature:

- Policy instruments;
- Street systems and public transport systems;
- Recycling programmes;
- Sustainability education; and
- Citizens' participation.

Many urban settlement planners and decision makers have addressed these core issues with varying degree of success. The unprecedented success Curitiba has experienced may arguably be due to one fundamental concept underpinning all three issues: focus on community education and participation. Alley makes a significant argument in this regard: "Making the city understandable is an important part of making it ecologically sustainable" (Alley 2001).

Policy instruments:

Jaime Lerner, an architect, has served as a visionary Mayor for three non-consecutive four-year terms beginning from 1971. Lerner was educated at Curitiba's Institute of Urban Research and Planning and he has consistently maintained that Curitiba – and indeed all cities – have enormous potential to be rediscovered as instruments of change (Dateline, 2006) driven by integrated social, economic and environmental policies. In 1971, the main commercial street downtown was turned into a 24 pedestrian street with shops, restaurants and cafeterias that has increased the city's tourism appeal and economic development: by 1994, tourism generated US$ 280 million or 4% of city's net income (Cavalcanti 1996)

The focus has been on small scale social and cultural regeneration projects with a noticeable absence of monumental projects. For example, the idea of constructing light house towers in the city incorporating new libraries to provide lookout facilities for local security guards. The dual purpose intensions were to reinforce civic identity through the provision of beacons of knowledge and security beacons.

The Master Plan established a guiding principle: **mobility and land use can not be disassociated** from each other if the city's design for the future is to succeed. Curitiba's officials created a zoning and land-use policy that requires mixed use high-density development along north-south structural arteries, in order to create the necessary population to support profitable public transport use. Thus, residential development focuses along the arteries, with essential services such as water, sewage, light, telephones, and public transportation provided. Further residential development occurs in four designated zones, in which all development must occur within close proximity to bus routes. An industrial park called the "Industrial City" was built in 1973 in the western district and plays an important part in the local economy (Jonas 1992).

Keeping Curitiba green has been part of the plan since the beginning. Since the early 1970s, the city has purchased over 1.5 million trees, which volunteer citizens have planted along city streets and avenues. Not only have trees & flower beds been planted along many of the city's streets, but today Curitiba is a park-lover's paradise. When the plan was first proposed, Curitiba had less than 2 square metres of open space per resident.

Today, that ratio has improved more than 10 times despite a 164% population increase - to over 1.5 million - during the same period. 16 parks have been developed and 1000 plazas established throughout the city. Newspapers are posted in these plazas for public reading, and day care centres have been strategically placed throughout the city for parents who are shopping or doing errands. Part of the Iguazu River was diverted to flow through a 7 km artificial channel before arriving at the city's parks, making it easier to keep water pollution under control in the numerous artificial lakes (Moore 1994).

Transport:

Lerner began the process of redesigning Curitiba by addressing the transportation system in the city. He viewed it as the key to successfully integrating Curitiba's residents and attributed it as both an instrument of development policy and a strategy for integrating land use and transport planning. An important lesson to learn from the Curitiba experiment is that developing a 'bus culture' is extremely important in preference to other more expensive forms of public transport including underground or surface trains.

The new transportation plan in the city produced an express bus lanes for faster service; access to buses through the city, with buses running the complete length of the city streets; and a special rapid boarding system that has cut boarding time in half. The city buses are privately owned with no direct financial subsidy.

By the early 1990s, 70% of commuters and shoppers were using the cheap public transportation, mostly 300-person buses that travelled as fast as subway cars in their own traffic lanes and stopped at special plexiglass tube stations which eliminated on-board paying, making the whole operation faster and less polluting. There is less congestion in Curitiba than in cities of similar size, which has lead to noticeably cleaner air. Curitiba's public transport system has now achieved the carrying capacity of 2 million passengers a day (Dateline 2006).

Retired buses are either used as mobile training centres or as free transportation to parks and open spaces. These mobile training centres serve as education facilities for Curitibans, who pay $1.00 to take courses in auto mechanics, electricity, typing, hair dressing, artisan work or the like. At the end of these training courses the students are placed in jobs throughout the city or they often start their own businesses. Furthermore, a 24 hour street has been established which serves as a town centre as well increases the city's economic development.

Recycling – innovative ways to generate economic and social resources:
Curitiba has pioneered small-scale, cheap and practical approaches that turn 'wastes' into economic and social resources - one innovative waste sorting program is called 'rubbish that is not rubbish'. Curitiba was one of the first cities in the world to begin a widespread voluntary recycling campaign: by the early 1990s, 70% of Curitiba's households recycled trash. Over 70% of Curitiba's garbage is recycled or composted, with most sold to local industries [Fraser 2006].

There are some important lessons for decision makers to learn from Curitiba's recycling programs, especially seeking participatory solutions that are not predicated on building expensive recycling plants. Recycling is found everywhere in Curitiba. Old buses have been refurbished into mobile vocational classrooms for job training and so forth. Sheep graze in the city parks, both to keep down the grass and to naturally fertilize the soil. An abandoned quarry has been turned into a rock concert arena. Even the Mayor's office (located in a city park for easy public access) is recycled – it's a log cabin made from old telephone poles. In Curitiba, simplicity applies to everyone.

Recycling programs also encompass the *favelas* (squatter slums or shanty towns). In a 'food for trash' policy, the city government bought surplus produce from farms around the state, which was then bagged and trucked into the favelas to be exchanged, a bag of food for a bag of sorted, recyclable trash. A similar program gives slum residents a free bus pass for a bag of trash. This has resulted in amazingly clean favelas with well-fed inhabitants and with much less rats, flies, and other vermin, which in turn has led to a decrease in communicable diseases.

Furthermore, residents of the favelas have been given most of the jobs in the recycling program, bringing income into those neighbourhoods. Admittedly despite the success of Curitibans' efforts in pursuing sustainable development, the city has all the problems that any big city has. However a significant difference as stated by Lerner is in providing good buses and schools and health clinics, and respect to people (Dateline 2006).

Recycling has noticeably reduced environmental damage citywide, which has, in turn, reduced the infant mortality and disease rates particularly in the favelas. Serious environmental problems do remain, however, as parts of the city are not connected to the sewer system and still suffer from extreme environmental damage.

Sustainability education:
Sustainability education, combined with planning improvements and citizenship participation, are critical success factors. What some called "The Best City in The World" arose, said Mayor Lerner, from considering children and the environment as more important than anything else. Environmental education has been introduced in most of Curitiba's schools. Textbooks were developed for primary schools emphasising the city's environment and history.

A novel idea for a Free Environmental University was created in 1991 to offer the general public short courses on environment management and protection. Citizens from the following sectors are encouraged to take courses:

- state and municipal secretaries
- unionists and professional associations,
- private and state companies in chemical, energy and petrochemical industries,
- environmental planners, managers and educators (Cavalcanti 1996)

Curitiba's characteristically cheap and participatory approach to integrated planning extends to community education: after school classes in Ecology are offered in poorer sections of the city where parents often work later in the day. There is a "Free University for the Environment" which offers free courses to the citizens. These courses focus on the environmental implications of their daily activities. (Lietaer and Warmoth 1999)

Voluntary citizens' participation:
The success of Curitiba has resulted from the visionary leadership of Mayor Lerner in combination with the cooperative efforts by the city's residents. Indeed, a key aspect to the revitalization of Curitiba has been the participatory and voluntary nature under which positive changes throughout the city have been implemented.

At the core of Curitiba's success is the vision of a city as a sustainable structure where people both live and work. Curitibans take pride in their urban environment because they are creating and maintaining systems that work in transportation, recreation and education. As Mayor Lerner has stated, the city has become "more intelligent and more humane," (Curitiba video, 1992) and, above all, there is a strong sense of solidarity among Curitibans (World Bank, 2002).

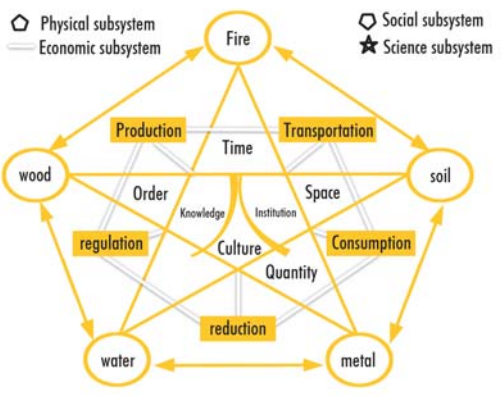
"The Curitiban approach is based on the idea of an 'action script' for each set of problems and involves partnerships between public, private and community sectors. The roles of each of the actors are seen as complimentary, relating to 'scale, means and knowledge', so that the issue of privatisation does not arise" (Jonas, 1992).

When recycling was introduced in Curitiba's schools children quickly caught on and convinced their parents to sort their garbage at home. Recovering alcoholics and homeless people are actively employed in the recycling program, and proceeds earned go back into social services provided for residents. The recycling program is voluntary, not mandatory, and awards participants with food and transportation vouchers. Over 22,000 families throughout the city have participated in the recycling program (Macedo 2004 and Fraser 2006)

Community participation becomes a reality only when the community is aware, informed and motivated — these three qualities come from public education programs and contribute to better understanding of the city's cultural history and its future sustainability. Community participation in the follow-up phase for projects that are implemented throughout the city is very important. Curitibans are encouraged to continue playing an integral part in the planning process because they will ultimately determine the success or failure of a program; and their feedback informs the adjustments that need to be made if projects don't work out as initially planned:

Conclusion:
The Curitiba experiment exposes the inadequacy of the oft-repeated question: should eco-sustainable development be market led, plan led, or a combination of both? The all-important question misses a significant bottom line — education. Curitiba experience has demonstrated that planning and market forces have had a significant impact on the way the city has evolved. However, it was the enthusiastic participation of the public in the planned programmes that facilitated the success of both plans, and the market forces in moving closer the sustainability goals. Public participation at such a large scale is attributed to elaborate, explicit and implicit education programmes, to not only build the citizens' environmental knowledge but also to enhance their sensitivities towards the environment. The social and economic incentives were put in place to contribute towards the people attaining a higher order of their environmental learning. This holistic approach towards educating the public about environmental problems and what they could do about them is a key feature of Curitiba's programmes that most other cities/countries have ignored.

3.3.2 Yangzhou Eco-city - a case study of SENCE
Unlike biological communities, a city functions as a kind of artificial ecosystem, dominated by human behaviour but sustained by a natural life support system and vitalized by ecological process. This artificial ecosystem was named by Shijun Ma a Social-Economic-Natural Complex Ecosystem (Ma and Wang, 1984) or SENCE model. Its structure is expressed as an eco-complex between human beings and its working and living settlement characteristics (including the geographical, biological



and artificial environs), its regional environment (including sources for material and energy, sinks for products and wastes, pools for buffering and maintaining wastes) and its social networks (including culture, institutions and technologies) and economic networks (the primary, secondary and tertiary industries and infrastructural services). Its natural subsystem consists of the traditional Chinese five elements: metal (minerals), wood (living organism), water (source and sink), fire (energy), and soil (nutrients and land). Its functions include production, consumption, supply, assimilation, recycling and buffering which play a key role in sustaining the city's complicated human-ecological relationships.

In recent years, a campaign of 'Ecopolis' development was spontaneously initiated in some Chinese cities and towns. An Ecopolis is an administrative unit that encompasses economically productive and ecologically efficient industries, a systematically responsible and socially harmonious culture, and a physically beautiful and functionally vivid landscape. The essential idea of Ecopolis development is to plan, design, manage and construct the ecosystem's functions of production, living and sustaining according to ecological cybernetics. It is a healthy process towards sustainable development framed within the carrying capacity of local ecosystems and achieved through changing production modes, consumption behaviors and decision making processes and instruments, based on ecological economics and biosystem engineering.

Implementing SENCE in Yangzhou - renewal of the Old Town towards an Eco-city: Yangzhou City is located in the middle of Jiangsu province, at the junction of the Grand Canal and the Yangtze River. It has a population of 4.47 million, covers 6638km2 and its history spans 2500 years – it was known as the first state in the reaches of Yangtze River. Dramatic changes have been brought on by urbanization and industrialization in Yangtze Delta, especially at the south bank of Yangtze River along the Suzhou-Wuxi-Changzhou corridor. To match the national speed of development while avoiding the heavy environmental pollution and ecological deterioration, Yangzhou City decided to find an alternative way to implement China's Agenda 21 and developed its own agenda, an outline for eco-city planning, in 2000 and began implementation.

Yangzhou's Eco-city development is an adaptive process towards sustainable development based on the carrying capacity of local urban, peri-urban and regional ecosystems. Its design evolution and practical implementation is characterised by the following five facets:

i. **Ecological sanitation:** providing citizens with a clean and healthy environment through encouragement of ecologically oriented, cost-affordable and people-friendly eco-engineering for treatment and recycling of human wastes, sewage and garbage; reducing air pollution and noise etc.
ii. **Ecological security:** providing citizens with ecologically safe basic living conditions - clean and safe supply of water, food, infrastructure services, housing and disaster prevention.
iii. **Ecological metabolism:** emphases on industrial transitions from the focus on traditional products and profit oriented industry to function-oriented and process-closed industry, through coupling of production, consumption, transportation, waste and energy reduction and regulation.
iv. **Ecoscape (eco-landscape) integrity:** emphases on alleviation of the heat island, hydrological deterioration, greenhouse effects and landscape patterns and processes.
v. **Eco-culture:** grounded on the ecological principles of totality, harmony, recycling and self-reliance.

Goals of the Yangzhou Eco-city Development: Based on the above five facets of Ecopolis development, there are three goals of the Yangzhou Eco-city Development:

- 1st goal - to promote economic transformation from traditional economy into a resource-type, knowledge-type and network-type sustainable economy with high efficiency. Make Yangzhou economy flourishing with ecological industry as its forerunner;
- 2nd goal - to promote regional development towards ecosystems with vitality, cleanliness, beauty, vigour and sustainability. Create a good ecological basis for social and economic development;
- 3rd goal - to promote the conversion from local people's traditional production and living style and values into environmentally friendly, highly resource efficient system that is a harmonious balance of society, ecology and culture. Bring up a new generation of eco-city constructors with cultural aspirations for a high quality eco-society.

Structural development of the Yangzhou Eco-city Development: There are three distinct stages in the structural development and implementation of the Yangzhou Eco-city Development:

First period (2000-2005): structural adjustments; infrastructure construction; construction of basic facilities; priority projects

initiation; and first fruits of pilot projects. Integrative power, including social power, economical power and environmental power, is a top priority. Primary indexes of eco-development meet the standard for national eco-development within pilot zones stipulated by the National Environmental Protection Agency.

Second period (2006-2010): construction of key pilot districts (cities and towns, ecological villages, factories, farms and landscape areas); key eco-projects are achieved and the experiences are extended in the whole region. Key industries (eco-tourism, eco-agriculture, eco-construction, eco-communication, and eco-food) increase greatly. Some key products (eco-food, tourism products) enter international markets. The whole city, essentially an eco-city, becomes one of the most advanced cities with comprehensive social, economic and environmental power in China.

Third period (2011-2020): urbanization of rural areas, modernization of the city and ecological transformations of society are achieved. The comprehensive social economic and environmental power of Yangzhou reaches an advanced level in the world. A series of capacity building measures are implemented within institutional, legislative, technical, and educational sectors, and financial safeguards have been devised and implemented.

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APPENDIX A:
Learner Centred Strategies

1. Deep Learning

A diversity of knowledge systems can be deployed which have an ethic of care or stewardship to improve environmental quality; and a commitment toward building local, regional and global (or "*Glocal*" – see AIJ, 2005 p27) social equity. How "Glocal" environmental change is linked with economic and social conditions?

How to develop a critical awareness of philosophical and ideological influences on eco-city and eco-village sustainability?

How to incorporate indigenous (non-western) values, and techniques? How to develop ethics and values consistent with eco-city and eco-village sustainability?

How to understand socio-cultural and historical influences on eco-city and eco-village sustainability?

2. Rich Tasks

Rich Tasks are teacher structured and student directed project based tasks that provide good opportunities for learning experiences:

Rich Tasks are the outward and visible sign of student engagement with … [a new] curriculum framework. They are the assessable and reportable outcomes of a curriculum plan that prepares students for the challenges of life in 'new times'. The Rich Task is a reconceptualisation of the notion of outcome as demonstration or display of mastery; that is, students display their understandings, knowledge and skills through performance on transdisciplinary activities that have an obvious connection to the wide world. (http://education.qld.gov.au/corporate/newbasics/html/richtasks/richtasks.html)

Rich Task # C - The Built Environment: Designing a Structure

Year 7–9 students will identify a client's needs and take these and other factors into account in preparing a design brief for a structure. They will design an environmentally sensitive and aesthetic structure to fulfill this brief and communicate the design through sketches, plans and models. They will give due consideration to structure and materials, quantities and costs.

3. Service-learning

Service-learning is a mode of tertiary learning that differs from personal fieldwork or observations. It is a course in community service and engagement set within a formal academic curriculum and discipline, organised into a structured set of individual or small group community based learning activities, directly related to community needs and focused on graduate or professional level issues. The academic content of the course drives the types of service activities in which students engage; and in turn these service activities drive the topics that are discussed in the course, and also shape the curriculum that is offered to future students[17].

Service-learning is an excellent method for tertiary institutions to disperse leading edge sustainability knowledge derived from recent research and developments into communities and, vice versa, for communities to informally educate young professionals-in-the-making on key concerns and issues. These two-way engagements can re-energise the creation of both local and formal knowledge and also create opportunities to bring these closer into alignment.

4. Action learning

Action Learning is based on individual and small group participation in a cyclic process of learning and reflection, with the common intention of making a positive change to a situation. It does not use forms of simulation such as scenario building, case studies or games. Learning is contextual and centred on the need to find a workable solution to a real problem or set of specific issues. Most action learning programs take from four to nine months to complete. Participation is voluntary and learner driven, while individual capacity building and skills development is as important as finding the best solution to the problem.

5. Action Competence

Action competence is the self-directed capacity to select a strategic action that will resolve an environmental problem or priority issue[18]. It is more dynamic and pro-active than just becoming aware or concerned about problems or issues.

Actions are powered by stakeholders' passions, visions, artistic flair or drive to initiate an improvement – they are not scripted and directed by those with institutionalised power. Targets of action are negotiated to focus on solving environmental, social and health problems that are significant locally but

[17]Drawn from the Criteria for Service-Learning Courses at University of California at Berkeley

[18]Jensen, B. and Schnack, K. eds. (1995) Action and Action Competence as Key Concepts in Critical Pedagogy. *Studies in Educational Theory and Curriculum*, **12**. Royal Danish School of Educational Studies, Copenhagen.
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may also have national and global dimensions. Finding solutions to these problems requires a readiness to understand and engage with complex issues.

Competence is characterised as the ability to develop framework for problems and envisage solutions, to plan and enact a project which is neither too big to accomplish nor too small to warrant self-respect, and be answerable for one's own actions. Competence extends to multi-skilling and multi-tasking, cooperation with peers and interpersonal skills in dealing with government officers and members of the local community.

Leading educators, industry trainers and community champions can play important mentoring and capacity building roles that assist stakeholders to build up their competence – their skills, qualifications, willingness and confidence - to carry out intended actions.

6. Community engagement

Community engagement is a two-way educative relationship in which a university forms partnerships with communities to build capacities and yield mutually beneficial outcomes including:

- Productive research outcomes that develop human and social capital;
- Linking the community and the world (boosting local/global connectivity);
- Contributing towards regional sustainable economic development;
- Development of corporate and private citizenship attributes;
- Driving social changes that contribute to sustainability; and
- Development of the cultural and intellectual fabric of the community.

The emphasis on building two-way relationships and synergies with the full range of 'community' – with business and industry; with social, cultural and religious organizations; with schools, hospitals and other public institutions; and with families and other social groups - is the distinguishing feature of community engagement. It is thus:

…more than community participation, community consultation, community development and public relations. It is much more than community service which is a one-way relationship in which the university provides benefits to its constituent communities. It also differs from community outreach or extension, in which university experts apply their knowledge to problems they observe or questions the community may propose. Whilst outreach is very much a unidirectional transfer of information on to a receptive public, engagement focuses on a two way interaction. (Funding Australian Universities for Community Engagement: A paper prepared by the Australian Universities Community Engagement Alliance (AUCEA), December 2005: 2-3)

In contrast, old notions of 'community outreach' continue to position 'community' as peripheral to core business in a university, and even as a distraction from it.

7. Risk-based community dialogues and adaptive management strategies

Communities can better engage and respond to urgent sustainability problems when ordinary members, key participants and champions are made aware of the types and scale of environmental risks to their own and their children's lives. Key information on identified risks and their implications should be clearly communicated by environmental planners, urban designers and environmental managers to local communities and organisations including unions, businesses, universities, consumer advocacies, NGOs and the media.

"Risk-based assessment and management are tools used to address existing or potential environmental threats to human health and the adverse effects on people, communities and economic interests. Risk-based management includes assessing the likely impact of these threats, and the development and implementation of strategies for their prevention, minimisation or removal." (Smith and Scott, 2006: 30-31)

8. Adaptive management is a reflexive style of natural resource management or environmental management based on making the best possible decisions, based at any time on the best information currently available. These provisional decisions will then be subject to periodic review and improvement, as part of an on-going process of knowledge building. Monitoring and evaluating the results of actions taken under an adaptive management strategy will provide a flow of information that may indicate the need to refine the management strategy, and change future courses of action. New scientific findings, new economic forces (such as the rising price of oil) and the changing needs of societies may also indicate the need to adapt resource management to new priorities.

Risk-based local planning strategies and adaptive environmental management programs developed and shared between local governments and communities create consensus and demonstrate commitment to forming partnerships that will facilitate transitions towards sustainability. A good start-up strategy is to educate local government professionals

and local communities in risk-based assessment and decision making, to help meet their responsibilities and roles in moving towards sustainability. This is a more positive approach characterised by increased openness and accountability in governance, when compared with reactive problem solving using engineered solutions.

9. Systems Thinking

Systems thinking is a pedagogy for understanding the complexities, interactions and dynamism of socio-ecological systems such as water catchments and water-sewage reticulation systems. Systems thinking as a discipline provides language tools and a methodology to manage natural resources and generate community capital. In systems thinking paradigms, approaches to generating solutions have the characteristics of collaborative learning environments (or, more colloquially, 'experimental learning labs') wherein researchers, policy makers, adaptive managers, community educators and facilitators cooperate on the basis that:

- Knowledge is uncertain and scattered;
- There are divergent views on key and/or contentious issues and no stakeholder is in a good position to speak 'the last word' on these issues with absolute authority;
- Lay knowledge and professional knowledge are treated with equal respect;
- Different stakeholders have different 'mental models', drivers and scales of application;
- Solutions often require shifts out of traditional discipline areas, towards multi-disciplinary and trans-disciplinary approaches.

Systems thinking sustainability educators including Frijof Capra, David Orr (www.ecoliteracy.org/education/sys-thinking.html) and Stephen Stirling are keenly aware of the need to get beyond "iceberg" solutions where only the symptomatic 'tip of problems are dealt with, not the underlying causes. Systems thinking starts with identifying the mental models that constitute the basis of problems, then works upwards to clarify systematic structures and intervention points.

Tools of systems thinking include "influence diagrams", visual flow charts and causal loop diagrams that reveal links and flows of natural and human resources including leverage points for generating enthusiasm and avoiding burn-out in community volunteers; and identifying champions with the willpower to tough it out and follow-through on long-haul projects. These are designed to identify stumbling blocks and critical success factors and accommodate uncertainties that can be embedded in knowledge bases for sustainable building and adaptive management programs.

About AIT-UNEP Regional Resource Centre for Asia and the Pacific (RRC.AP)

In its first 20 years, the Regional Resource Centre for Asia and the Pacific (RRC.AP) has undergone dramatic changes in its working landscape. Emerging from a specific focus on geographical information system and remote sensing to assist countries in Southeast Asia, the Global Resource Information Database (GRID)-Bangkok Facility (established in 1989 as an out-posted office of the UNEP Assessment Division), has evolved into a broadly-focused technical Centre that serves countries in Asia and the Pacific.

Responding to the growing demands for capacity building to support the environment community at large, the UNEP Executive Director upgraded GRID, which became the Regional Resource Centre for Asia and the Pacific in 2000. Thus, the momentum was set for RRC.AP's ever-expanding presence in Asia and the Pacific, as a partnership centre between UNEP and the Asian Institute of Technology (AIT). Today, RRC.AP responds to the region's needs for capacity building in science, assessment, policy tools, and emerging issues; knowledge and information dissemination; and pilot projects for demonstration and replication.

Tying a wide range of operations together into a smoothly integrated system, RRC.AP has organized its 50 full time international staff into four teams, corresponding to the type of support that they provide: Regional, Network, Knowledge, and Institutional. They work with seconded staff from the UNEP Regional Office for Asia and Pacific and the Japanese Institute for Global Environmental Strategies (IGES).

For more information,
see **www.rrcap.unep.org**

About the Sustainable Buildings and Climate Initiative

Launched in 2006 by the United Nations Environment Program (UNEP), the Sustainable Buildings and Climate Initiative (SBCI), formerly the Sustainable Buildings and Construction Initiative, is a partnership between the private sector, government, non-government and research organizations formed to promote sustainable building and construction globally.

UNEP Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability

SBCI harnesses UNEP's unique capacity to provide a convening and 'harmonizing' role to present a common voice from the building sector on climate change issues. More specifically UNEP-SBCI aims to:

1. Provide a common platform for and with all building and construction stakeholders to collectively address sustainability issues such as climate change;
2. Establish globally consistent climate-related building performance baselines and metrics for monitoring and reporting practices based on a life cycle approach;
3. Develop tools and strategies for achieving a wide acceptance and adoption of sustainable building practices throughout the world;
4. Implementation - Promote adoption of the above tools & strategies by key stakeholders.

For more information,
see **www.unep.org/sbci**

About Sustainable United Nations (SUN)

Sustainable United Nations (SUN), is a UNEP initiative that provides support to UN and other organisations to reduce their greenhouse gas emissions and improve their sustainability overall. SUN was established in response to the call from UN Secretary General Ban Ki-Moon at the World Environment Day 2007 (5 June), to all UN agencies, funds and programmes to reduce their carbon footprints and "go green". This call was echoed in October 2007 in a decision of the UN Chief Executives Board (CEB/2007/2, annex II) to adopt the UN Climate Neutral Strategy, which commits all UN organisations to move towards climate neutrality. SUN is in this context working with the UN Environment Management Group – the UN body coordinating common environmental work within UN – to provide guidance, and develop tools and models for emission reduction within organisations.

SUN is using a "whole-organisation" approach in identification of sources and causes for emissions and opportunities for reduced emissions and improved sustainability. In this way opportunities for improvements are typically found within one of the three major focus areas for SUN:

1. Physical assets: building, equipment, vehicles…
2. Management processes: procurement, travel, management systems…
3. Organisational Culture: day-to-day office behaviour, "corporate" culture, green meetings…

SUN operates in synergy with existing initiatives and networks such as the Sustainable Buildings and Construction Initiative, the High Level Committee on Management Procurement Network, the UN Global compact, or the Marrakech Task Force on Sustainable Public Procurement and many others.

For more information, see
www.unep.fr/scp/sun

About the UNEP Division of Technology, Industry and Economics

The UNEP Division of Technology, Industry and Economics (DTIE) helps governments, local authorities and decision-makers in business and industry to develop and implement policies and practices focusing on sustainable development.

The Division works to promote:

> sustainable consumption and production,
> the efficient use of renewable energy,
> adequate management of chemicals,
> the integration of environmental costs in development policies.

The Office of the Director, located in Paris, coordinates activities through:

- **The International Environmental Technology Centre** - IETC (Osaka, Shiga), which implements integrated waste, water and disaster management programmes,focusing in particular on Asia.
- **Sustainable Consumption and Production** (Paris), which promotes sustainable consumption and production patterns as a contribution to human development through global markets.
- **Chemicals** (Geneva), which catalyzes global actions to bring about the sound management of chemicals and the improvement of chemical safety worldwide.
- **Energy** (Paris and Nairobi), which fosters energy and transport policies for sustainable development and encourages investment in renewable energy and energy efficiency.
- **OzonAction** (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition to ensure implementation of the Montreal Protocol.
- **Economics and Trade** (Geneva), which helps countries to integrate environmental considerations into economic and trade policies, and works with the finance sector to incorporate sustainable development policies.

UNEP DTIE activities focus on raising awareness, improving the transfer of knowledge and information, fostering technological cooperation and partnerships, and implementing international conventions and agreements.

For more information, see www.unep.fr

Guidelines on Education Policy for Sustainable Built Environments

Sustainability education for the building sector is fundamental to the creation of sustainable built environments. In many regions, demand on existing urban infrastructure, supporting eco-systems and for new building has never been greater. At the same time climate change and urbanization are creating new vulnerabilities for urban populations which must be addressed. Globally the building sector is responsible for up to 40% of our energy and resource consumption, up to 30% of our solid waste production and up to 30% of all energy-related greenhouse gas emissions. It is clear that such impacts are unsustainable. So how do we learn to develop and operate our buildings towns and cities so that such impacts are not only avoided, but so our built environments repair, replenish and sustain?

These guidelines provide a synthesis of sustainability education for key stakeholders in the built environment. They set out a suite of policy priorities, learning aims, strategies and case-study curricula that can provide a basis for education and capacity building supporting design, construction and management of sustainable buildings and settlements. Included are:

- *Key sustainability education principles;*
- *Education Policy priorities that promote design for sustainability in built environments;*
- *Learning and teaching strategies for key built environment stakeholders;*
- *Best practice policies, learning programs and case studies.*

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