

# COMMONWEALTH OF AUSTRALIA

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# **Sustainability Education in the Engineering and Built Environment Curriculum: The Case for Asia-Pacific**

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*School of Property, Construction and Project Management  
RMIT University*

19-21 November 2012

# Outline of presentation

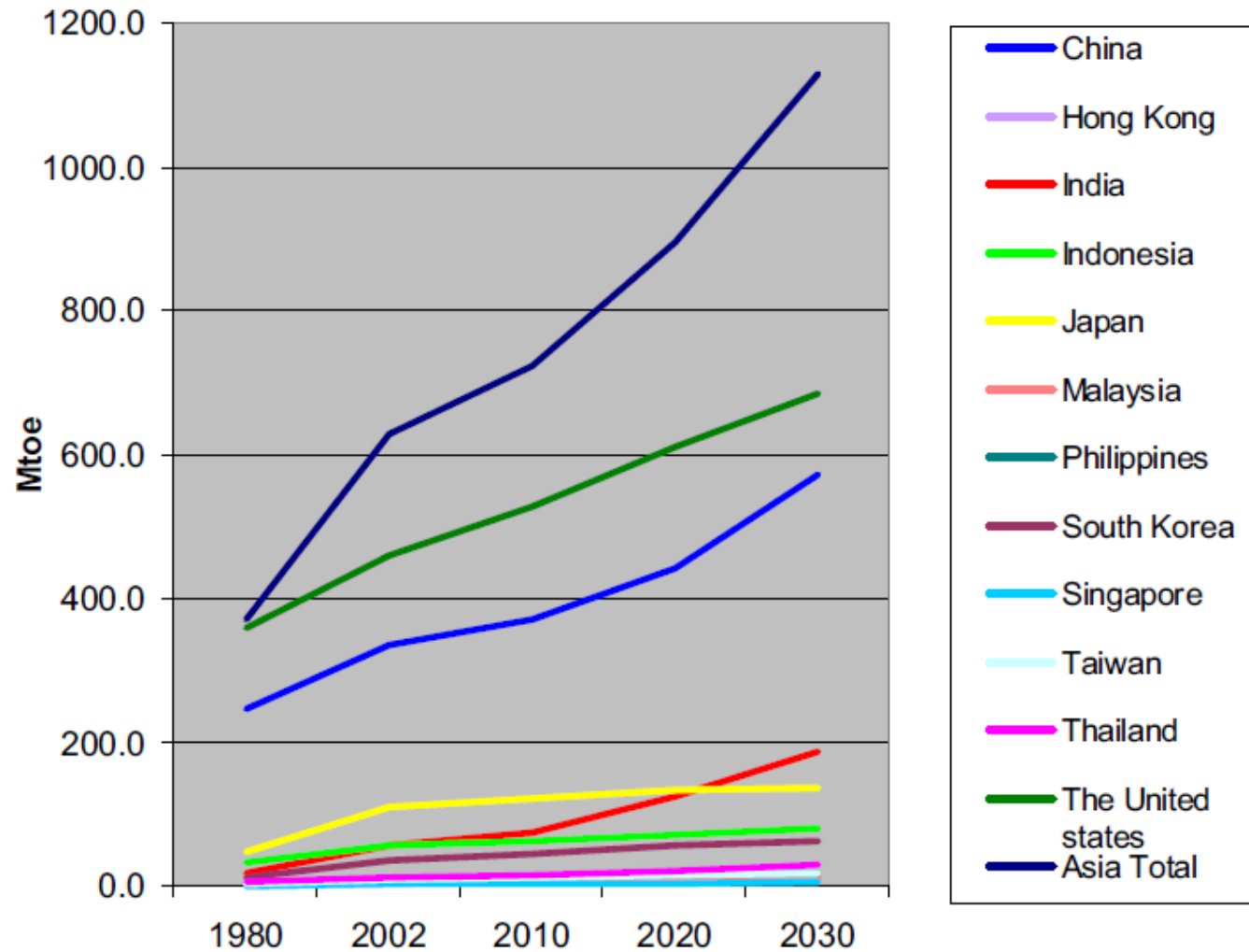
**Built Environment** • Impact of the built environment

**The case for Asia-Pacific** • ProSPER.Net Project  
• Education for sustainability in the built environment  
• Transforming sustainability knowledge

**Integration and innovation in sustainability education** • Workshop findings: Learning outcomes  
• Workshop findings: Pedagogical methods  
• Development and framework for the guide  
• Future directions and imperatives

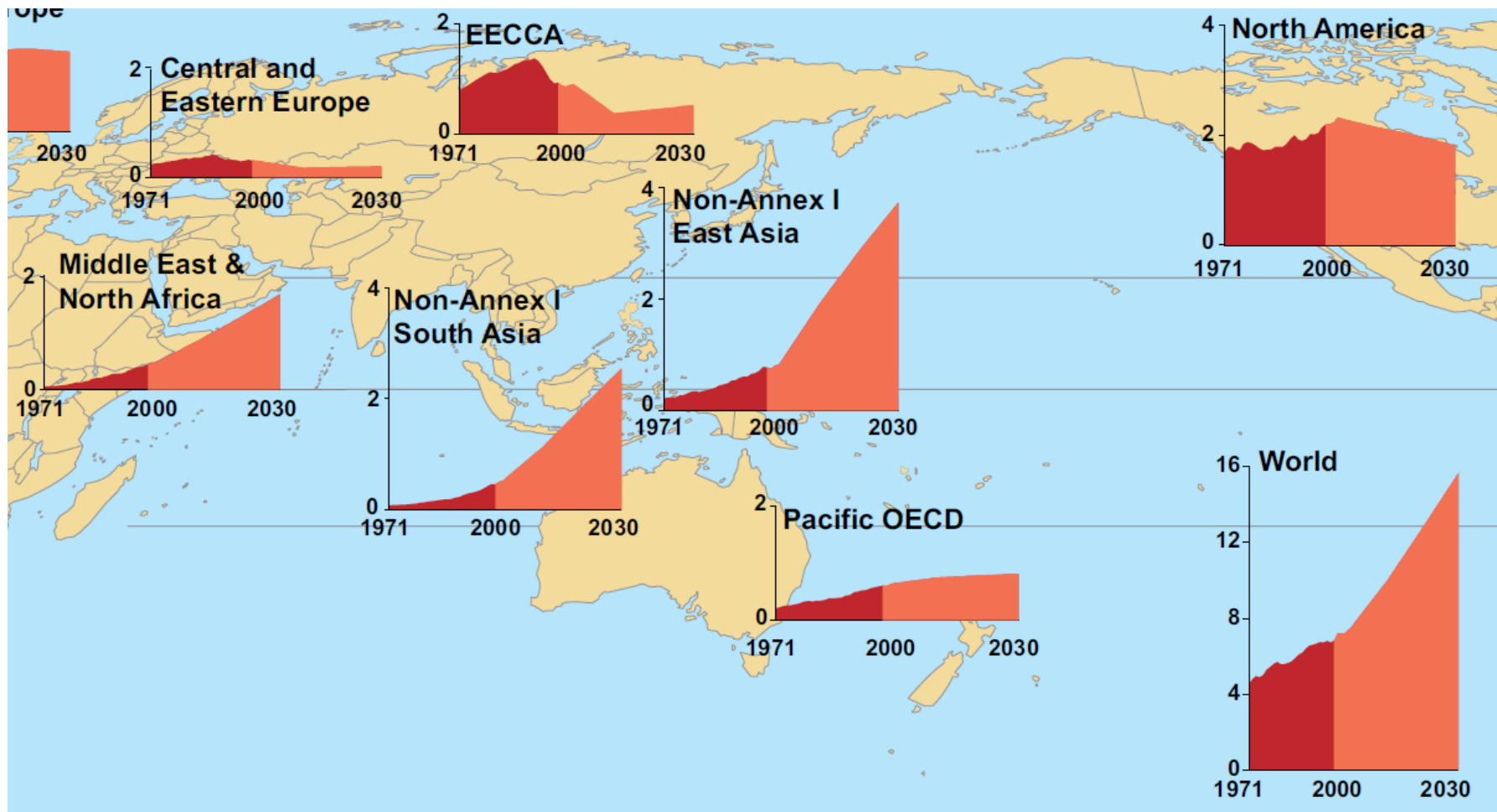
# Overview: Impact of the built environment

## *Final energy consumption by buildings in Asia*



Source: Asia / World Energy Outlook 2006 (*The Institute of Energy Economics Japan, 2006*)

# Projected buildings related CO<sub>2</sub> emissions (IPCC)



Projections under rapid economic growth in developing nations

Source: Residential and commercial buildings, *Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Levine, et al., 2007, p392)

# Major cities and centres in the Asia-Pacific Region



# The role of higher education

## United Nations University - Institute of Advanced Studies

### Promotion of Sustainability in Postgraduate Education and Research

- Alliance
- Working together
- Postgraduate and undergraduate curricula
- Strong education and research programs
- Aspiring innovators in Sustainable Development and related fields



UNITED NATIONS  
UNIVERSITY

**UNU-IAS**

Institute of Advanced Studies



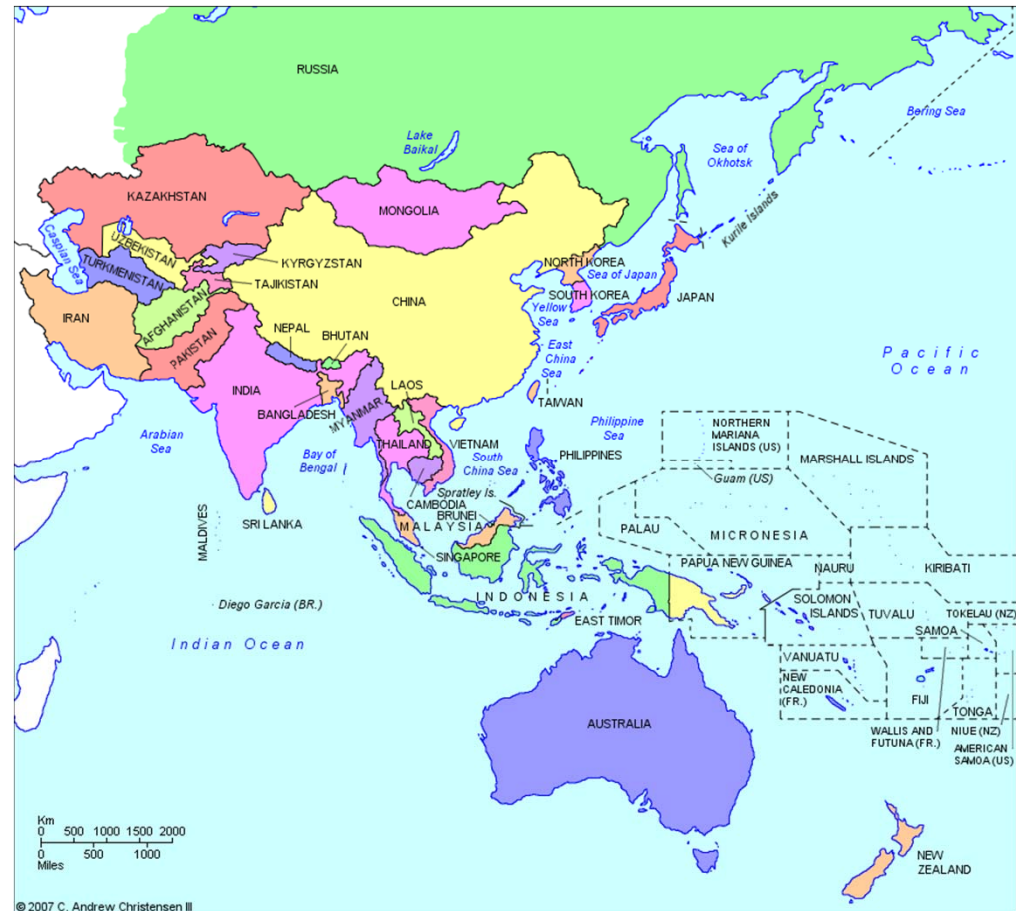
ProSPER.Net

# ProSPER.Net Project: The case for Asia-Pacific

“Integrating sustainability education into existing engineering and built environment curriculum”

## Objectives

- Integrate **sustainability thinking and practice** into engineering and built environment curricula
- Identify **key priorities** for inclusion in the professional development program
- **Contextualise the priorities** within global and local policy commitments for sustainability in the built environment



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Source: World Monitor Info : Asia and the Pacific Region (2007)

# ProSPER.Net Project: The case for Asia-Pacific

“Integrating sustainability education into existing engineering and built environment curriculum”

## Outputs of the project

### Desktop **literature review**

- What is currently being included/integrated and how is this taking place?

### **Participant involvement**

- Current programs and course offerings in the built environment curricula

Core activity: **workshop**  
(Ho Chi Minh City, Vietnam)

- Bring together participants – participatory action research



# ProSPER.Net Project: The case for Asia-Pacific

## Universities:

Asian Institute of Technology (Thailand)  
Tongji University (China)  
University of the Philippines (Philippines)  
National Institute of Advanced Studies in Architecture (India)  
Universiti Sains Malaysia (Malaysia)  
Universitas Gadjah Mada (Indonesia)  
International University, Vietnam National University – HCM (Vietnam)  
University of Tokyo (Japan)  
RMIT University (Australia).

## Industry:

World Green Building Council  
Vietnam Green Building Council  
Sino-Pacific Construction Consultancy Co. Ltd (Vietnam)  
Vietnam Centre for Research and Planning on Urban and Rural Environment  
Vietnam Institute for Architecture and Urban-Rural Planning (VIAP)  
Vietnam Ministry of Construction (MOC).

# ProSPER.Net Project: The case for Asia-Pacific

## Highlighted issues

- **Curriculum design** and structure;
- **Capacity building** for academics in transforming sustainability knowledge;
- Sustainability **pedagogies**;
- Pedagogical implications in the engineering and built environment disciplines;
- **Learning outcomes** – student experiences;
- **Industry input** – students as employable graduates; and
- **Challenges to professionals** in the field of built environment, their institutional structures and boundaries.



# Education for sustainability in the built environment

Learning ***about***  
sustainability

*versus*

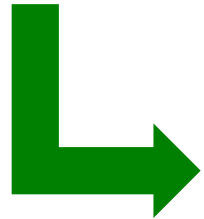
Learning ***for***  
sustainability

<i>Traditional ('about' approach)</i>	<i>Critical ('for' approach)</i>
<ul style="list-style-type: none"><li>• Passing on knowledge and raising awareness of issues</li></ul>	<ul style="list-style-type: none"><li>• Understanding and getting to the root of issues</li></ul>
<ul style="list-style-type: none"><li>• Teaching attitudes and values</li></ul>	<ul style="list-style-type: none"><li>• Encouraging values clarification</li></ul>
<ul style="list-style-type: none"><li>• Seeing people as the problem</li></ul>	<ul style="list-style-type: none"><li>• Seeing people as agents of change</li></ul>
<ul style="list-style-type: none"><li>• Single actions</li></ul>	<ul style="list-style-type: none"><li>• Learning for Change</li></ul>
<ul style="list-style-type: none"><li>• More focus on individual and personal change</li></ul>	<ul style="list-style-type: none"><li>• More focus on structural and institutional change</li></ul>
<ul style="list-style-type: none"><li>• Integration</li></ul>	<ul style="list-style-type: none"><li>• Innovation</li></ul>
<ul style="list-style-type: none"><li>• Problem-solving</li></ul>	<ul style="list-style-type: none"><li>• Creating alternative futures</li></ul>
<ul style="list-style-type: none"><li>• Sending messages</li></ul>	<ul style="list-style-type: none"><li>• Creating opportunities for reflection, negotiation and participation</li></ul>

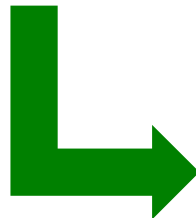
Source: A National Review of Environmental Education and its Contribution to Sustainability in Australia: *Frameworks for Sustainability*.  
(Tilbury & Cooke, 2005, p16)

# Educational responses

*education **about***



*education **for***



*Sustainable education*

Innovative  
Interdisciplinary  
Participative  
Holistic

***‘designed’ learning + ‘attendant’ learning***

Source: Education for sustainability: the role of capabilities in guiding university curricula (Sterling & Thomas, 2006, p355)

# Transforming sustainability knowledge

- **fundamental change of purpose** or, at very least, an additional key purpose of education.
- embedding, embodying and exploring the nature of sustainability as intrinsic to the **learning process** – nurturing **critical, systemic and reflective thinking; creativity; self-organisation; and adaptive management** – rather than education ‘about’ sustainability, or education ‘for’ particular sustainable development outcomes.
- not prescriptive, but **indicative and purposeful**.
- goes beyond liberal humanist traditions in education through **synergy with systemic and sustainability core values, concepts and methodologies**.
- Challenges the limiting effects of characteristics of the dominant mechanistic paradigm, such as top-down control, centralisation, managerialism, instrumentalism and the devaluing of humanities and arts.
- based on ‘systemics’ rather than ‘systematics’ – **emphasis is on systemic learning as change**, rather than *systematic control* in response to change.

Source: An analysis of the development of sustainability education internationally: evolution, interpretation and transformative potential.  
(Sterling, S., 2004, p57-58)

# Sustainability Education: Integration and Innovation

## Integration of sustainability in higher education

<i>Integration of sustainability within higher education implies shifts</i>	
<i>From</i>	<i>To</i>
• Transmissive learning	• Learning through discover
• Teacher-centred approach	• Learner-centred approach
• Individual learning	• Collaborative learning
• Learning dominated by theory	• Praxis-oriented linking theory and experience
• Focus on accumulating knowledge and a content orientation	• Focus on self-regulative learning and a real issues orientation
• Emphasis on cognitive objectives only	• Cognitive, affective, and skills-related objectives
• Institutional, staff-based teaching/learning	• Learning with staff but also with and from outsiders
• Low-level cognitive learning	• Higher-level cognitive learning

Source: An analysis of the development of sustainability education internationally: evolution, interpretation and transformative potential.  
(Sterling, S., 2004, p58)

# ProSPER.Net Workshop: Findings

## Learning outcomes and anticipated attributes

	<i><b>From academics</b></i>	<i><b>From industry</b></i>
1	<ul style="list-style-type: none"><li>• Genuine concern</li></ul>	<ul style="list-style-type: none"><li>• Motivation to make change</li></ul>
2	<ul style="list-style-type: none"><li>• Discipline / competence / sustainability</li></ul>	<ul style="list-style-type: none"><li>• Life-cycle thinking</li></ul>
3	<ul style="list-style-type: none"><li>• Good team player</li></ul>	<ul style="list-style-type: none"><li>• Open to other disciplines</li></ul>
4	<ul style="list-style-type: none"><li>• Right attitude</li></ul>	<ul style="list-style-type: none"><li>• Environmental / social / economic implications of their work</li></ul>

# ProSPER.Net Workshop: Pedagogical Methods

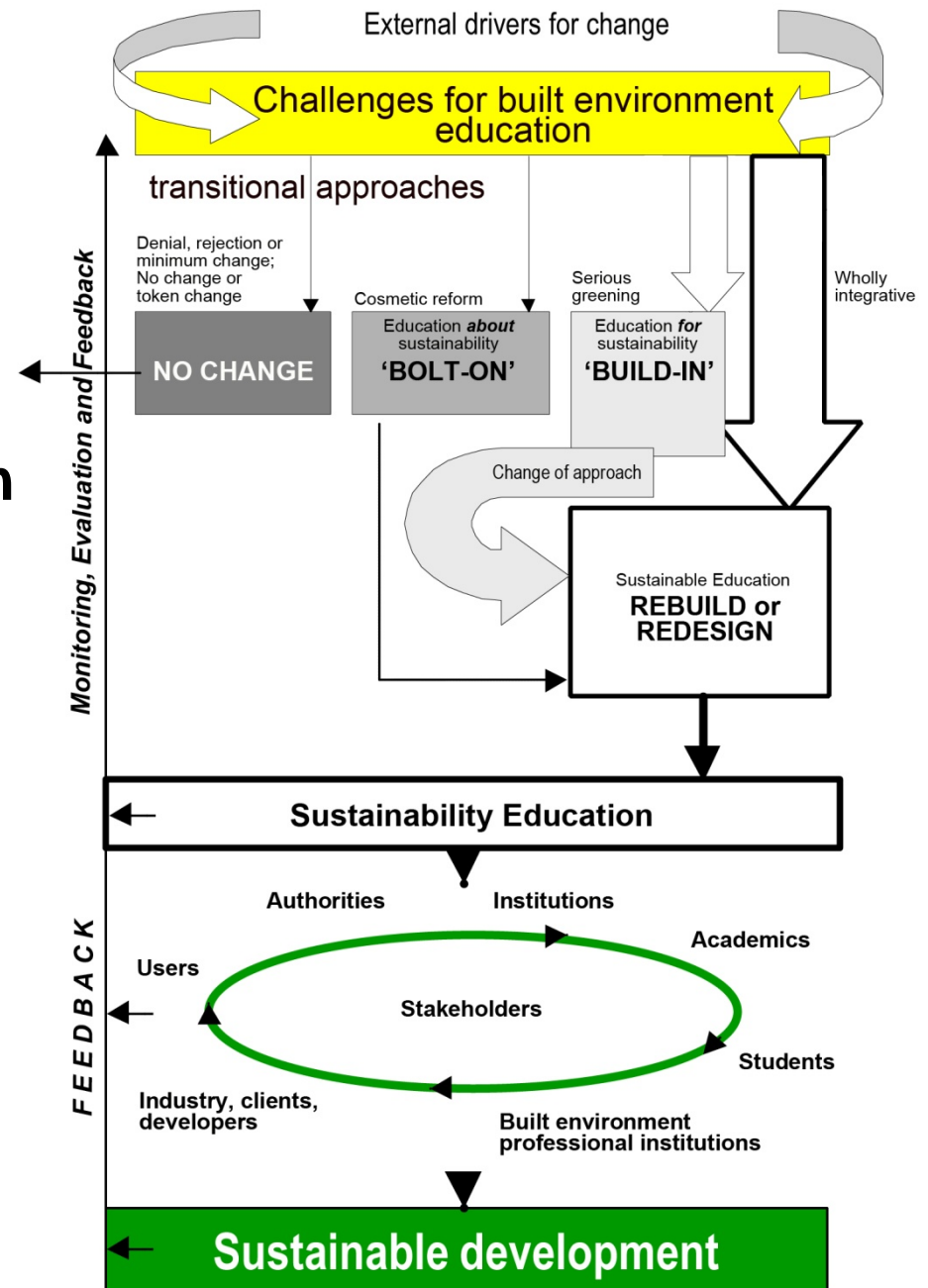
## Development and changes to built environment curriculum

<i><b>How educators will make the change</b></i>	<i><b>How to engage industry</b></i>
<ul style="list-style-type: none"> <li>• Change teaching content</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing professional education</li> </ul>
<ul style="list-style-type: none"> <li>• Research collaboration</li> </ul>	<ul style="list-style-type: none"> <li>• Open lectures / seminars open to all in the university rather than just within the program</li> </ul>
<ul style="list-style-type: none"> <li>• Sharing / networking lessons learned</li> </ul>	<ul style="list-style-type: none"> <li>• Research collaboration</li> </ul>
<ul style="list-style-type: none"> <li>• Best practice examples / case studies used where possible</li> </ul>	<ul style="list-style-type: none"> <li>• Form partnerships: students and industry through conferences such as with Green Building Councils, etc.</li> </ul>
<ul style="list-style-type: none"> <li>• Dialogue / discussions with industry</li> </ul>	<ul style="list-style-type: none"> <li>• Getting industry speakers</li> </ul>
<ul style="list-style-type: none"> <li>• Invite industry to: student presentations, faculty presentations</li> </ul>	<ul style="list-style-type: none"> <li>• Accreditation considerations</li> </ul>
<ul style="list-style-type: none"> <li>• Dialogue / discussions with other university staff / officials</li> </ul>	<ul style="list-style-type: none"> <li>• Organise activities with industry (e.g. conferences, seminars, etc.)</li> </ul>
<ul style="list-style-type: none"> <li>• Keep looking for funding</li> </ul>	<ul style="list-style-type: none"> <li>• Send graduates to individual companies</li> </ul>
<ul style="list-style-type: none"> <li>• Lobbying politicians</li> </ul>	<ul style="list-style-type: none"> <li>• Mentoring</li> </ul>
	<ul style="list-style-type: none"> <li>• Alumni tracking – surveys</li> </ul>
	<ul style="list-style-type: none"> <li>• Advisory boards</li> </ul>
	<ul style="list-style-type: none"> <li>• Adjunct professors</li> </ul>
	<ul style="list-style-type: none"> <li>• Feel good stories / testimonials</li> </ul>

# Curriculum guide

Development and framework for a curriculum guide:

- focus primarily on the **built environment and construction sector**
- point to **sustainability education** in the built environment
- emphasise **integration** of sustainability thinking and practice
- nurture key **role of related professions** in sustainable developments.

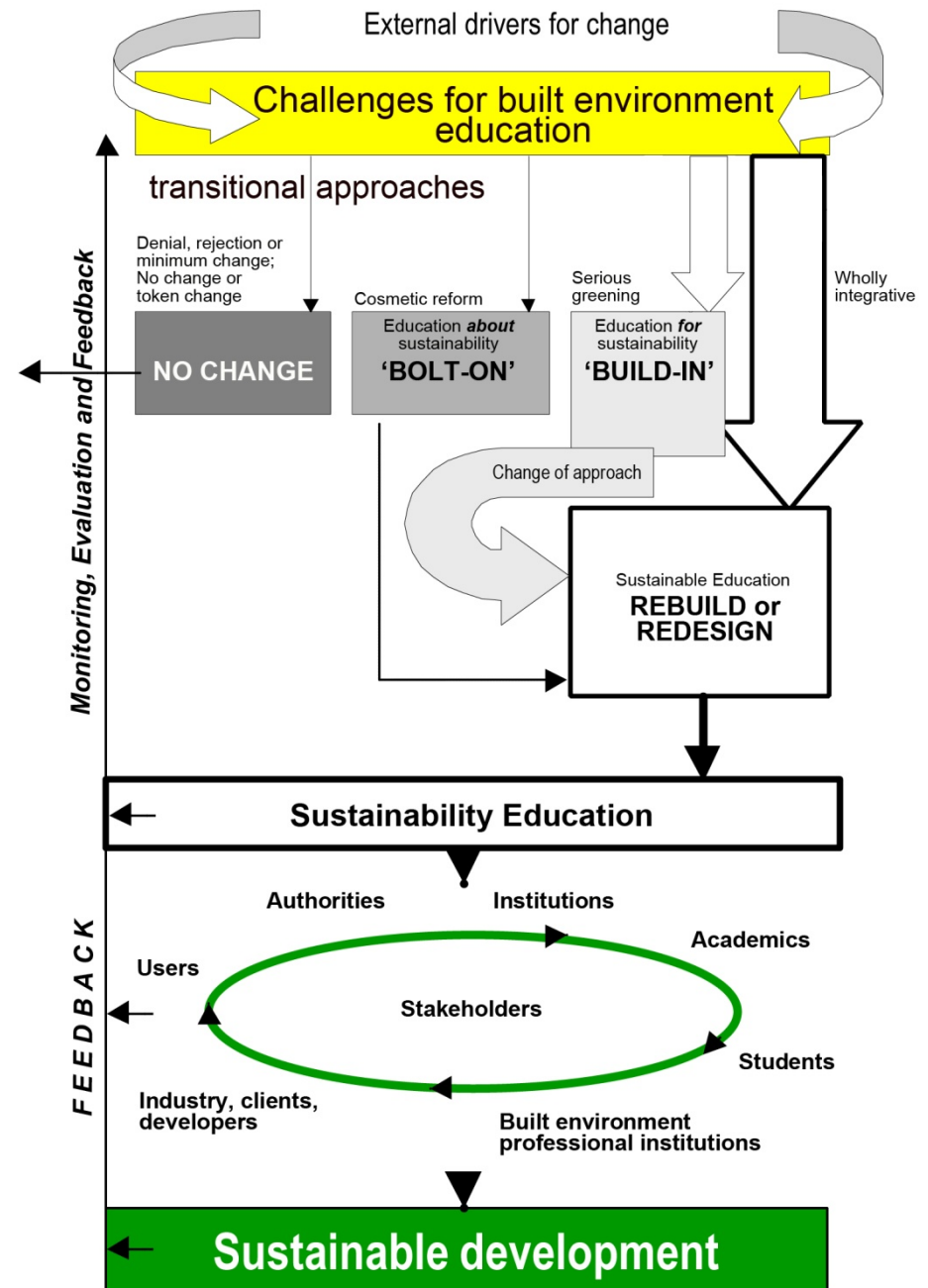


Adapted from: Strategies and Actions for Sustainable Construction (CIB, 1999, p21)

# Curriculum guide

## Structure:

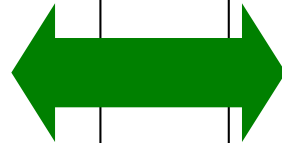
- Section 1:  
outlining priorities;  
contextualising priorities and  
strategies for capacity building
- Section 2:  
guiding principles for teaching  
and learning issues;  
learning aims and outcomes;  
transformative approaches  
monitoring and feedback loops
- Section 3:  
Curriculum dissemination and  
distribution



Adapted from: Strategies and Actions for Sustainable Construction (CIB, 1999, p21)

## Future directions and imperatives

Sustainability as  
knowledge  
process  
practice  
paradigm



Key to professional education  
pedagogical implications  
learning outcomes  
industry input  
challenges to  
professionals in the  
engineering and built  
environment field

# Architecture

Chemical Project  
**Engineering**  
Housing Sustainable Regional Environment Management Mineral Studies  
Materials Social Building Design Resources Global  
Physics Construction Architectural  
Civil Urban Property Science Town  
Development Environmental Planning Technology

# Thank you.

## Further information:

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