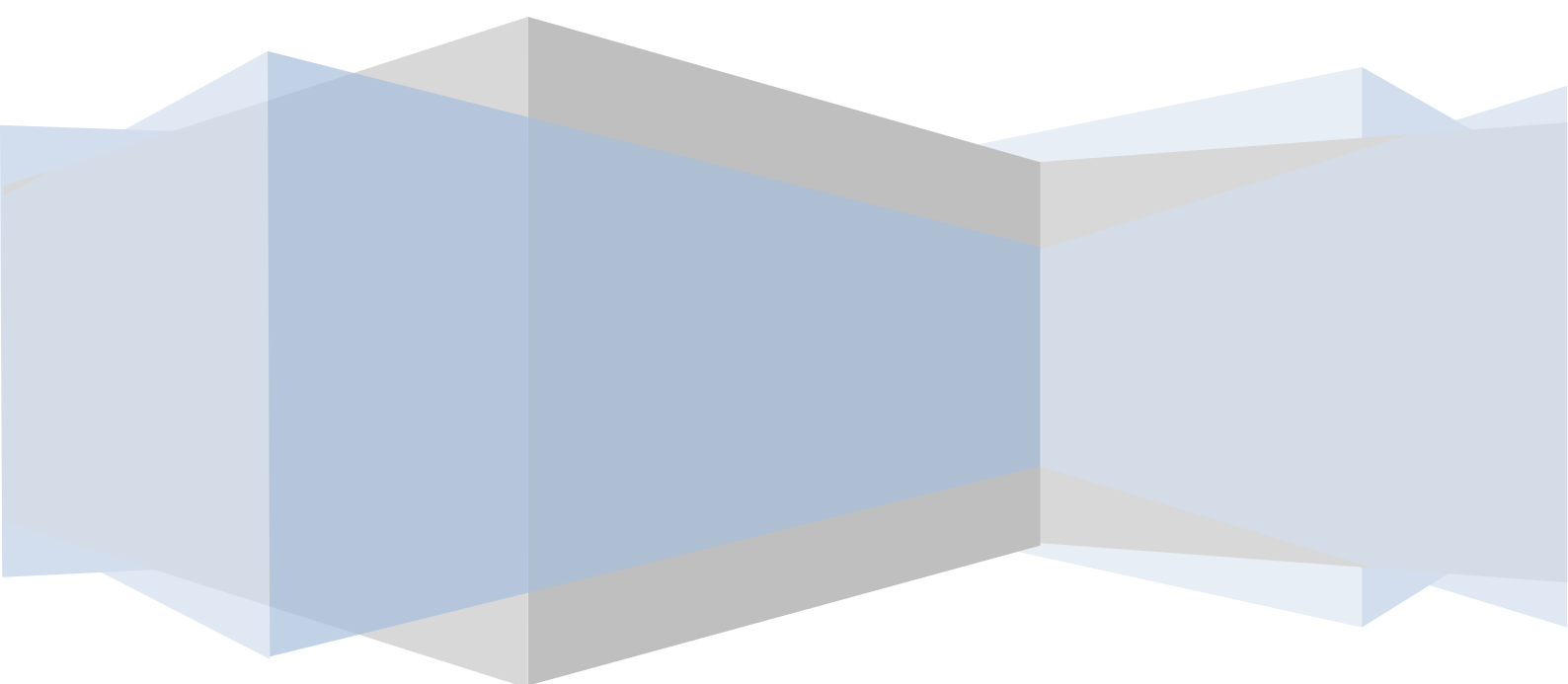# Greening Universities Toolkit

TRANSFORMING UNIVERSITIES INTO GREEN AND SUSTAINABLE CAMPUSES: *A TOOLKIT FOR IMPLEMENTERS*

DRAFT

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- *Paul Osmond, Malay Dave and Deo Prasad*
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ACKNOWLEDGEMENTS

Foreword

As we near the end of the United Nations Decade of Education for Sustainable Development (2005-2014), we are reminded that education is central to UNEP's mandate of "inspiring, informing and enabling nations and peoples to improve their quality of life without compromising that of future generations." In particular we are reminded that education is not about "doing as I say", but learning to "do as I do" – given that what we *do* is pivotal to how the world's communities deal with the multiple challenges of climate change, resource efficiency, biodiversity protection and management of our growing legacy of waste and environmental pollution.

Universities, as the pinnacle of formal, organised education, thus have a particular responsibility both to help define and also to become *exemplars* of environmental best practice.

The former aspect is generally well understood. Worldwide, Universities teach, conduct research and contribute to the global knowledge base across every aspect of sustainability, from photovoltaic engineering to ecological accounting. Yet when it comes to the University's own fabric and operations, there is frequently a significant disconnect… "do as I say" all too often reasserts itself.

The focus of this Toolkit is to help address that gap – to provide University staff and students with a selection of strategies, tools and resources, gleaned from the literature, from global case studies and from practice which are intended to inspire, encourage and support Universities to develop and implement their own transformative strategies for establishing green, resource-efficient and low carbon campuses. In turn, it is hoped the "green campus" will help inform the "green curriculum", and extending beyond institutional boundaries, help to catalyse more sustainable communities.

This Toolkit is part of a wider Greening Universities Initiative established through UNEP's Environmental Education and Training Unit, in collaboration with other UN agencies, under the umbrella of the recently formed Global Universities Partnership for Environment and Sustainability (GUPES). GUPES brings together over 100 Universities from across Africa, Asia and the Pacific, Latin America and the Caribbean, West Asia, Europe, and North America. At its core is the role Universities can foster for critical thinking, for example on emerging ethics and values towards the next generation of planetary leadership.

We commend this Toolkit to our GUPES partner Universities and the wider global university community, and wish you every success in putting into practice the initiatives expounded therein – while remaining cognisant of the magnitude of the tasks ahead.

In concluding these introductory remarks, it is important to emphasise that this is a *living* document. Continual qualitative improvement, as distinct from unlimited quantitative growth, is the essence of sustainable development. So we welcome your feedback, examples and case studies for inclusion in the web-based version of the Toolkit, and to update future editions of the published version.

Foreword

The Design and Development of this Toolkit

The Toolkit was conceived in 2011 as part of the Greening Universities Initiative set up by UNEP's Environmental Education and Training Unit (EETU) in partnership with other UN agencies and leading "green universities" experts and researchers, under the umbrella of the Global Universities Partnership for Environment and Sustainability (GUPES). UNEP's approach to this project involves:

- Developing criteria for green/sustainable campuses, including infrastructural, managerial and operational considerations;

- Supporting the development and implementation of strategies for transforming Universities into green/sustainable campuses;

- Advocacy, lobbying and publicity activities for greening Universities;

- Developing and launching a global award scheme for green Universities.

Publication of this Toolkit addresses the first of these four objectives. The University of New South Wales (UNSW) Faculty of the Built Environment was engaged to prepare the draft Toolkit for review by UNEP. This process involved four stages:

- An extensive review of the green University literature, including both academic research and the so-called "grey" literature of reports, websites and operational material produced by individual Universities and international and national associations relevant to University sustainability;

- Two international workshops auspiced by GUPES, held in Santiago, Chile in September 2011 and in Nairobi, Kenya in February 2012, which reviewed and discussed work in progress and provided input and direction to the final document;

- Collection of a substantial body of best practice case studies from Universities worldwide both to inform the content of the Toolkit overall and to include as a standalone section on global exemplars; and

- Final review by the EETU to ensure currency, consistency and alignment with the objectives of the UNEP Greening Universities Initiative.

Objectives and Expected Outcome of this Toolkit

The objective of this Toolkit is to inspire, encourage and support universities to develop and implement their own transformative strategies for establishing green, resource-efficient and low carbon campuses. It will provide an opportunity to build stakeholder capacity to deliver systemic, institution-wide integration of sustainability principles into all aspects of university business. This initiative is intended to improve the sustainability performance of universities globally and to provide support to other stakeholders embarking on their own sustainability journeys. Further, it will enhance the practical relevance of universities to sustainable development and by extension, the new paradigm of the "green economy". In short, the aim is to encourage and promote the contribution of universities to the overall sustainability of the planet. We cannot have a sustainable world where universities promote unsustainability [1] – conversely, the sustainable university can help catalyse a more sustainable world.

Using this Toolkit

This Greening Universities Toolkit is designed to provide universities with the basic strategies and tactics necessary to transform themselves into green, low carbon institutions with the capacity to address climate change, increase resource efficiency, enhance ecosystem management and minimise waste and pollution. To effectively support this journey and other transformative processes in Universities, the Toolkit is structured in such a way that the focus is on the **sustainable planning, design, development and management** of the university campus. This is linked to the core business of teaching, research and outreach, which are the subject of a separate initiative by UNEP's Environmental Education and Training Unit (EETU)[Higher Education Guidelines for Curriculum Review and Reorientation Towards Sustainable Development], Aspects of teaching, research and outreach are addressed here only insofar as they intersect/interact with the fabric and operations of the campus.

Overview of this Toolkit

- The first section, *Universities and sustainability: definitions, issues, risks and challenges*; establishes the **context** with a brief introduction to sustainability and sustainable development, and the elements expected of a sustainable university.

- The second section, *Strategies for initiating transformation*; addresses the **strategic** infrastructural, managerial, operational and cultural issues to be considered in setting up a framework for sustainability planning and management.

- The third section, *Tools for implementing transformation*; sets out generic guidance on the **tactical** aspects – step-by-step methods and procedures, checklists, performance indicators and monitoring, evaluation, reporting and communication tools. Hyperlinks to a variety of existing online resources and organisations are provided to enable universities to access information pertinent to their particular circumstances, and brief examples of best practice are described to encourage emulation.

- The fourth section, *Recognising and rewarding progress*; outlines a methodology and potential criteria for a global award scheme to facilitate **continual improvement** in university sustainability performance, and introduces a university **sustainability scorecard**.

- The fifth section*, Resources for change*; lists a variety of books, journals, associations and websites which can provide further **information and guidance** on university sustainability topics.

- The sixth section, *Greening your University;* is an **introductory brochure** which presents a brief outline of the overall project and a concise summary of the outcomes.

- The seventh section, *Global exemplars*; presents a series of best practice **case studies** from universities around the world.

- Finally, a **technical appendix** is included which sets out the full list of references drawn on and the methods and calculations used to inform the development of the Toolkit.

Each section has been prepared as a stand-alone document which can be read and used on its own, or be combined with the other sections to constitute the full Toolkit. The emphasis is on practical guidance, drawn from mainstream, proven systems, techniques and tools and illustrated by examples of what works, and why.

Introduction

Universities have long been agents of change – catalysts for social and political action as well as centres of learning. Universities not only educate most of the world's leaders, decision-makers and teachers and advance the boundaries of knowledge, but as major employers and consumers of goods and services they play a significant economic role nationally and globally*.*

Given the ascribed role of Universities in society, and the prevailing environmental and sustainability challenges, Universities are coming under increasing pressure to engage with and respond to climate change and other sustainable development issues and the associated risks and opportunities. They are expected to be the engines and innovation centres for sustainable development through teaching and learning, research and knowledge transfer. Critically, universities' educational role does not end with undergraduate and postgraduate learning; it extends to the plethora of activities which support and extend the teaching and research core: campus management and operations; campus planning, design, construction and renovation; purchasing; transport; and engagement with the wider community. Awareness is also growing in the higher education sector that universities can teach and demonstrate the theory and practice of sustainability through taking action to understand and reduce the unsustainable impacts of their own activities. Linkage of curricula and campus operations under the aegis of sustainability can create a powerful "shadow curriculum" which emphasises the nexus between theory and practice [2-5].

Evidence, however, shows that many universities are struggling with the concept and agenda of university "greening"; achievements to date have been scattered and unsystematic. Completion of a showcase green building is not the same as embracing a university-wide commitment to ensure all future buildings are built green – the former is a project success, the latter a systemic transformation [6], which is more desirable for sustainability. However, sustainability needs not be considered only from perspectives extrinsic to universities, but also from more intrinsic perspectives. These should motivate universities to adopt sustainable/green university strategies which should demonstrate sustainability principles.

Education has been described as humanity's best hope and most effective means in the quest to achieve sustainable development [7]. In this context, universities have a special responsibility to help define and also to *exemplify* best practice.

The steady growth of higher education in both the developed and the developing world has created a surge of competing priorities, of which sustainability is one of the more recent. The most successful green campus initiatives are those which acknowledge these shifting priorities and welcome the emerging opportunities which growth and development can generate [6]. While some noteworthy exemplars of university sustainability initiatives exist around the world, there is a need to maximise the potential benefits by encouraging their replication in as many universities as possible globally.

Section 1: Universities and sustainability: definitions, issues, risks and challenges

1.1. What do we mean by "sustainability"?

The World Conservation Strategy was launched in 1980 by the IUCN (International Union for Conservation of Nature and Natural Resources), UNEP (United Nations Environment Programme) and WWF (the World Wildlife Fund) and introduced not only the concept of sustainable development but also the term "sustainable" in relation to human use of the biosphere. However, the antecedents of the sustainability debate are evident in the discussions of 'limits to growth' in the early 1970s, whilst the concept itself was developed at the United Nations Conference on the Environment in Stockholm in 1972 [8].

The World Conservation Strategy was significant for stressing that rather than *conservation* and *development* being mutually exclusive activities, as had generally been argued up to that time, they are interdependent. The WCS stressed that development *requires* the conservation of the living resource base on which it ultimately depends; in the longer term development will not be able to take place unless we conserve our living resources. Likewise conservation will not occur unless at least minimal standards of development are met, i.e. basic needs of food, shelter and clean water [9].

Subsequent definitions of "sustainability" and "sustainable development" run into the hundreds and reflect a wide range of perspectives. Despite lack of agreement on an unequivocal interpretation of the concept, there is general agreement that it involves simultaneous satisfaction of economic, environmental and social goals. Meeting environmental criteria in a society which fails to meet economic and social goals concerning justice and equity does not make for sustainability.

The most emblematic definition of sustainable development is that set out in *Our Common Future*, the 1987 "Brundtland Report" of the World Commission on Environment and Development [10], which states:

> *Humanity has the ability to make development sustainable* **– to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs.**

The WCED go on to say (p 8):

> *The concept of sustainable development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activities. But technology and social organization can both be managed and improved to make way for a new era of economic growth.*

And (p 46):

> *In essence, sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both the current and future potential to meet human needs and aspirations.*

This statement of sustainable development is one which we would probably all endorse. It captures the key *temporal* prerequisite of sustainability – persistence into the long-term future – through its explicit reference to intergenerational equity. On the other hand, the Brundtland formulation can be seen as enigmatic as well as emblematic – by expressing a

qualified consensus reached by a UN Commission charged with reconciling the goals of environmental protection and economic growth it epitomises the contestability of the territory. The price of consensus commonly is ambiguity; the positive aspect is that ambiguity can encourage discussion and debate, an essential part of the practical process of working towards sustainability [11].

1.2. Sustainability and sustainable *development*

The terms "sustainability" and "sustainable development" have been used interchangeably above – but is this appropriate? The following distinction [12] offers a useful guide:

Sustainability is the ultimate goal or destination. Exactly what defines the state of being, of what is sustainable (whether it be a society, logging, fishing etc), is informed by science but ultimately depends on personal values and world views.

To achieve a state of environmental sustainability, a framework or process is needed. Certain conditions have to be met and steps in the process toward 'sustainability' have to be made. The framework of sustainable development is the means for achieving sustainability.

So, in brief, "sustainability" refers to the goal and "sustainable development" is the path or framework to achieve it. As with the term "sustainability", what is considered as a necessary path and time frame will vary amongst individuals.

Further, it must be emphasised that *development* is not synonymous with *growth*. Growth is about becoming quantitatively bigger; development on the other hand is about becoming qualitatively better [13].

Sustainable development, then, may be defined as the intentional means whereby humans strive towards sustainability, the co-evolution of human and natural systems to enable adaptation to change indefinitely, which:

- Is based on qualitative development/improvement, not quantitative growth;

- Conserves and enhances natural capital stocks, which cannot sustainably be substituted by other forms of capital;

- Combines social equity in improving present quality of life with intergenerational equity in meeting the needs of the future; and

- Acknowledges cultural development and cultural diversity (as with biodiversity) as central to the adaptive process of realising sustainability.

1.3. The four capitals and the four bottom lines

Ecological economists generally recognise four distinct "capitals" [14-16] which are necessary to support the real, human welfare producing economy:

- Natural (the land, sea, air and ecosystems from which the human economy derives its materials and energy and to which it ultimately returns its wastes);

- Built (buildings and cities, the physical infrastructure which produces economic outputs and the human artifacts thus obtained);

- Human (the health, skills, knowledge and values of the human population); and

- Social (the web of formal and informal interpersonal connections and institutional arrangements which facilitate human interactions).

This taxonomy provides a useful model to help articulate the structures, processes and relationships which are fundamental to the transition to sustainability.

The expectation of tripartite satisfaction of economic, environmental and social goals referred to above can also be expressed in terms familiar to the business world; the **triple bottom line** refers to satisfaction of not just the acknowledged bottom line of meeting economic goals (profits) but also the need to now simultaneously meet environmental and social goals (or "bottom lines") in carrying out their business. This also provides a practical framework for the development of policies and strategies to drive institutional change. When the objective is transformation rather than mere observation, the rationale for including **governance** as a fourth bottom line is reinforced (Figure 1.1). Governance is defined in the present context to include both the formal regulatory, business, administrative and political processes of the university which determine or influence decision-making and action, and the informal networks, traditions and cultural and behavioural norms which act as enablers or disablers of sustainable development.
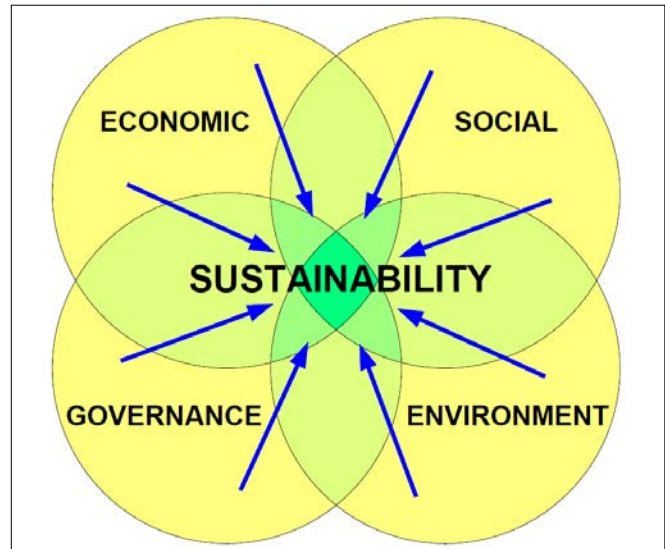
Figure 1.1: The quadruple bottom line.

1.4. What does a "sustainable university" look like?

It seems pretty clear that there can be no sustainable world where universities promote unsustainability [1]. Moreover, "…no institutions in modern society are better situated and more obliged to facilitate the transition to a sustainable future than colleges and universities" [17].

A "fully mature" approach to university sustainability may be summarised as "one in which the activities of a university are ecologically sound, socially and culturally just and economically viable" [18]. How the transition towards sustainability is expressed in a particular university must inevitably reflect the social, cultural, economic and ecological circumstances of the nation and region in which that university is situated. Nevertheless, although they can be expressed in different ways, there are well-defined foundational principles which characterise university sustainability [18-22].

In general terms, a university consciously choosing the path of sustainable development would exemplify the following principles:

- Clear articulation and integration of social, ethical and environmental responsibility in the institution's vision, mission and governance;

- Integration of social, economic and environmental sustainability across the curriculum, commitment to critical systems thinking and interdisciplinarity, sustainability literacy expressed as a universal graduate attribute;

- Dedicated research on sustainability topics and consideration of "quadruple bottom line" sustainability aspects in all other research;

- Outreach and service to the wider community, including partnerships with schools, government, non-governmental organisations and industry;

- Campus planning, design and development structured and managed to achieve and surpass zero net carbon/water/waste, to become a regenerative organisation within the context of the local bioregion;

- Physical operations and maintenance focused on supporting and enabling "beyond zero" environmental goals, including effective monitoring, reporting and continual improvement;

- Policies and practices which foster equity, diversity and quality of life for students, staff, and the broader community within which the university is based;

- The campus as "living laboratory" – student involvement in environmental learning to transform the learning environment;

- Celebration of cultural diversity and application of cultural inclusivity; and

- Frameworks to support cooperation among universities both nationally and globally.

Universities by definition have accepted the challenge of leadership and aspiration to best practice, in the creation and dissemination of knowledge. The transition to sustainability opens up new challenges, but also tremendous opportunities. Governments, businesses, NGOs and individuals – and a growing number of universities – have already made significant progress, and the road ahead is well illuminated in terms of tested and evidenced strategies. The following Section of the Toolkit introduces those strategies which have shown the greatest capacity to enable systematic institutional transformation, and are also internationally recognised and readily available. These include the International Organization for Standardization (ISO) environmental management standards and social responsibility guidelines, the Global Reporting Initiative framework and university-specific resources which have been developed by several international sustainable campus associations and intergovernmental organisations (see also Section 5, *Resources for change*).

1.5.2 Sustainability issues, risks and associated challenges in universities

Universities are complex, multi-faceted entities with diverse organisational subcultures, traditions and concerns [6], and the transitory nature of university life for the bulk of the campus community can mean the real impacts of the institution remain unacknowledged [23]. There may be individual high quality initiatives aimed at addressing these impacts, but where these are restricted to one or a handful of organisational units they inevitably end up ad hoc and uncoordinated. In addition, limited funding and multiple calls on capital budgets favour short-term fixes over green investments with long-term paybacks.

Staff and students have heavy workloads; limited time and multiple expectations as to how that time is used can make it problematic to initiate, maintain, complete and evaluate projects, and compound natural resistance to change. Moreover, universities generally lack the incentive structures necessary to promote changes at the individual level [24].

Universities are located in a sea of competing and interacting social processes whereby decisions on growth and direction are often made outside the immediate institutional community [25]. Structural change in response to new research priorities and societal educational demands combined with the loss of corporate memory through staff turnover and the transience of the student population can mean mistakes are repeated, previous high performing initiatives are not emulated and it becomes difficult to build on progress or initiate continual improvement cycles. Sometimes failure to develop appropriate performance measures limits direct feedback on the benefits of sustainability actions – the environmental, social and financial value of achievements is not understood or promoted [26-28].

Two common denominators across all of these well-recognised risks and challenges are lack of commitment by university leadership, and lack of awareness and engagement of staff and students.

However, some of the same characteristics of universities which tend to hinder progress towards sustainability – for example the tradition of decentralisation and autonomy – have a dual nature, and can equally act as enablers of change. In particular, the university has historically provided a safe haven for the innovator and the activist. Early-adopter sustainability champions, whatever their substantive role in the organisation, can be critical change agents. And where cross-campus interdisciplinary networks already exist, they can contribute to the critical mass for the dissemination of new ideas. There are also important external drivers, for example pressure from peer institutions, particularly those which have already made worthwhile progress towards sustainability; and pressure from society at large – community aspirations for a cleaner, greener world, and corporations and government bodies keen to support sustainability-focused research, or to hire graduates with the relevant skills [24].

In discussing the issues, risks and challenges of university sustainability it is helpful to separately review the "triple bottom line" dimensions of environment, economy and society / culture, recognising both their inter-relationships, and the crucial role of the fourth "bottom line" – governance – across these three dimensions.

1.5.1 Environmental

Universities embody the environmental issues, risks and challenges of the wider communities in which they are situated, but also express their own unique characteristics. On one level, a university may be likened to a small town, with all the associated issues of

spatial planning, management of physical growth and development, maintenance of buildings and open spaces, supply of electricity, water and other utilities, and often provision of residential accommodation and ancillary services. In addition, there are the typically corporate functions of finance, procurement, human resources, etc.

However, the distinguishing feature of a university is its core purpose of teaching, research and community outreach. This generates a plethora of distinctive environmental issues on top of those typical of the small town or the corporate office, which often include significant (indeed semi-industrial) levels of resource consumption, carbon emissions, waste and pollution. Risks here include the reputational and financial – linked to legal compliance – which on their own are enough to motivate some institutions towards sustainable development. The broader challenge is to minimise the legally compliant but environmentally unsustainable impacts of the university's activities while maintaining and extending its teaching / research / outreach core.

To meet this challenge requires an understanding of the particularities of the university's activities as well as its environmental impacts, in other words, the key areas for intervention: in relation to *environmental* parameters such as energy, carbon and climate change, water, waste, and biodiversity; and *management* parameters such as the planning, design and development of the campus; and the "greening" of specific operational activities such as offices, laboratories, information technology, transport and procurement. Both sets of parameters are addressed in Section 3, *Tools for delivering transformation.*

1.5.2   Economic

Universities are major employers, major investors and major purchasers of goods and services. There are opportunities across all these areas for intervention, in terms of direct and indirect support for local jobs, ethical/sustainable investment and "green" procurement strategies which can help integrate sustainability along the supply chain (for example by specifying standards of environmental performance in tender documentation).

One challenge common across many nations is a declining level of public funding. Cost is a significant factor in most sustainability investment, and in some cases may appear insurmountable. However, even in situations where natural disaster or difficult economic conditions limit university budgets to the minimum necessary to keep their doors open, options to address sustainability imperatives are available. Typically these will involve the capture of savings around management of the key flows (inputs and outputs) of energy, water and materials, which can provide a buffer for future capital and operational investment in sustainability initiatives.

The risk is that senior management may welcome the savings, but be reluctant to channel any (let alone all) into new greening endeavours, thereby relinquishing the opportunity for continual improvement. The key here is management buy-in – which means a shift from a "command and control" mentality to a shared *vision* [29], discussed in Section 2, *Strategies for initiating transformation.*

Nevertheless, universities in different parts of the world, and at different stages of their life cycles, are not directly comparable – there is no "one size fits all" approach to addressing the economic dimension of sustainability. The intent of this Toolkit is to provide a conceptual framework which allows participating universities to take from it what is appropriate to their circumstances, from effectively zero cost behaviour change "housekeeping" measures to reduce energy consumption to development of institution-wide sustainable investment and procurement strategies. Indeed for any university, whatever its circumstances, logic supports

a step by step approach which starts with initiatives able to generate immediate monetary savings (and gain staff, student and management support) before tackling more complex, costly or contentious matters. These opportunities are discussed in some detail in Section 3.

PROMOTING RESPONSIBLE INVESTMENT BY CANADIAN UNIVERSITIES

The Coalition of Universities for Responsible Investing was founded in 2009 to identify constructive, new approaches to bring environmental, social and governance concerns into the management of university endowments and pension funds. Focusing on Canadian universities, CURI aims to help resolve the responsible investment gap by:

- Providing multi-stakeholder solutions for investment policy development and the proactive management of beneficiary interests, through the provision of best practices, sample policies and other relevant guidance material;

- Serving as a forum where relevant stakeholders – including industry experts, students, alumni, trustees and academics – are invited to participate in innovative and collaborative initiatives including conferences, web-based discussions, outreach campaigns and networks; and

- Supporting curriculum development to advance knowledge and expertise in the field of responsible investing.

CURI is also committed to building an international movement to connect dispersed efforts to incorporate responsible investment in universities, for example through facilitating collaboration between universities and investor coalition groups such as the Social Investment Organization, the UN Principles for Responsible Investing, and the Responsible Endowments Coalition.

http://www.curi.ca/

1.5.3 Socio-cultural

The socio-cultural dimension of sustainability needs to be considered at two levels: internally with respect to the university's own formal and informal organisational structures; and externally with respect to the university's relationships with the wider community. Regarding the former, the key issue is gaining support and commitment from students, academic staff, operational staff and senior management, groups whose motivations, priorities and ways of thinking and doing may be on some issues not just unaligned, but diametrically opposed.

Section 2 provides a detailed explanation of stakeholder engagement strategies to promote cross-university participation in sustainability action – and in particular, commitment from senior management. Absence of top management support precludes long-term gains. Similarly, if the university's leadership is not "walking the talk", then employees will disregard any change initiative as just "talk" [29].

Some remarks on **avoiding greenwash** are pertinent at this point. Greenwash refers to the not uncommon situation where an organisation makes serious claims to "green" credentials but does little or nothing to act on them. Even before making a formal commitment to sustainable development, there must be a sufficient level of organisational maturity to give confidence to the university community that decisions will be followed through. In particular:

- Is there evidence that the university has the resources to commit to implementation of sustainability program (budget, people, time, knowledge and skills)?

- Is there a history of following up internal and external engagement with action on the issues raised?

- Does the university have efficient and effective governance and administration systems (finance, facility management, human resources, teaching and research management)?

- Are there effective, day-to-day internal and external communications channels (newsletters, websites)?

- Is the university open and transparent in its dealings with staff, students and the wider community?

- A university is by definition a teaching organisation, but is it also a learning organisation (staff development programs, internal and external benchmarking, quality systems)?

Answers to these questions may provide a useful checklist of the capacity of the institution to deliver on its promises. A lot of negative answers would suggest there are more deep-seated management issues to be addressed before taking on the additional challenge of sustainable development.

Section 2: Strategies for initiating transformation

Having established the destination, the next step is to decide how to get there. Fortunately, there is no need to "reinvent the wheel" – given the intent of this Toolkit as a resource relevant to universities worldwide, strategies and frameworks with evidenced global applicability are adopted where possible, and adapted where necessary. The focus of this Section is on the high level strategies needed to initiate a university's transition to sustainability – understanding barriers and drivers, making the commitment, establishing a vision and engaging with the university and external communities to bring it to fruition. The sources drawn on for this Section include the International Organization for Standardization, the UNEP *Practitioner's Handbook on Stakeholder Engagement* [30] and work done over the past two decades by organisations such as the University Leaders for a Sustainable Future (ULSF), International Sustainable Campus Network (ISCN), and Association for the Advancement of Sustainability in Higher Education (AASHE). Details for these and other similar international organisations are provided in Section 5, *Resources for change.*

It is stating the obvious that the transition to global sustainability requires conscious, long-term, directed effort, but the message bears repeating. It will not happen through wishful thinking. The time scale for such transformational change is frequently cited as 40-50 years, or between one and two generations. If, for instance, worldwide CO_2 emissions were halved by 2050 compared to 1990 (suggesting a reduction of at least 80% by developed countries), there is a high probability that global warming could be stabilised below two degrees [31]. The strategies introduced in this Section reflect this long-term perspective.

2.1. Where to begin?

Strategies for organisational change are often characterised as top down (management driven) or bottom up (staff driven). The best strategies usually involve a combination of both approaches; for example, adoption of a high level vision statement or policy, and initiation of low cost, high impact project(s) at a grass roots level. Improving energy efficiency is a typical example of such "low hanging fruit".

Experience worldwide has demonstrated time and again that leadership from university management at the highest level is essential to integrate sustainability into mainstream practice. Bottom-up action by staff and students is necessary, but is not in itself sufficient to bring about inclusion of sustainability in the university's core business. For development to be sustainable, it must be rooted in cultural values [32] – the bottom-up approach alone is unlikely to achieve the cultural shift which is a precondition for institutional sustainability transformation [33].

However, the top-down approach by itself is also insufficient. The decentralised and semi-autonomous nature of university entities such as departments, schools and research centres tends to encourage responsibility to the unit rather than the university, so initiatives driven solely from the top may be seen as an imposition and will be difficult to implement successfully [34].

There are three distinct constituencies in any university – students; academic staff; and administrative / operational staff. Any sustainability program which aims to achieve widespread participation must take account of the varying roles, experiences and

expectations of these separate subcultures as the starting point. The evidence suggests the greatest leverage in achieving institutional change occurs when all three groups share a vision and a perception that they are working to the same end [6]. Further, once an idea has been accepted and incorporated into the system's culture and day-to-day operations it becomes difficult to dislodge, even with a change of top management [35].

Another way to manage change is to think of a university as a complex ecosystem composed of interdependent components which must be considered in their totality, together with their web of connections. This "whole systems" approach implies a condition of dynamic equilibrium in which goals, objectives, and activities are adjusted and fine-tuned in the organisation and day-to-day practical delivery of campus sustainability programs [25]. This model is consistent with the continual improvement cycle discussed in Section 3, and is the hallmark of a *learning organisation.*

In summary, experience worldwide confirms that a combination of top management commitment and staff and student engagement offers the best opportunity both for successful initiation and long-term performance of university sustainability programs. The following sections discuss some practical strategies to bring this about, while Section 3, *Tools for delivering transformation*, addresses the substantive "tactical" aspects of making it happen, broadly in line with the ISO 14001 Environmental Management System standard as adapted for the higher education context (Table 2.1). **Table 2.1: Process overview – summary of Sections 2 and 3 of the Toolkit.**

Activity	Comments
Making the commitment	This commonly includes developing a sustainability vision and/or mission statement, and/or signing a third party declaration or charter on university sustainability.
Engaging the university and wider community	Includes strategies and tactics for engaging with and securing the participation of university stakeholders (academic and operational staff and students) as well as the wider community of alumni, industry partners, government agencies, local schools and residents etc.
Developing a sustainability policy	The university's sustainability policy is the high level driver for its short- and long-term sustainability goals.
Establishing a sustainability committee	The committee, representing staff and students and chaired by a member of senior management, is responsible for input to and review of the university's sustainability policy, objectives, targets and action plans, for final management approval.
Setting up the sustainability team	Top management should appoint a sustainability manager with sufficient authority, resources and freedom to act, who may head a professional sustainability unit and/or coordinate a team of staff and student volunteers, depending on the size and resources of the particular university.
Determining the baseline: initial environmental / sustainability reviews	This provides the starting point for prioritising issues for action (for example through application of risk assessment methods) and setting objectives and targets.
Selecting and defining indicators	Indicators enable tracking of progress towards achievement of objectives and targets. Suggested indicator **themes** are: energy, carbon and climate change; water use; land use; material flows; sustainability in research; education for sustainability; governance and administration; and community outreach.
Setting objectives and targets	**Objectives** are overall goals arising from the university's sustainability policy; **targets** are detailed performance requirements set to achieve the objectives. Targets should be "challenging but achievable", and should reflect the university's commitment to sustainable *development* and the ultimate

	achievement of a sustainable university.
Developing and implementing sustainability action plans	Sustainability management programs or action plans are the engine room for change. Plans are time-bound, and developed and reviewed on a regular basis in line with the sustainability targets. The plans set out in this Toolkit address the following substantive areas: Energy, Carbon and Climate Change; Water; Waste; Biodiversity and ecosystem services; Planning, Design & Development; Procurement; Green office; Green lab; Green IT; Transport
Awareness and training	Awareness building and training opportunities need to be built into every sustainability action plan.
Communications and documentation	Each sustainability action plan will need to incorporate a communications strategy to facilitate engagement of the university community and maximise the chances of success. Documentation of all aspects of the system minimises the loss of "corporate memory".
Closing the loop: monitoring, evaluating and communicating progress	This system requirement includes establishment of internal audit and management review cycles, annual sustainability reporting, and marketing promotion and celebration of successes.

2.2 Making the commitment – visions, missions, values and declarations

Terms such as "vision" and "mission" may be dismissed as management jargon, and sustainability is not advanced through uncritical adherence to textbook prescriptions. Fundamentally, universities should define their own concept and definition of what a sustainable university is about [36]. However, all universities have strategic planning processes, which commonly include some kind of vision of what the university leadership (in most cases), or the university community more generally, want to see their institution become. Typically this will be some version of "the best" [37].

Envisioning exercises are sometimes conducted by local governments, universities still rely predominantly on more traditional and hierarchical methods [19] whereby vision statements are generally handed down from above. A more robust process, and certainly one which encourages ownership of the outcome, is to involve the university community through seminars, workshops, surveys etc in the same way as local residents may be engaged in the process of developing a vision for their city's future.

ENVISIONING THE SUSTAINABLE UNIVERSITY

Universities are increasingly aspiring to be both models and catalysts of change, leading the world to a more sustainable future. Yet complex and ineffective governance, traditional disciplinary boundaries, and the lack of a shared vision often hinder progress towards this goal.

In 2007, the **University of Vermont** in Burlington, USA initiated an envisioning process to develop a plan to transform the university into a leader in whole systems thinking and sustainable design. The process involved 1,500 participants from the campus and the Burlington community. Participants' visions of a sustainable and desirable university were gathered through two community events and three online surveys. Analysis of the results led to the formation of a vision narrative, a sustainability charter, and guided the creation of a range of initiatives. The results suggest that when provided with sufficient and well-structured opportunities, university community members will become active participants in initiatives aimed at fostering institutional change.

By focusing on shared values and long-term goals, envisioning exercises can achieve a surprising amount of consensus while avoiding the divisiveness and polarization that often plague open-ended discussions and university governance.

Pollock, N., Horn, N, E., Costanza, R. & Sayre, M. (2009). Envisioning helps promote sustainability in academia: A case study at the University of Vermont. *International Journal of Sustainability in Higher Education,* 10, 343-353.

While a vision statement represents a commitment to the future rather than a decision to do something now, it provides a good starting point for policy development and a motivational focus for the university community, if the staff and students have been actively involved from the start. They must *own* it. A strong strategic vision helps focus attention on opportunities which support that vision [38] – beginning with the end in mind and working to achieve it step by step.

A vision statement should by definition be future oriented and ambitious [22], but it also needs to be specific enough that it is not simply a promise to be "the best". It should reflect the organisation's values and culture, and also its activities and context. Where is the university located? Is it big or small, primarily a research institution or mainly teaching focused? What are its particular teaching/research strengths? Is the campus part of a heavily built-up urban area, or spread out across a "greenfields" site? Is it a centuries old university, steeped in tradition, or was it founded in the past decade? What are its relationships with the wider community? All these present-day issues (and more) can contextualise and inform where and how the university sees itself positioned in terms of an envisioned sustainable future.

DEVELOPING A VISION STATEMENT – UNIVERSITY OF MARIBOR

The University of Maribor in Slovenia is leading the nation's universities in introducing sustainability principles into its everyday performance, guided by its institutional vision.

The number of tertiary students in Slovenia more than doubled between 1995 and 2005, coinciding with its evolution as an independent country and admission to the European Union. In 2006 the University of Maribor established a Sustainability Council, including representatives from most departments, in response to growing interest from the university community. The Council adopted a combination of top-down and bottom-up approaches to promote the sustainability agenda, and in June 2006 proposed the following vision statement:

"To become an institution that integrates sustainable development principles into everyday activities, from achieving research and educational excellence (ranking within the first third of European universities) and to foster local, regional, and international cooperation, and spread cultural awareness and values."

The University adopted the Plan-Do-Check-Act continual improvement "Deming cycle" [39] to drive its sustainability initiatives (see also Section 3). The Sustainability Council continues to bring together stakeholders from across the University to coordinate and foster sustainability projects.

Lukman, R. & Glavič, P. (2007). What are the key elements of a sustainable university? *Clean Technologies and Environmental Policy,* 9: 103-114.

Many organisations, including many universities, adopt a **mission statement** as well as (or instead of) a statement of their vision for the future. A mission statement helps explain the motivation for the vision; it should answer (in general terms) the questions who, what, and why, and lay the foundation for future action [36]. A mission is more pragmatic than a vision. It is about what the organisation plans to *do* rather than what it wants to *be.* It uses "doing words" (lead, educate, plan, develop…) to identify actions, and defines those areas in which action will be taken (curriculum, research, fabric and operations...).

VISION, MISSION AND VALUES

With more than 300 members, the UK Environmental Association for Universities and Colleges (EAUC) strives to lead the way in bringing sustainability to the business management and curriculum of institutions across the UK and further afield. As well as its vision and mission, the EAUC website sets out the Association's foundational **values**:

"Our Vision: Our vision is a university, college and learning and skills sector where the principles and values of environmental, economic and social sustainability are embedded.'

'Our Mission: We will lead, inspire and equip Members and stakeholders with a shared vision, knowledge and the tools they need to embed sustainability within curriculum and operations.'

"Our Values:

Leadership and Service for Sustainability. With humility, honesty and integrity, as a role model, we inspire change and challenge unsustainable practice.

Partnership and Independence. Benefiting from our autonomous position we value collaborative networks and partnerships.

Commitment and Creativity. As one team, we bring a potent mix of optimism, determination, innovation and dynamism to solving problems.

Listening, Understanding and Learning. We continually learn, account for and improve our organisation through the knowledge and initiative of our members, staff, trustees and other stakeholders."

Since the launch of the Talloires Declaration in 1990 [20], regional and international conferences, higher education associations and intergovernmental organisations such as UNESCO have developed a variety of **agreements, declarations and charters** on university sustainability (See Section 5). These represent another strategic tool available to universities choosing the path of sustainable development. As at 2011 there were more than 30 such international agreements, signed by more than 1400 universities globally [40].

Similar to a vision or mission statement, a sustainability declaration represents a high level commitment to achieving a sustainable future; as such it can offer general guidance, but is not designed to provide specific direction. Institutions pledge to implement broadly defined actions around core issues such as environmental literacy, institutional culture change, interdisciplinary collaboration and stakeholder participation. These actions may be *staged* for ease of implementation, for example the International Sustainable Campus Network – Global University Leaders Forum *Sustainable Campus Charter* [41] structures commitments into a nested hierarchy encompassing individual buildings, campus-wide planning and target setting, and integration of research, teaching, outreach and facilities for sustainability.

Of course signing a declaration does not of itself guarantee implementation of its commitments. Voluntary agreements by definition provide no mechanisms to enforce accountability. On the other hand, commitment to an external agreement can provide the basis for a university to develop its own internal sustainability vision and policy. Arguably, international declarations and charters have also helped to shape the growing consensus on the role of universities in sustainable development, and even national legislation [40].

2.3 Engaging the university (and wider) communities

Section 2.2 above introduced the notion of top-down, bottom-up and combined strategies. In all cases, genuine engagement of academics, administrative / operational staff and students in the early stages is crucial to the successful initiation of the sustainability agenda. Indeed the organised participation of students and staff in *every* aspect of the sustainability transition is essential to success. Hence the strategies presented below can be employed to support and reinforce any of the practical sustainability initiatives and interventions discussed in Section 3 of this Toolkit at any stage of the journey, involving different people at different stages.

The topic of community engagement and participation is an important focus for research and teaching, and an issue for practical application in governance and the corporate sector, but universities can sometimes be reticent about practicing what they teach. But as with other aspects of greening the university, tested and effective strategies exist for motivating, informing and engaging the involvement of the university and wider communities, discussed below.

It should be emphasised that the present discussion is about engagement to inform and promote institutional sustainability, not what is referred to as "civic engagement" or "outreach" whereby the university is promoting sustainability beyond its own institutional boundaries. The latter interpretation is outside the scope of this toolkit – although the strategies for accomplishing it are much the same as for the former.

"Engagement" describes the full scope of an organisation's efforts to understand and involve stakeholders in its activities and decisions. It includes basic communication strategies consultation exercises and deeper levels of dialogue and collaboration [42]. Stakeholder engagement in the wider world is progressing from simple informing to discussing to partnering. A similar progression is necessary in the higher education sector to drive sustainable development.

Engagement of staff and students in creating a sustainability vision or mission or around signing a declaration or developing a policy
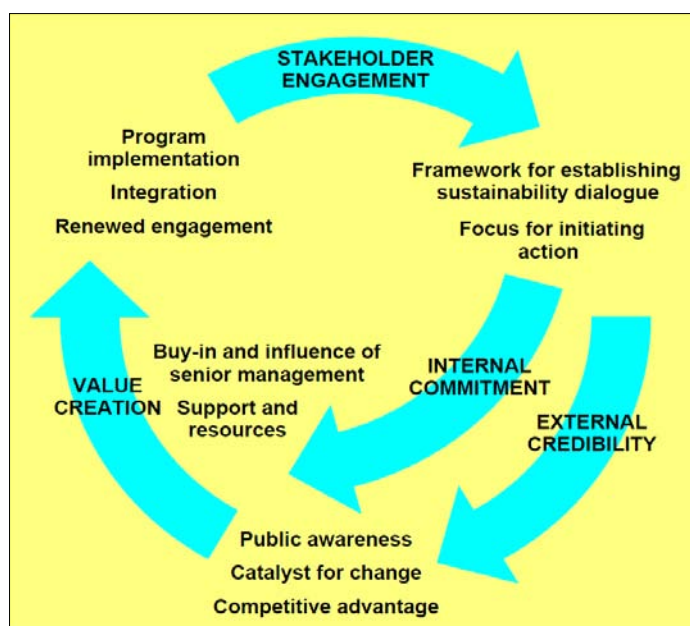
Figure 2.1: The "virtuous cycle" of stakeholder engagement. Modified from *The Guide to Practitioners' Perspectives on Stakeholder Engagement* [39].

provides both a framework for dialogue and a focus to initiate action. This in turn generates credibility, encourages commitment and ultimately facilitates the integration of sustainability into institutional culture – a "virtuous cycle" (Figure 2.1).

INTERNATIONAL CAMPUS NETWORK DISCUSSES COMMUNITY ENGAGEMENT

The International Sustainable Campus Network Symposium *Better Campus, Better City: Learning for a Sustainable Future* took place in Shanghai during the World Expo 2010. The conference session on "Green buildings and beyond" prompted some insightful discussion on the effective integration of sustainable buildings, technologies and design elements on campuses. First and foremost, stakeholder engagement was identified as critical. Frequently difficult and complex choices must be made which impact stakeholders right across a campus. For example, at the National University of Singapore, a decision was made to air-condition common spaces and classrooms but not the dormitory rooms. As an energy saving measure, the benefits of this decision were clear; however, students needed to understand why the choice was made. Sometimes the impacts of campus development spread well beyond the physical boundaries. For example when campus transportation and mobility options are developed, the neighbourhoods around the campus will be affected, necessitating honest dialogue with local residents.

ISCN (2010). "Better Campus, Better City: Learning for a Sustainable Future", International Sustainable Campus Network Symposium, Shanghai, July 27-28.

2.3.1   *Initiating engagement for sustainable development*

The primary stakeholders are the staff and students, but within these constituencies there are of course particular groups and individuals whose involvement is critical [43]:

- University leadership – the office of the President / Vice Chancellor and the governing Council or Board, academic and operational executives;

- Key operational departments – facilities management, purchasing, IT, marketing and media, student housing, etc;

- Academic experts in various aspects of sustainability;

- Academic and operational staff associations;

- The student association and student clubs.

In addition, the web of groups and individuals who affect, or are affected by the university and its activities [30] extends well beyond the immediate university community to include:

- Alumni, who may be scattered across the world;

- Public and private sector funding bodies, which have their own agendas and objectives;

- Government and corporate research partners, as above;

- National and international associations to which the university may belong;

- External suppliers of goods and services, for whom the university may represent a major economic development opportunity;

- School students and their families, as prospective university students; and

- The local community within which the university is situated.

The precise composition of the wider "secondary community" of university stakeholders will vary from place to place, and will certainly include members not specifically identified above. It is worth noting too that usually it is better to cast the net more widely than is absolutely necessary rather than inadvertently exclude an important group. However, it is also necessary to define and adhere to the time and resources available for the task. How extensive the engagement process needs to be will be determined by its purpose and scope – initiation of an institutional sustainability vision or policy, or the launch of an individual program or project. So a stakeholder "mapping" exercise represents a good starting point. Aspects to consider are:

- **Who** needs to be involved?

- **Why** do they need to be involved?

- **How** should they be involved?

Equally, who from the university is managing the engagement process – if it is initiated by staff and/or students (bottom-up), has senior management been invited to the table? And if initiated by management, has it been organised so that staff (or students) do not see it as an imposition on their already busy schedules? In either case, clear **objectives** are essential, and also a clear explanation of the baseline position (whether with respect to overall policy, or to a specific project, depending on the purpose of the engagement) from which it is intended to progress. Those who are being asked to get involved need to be adequately briefed.

Finally, in relation to capacity, community engagement requires resources too. Those being asked to contribute their time and energy will respond to the time and energy put into the participatory process. Whether engaging with internal or external stakeholders, those involved need to be both good listeners and good advocates. It can often be a useful strategy to utilise the services of an independent specialist facilitator where the issues are complex and often poorly defined [30], as is the case with sustainable development.

2.3.2   Levels and methods of engagement

The stakeholder engagement spectrum ranges from informing through to empowering. The table below is adapted to the university context from *The Practitioner's Handbook on Stakeholder Engagement*, published by UNEP, AccountAbility and Stakeholder Research Associates to promote the use of stakeholder engagement worldwide as a way of advancing sustainable development goals [30]. While the focus of the *Handbook* is on the corporate sector and external engagement, strategies are easily modifiable to suit other types of organisations.

Table 2.2: Levels and methods of stakeholder engagement, modified from *The Practitioner's Handbook on Stakeholder Engagement* [30].

Level	Goal	Communication	Relationship	Typical methods
Inform	Inform or educate stakeholders.	One-way.	*"We will keep you informed."*	Newsletters, brochures, displays, websites, presentations.
Consult	Gain information and feedback from stakeholders to	Limited two-way – views solicited and provided.	*"We will keep you informed, listen to your concerns, consider your insights, and provide*	Surveys, focus groups, workshops, "toolbox" meetings, standing advisory committee,

	inform decisions made by management.		*feedback on our decision."*	online feedback and discussion.
Involve	Work directly with stakeholders to ensure their views are understood and considered in decision making.	Two-way, learning takes place on both sides.	*"We will work with you to ensure that your views are understood, to explore options and provide feedback about how stakeholders' views influenced the decision making process."*	Multi-stakeholder forums, advisory panels, consensus building processes, participatory decision making processes.
Collaborate	Partner with or convene a network of stakeholders to develop mutually agreed solutions and joint plan of action.	Two-way, or multi-way between the university and stakeholders. Learning, negotiation, and decision making on both sides. Stakeholders work together to take action	*"We will look to you for direct advice and participation in finding and implementing solutions to shared challenges."*	Joint projects, voluntary two-party or multi-stakeholder initiatives, partnerships. In the university context this may involve partnerships with student or staff associations, local NGOs, etc.
Empower	Delegate decision making on a particular issue to stakeholders.	New organisational forms of accountability: stakeholders have formal role in governance or decisions are delegated to stakeholders.	*"We will implement what you decide."*	Integration of stakeholders into governance structure (note that many universities already include staff and student representatives in governing bodies, but their influence may be nominal).

Higher level engagement makes for greater opportunities for transformation. In practice, the three lower levels – *Inform*, *Consult* and *Involve*, and their associated methods – are most appropriately applied during the early stages of consolidating commitment, articulating a vision and formulating a policy. The two higher levels – *Collaborate* and *Empower* – are more relevant to the implementation of a comprehensive sustainability program. In particular *empowerment* necessitates governance structures of a distinctly new type, appropriate for an organisation well advanced along the transition to sustainability.

Table 2.1 demonstrates that methods of engagement should reflect the intended objectives [30]. They must also take into account local circumstances, and acknowledge that each method has both strengths and weaknesses.

For example **web or email** based feedback or discussion facilities may be convenient for engaging with staff and students, but online approaches may exclude members of the external community without internet access. **Surveys** (verbal, written or online) are very helpful to establish a baseline and identify issues of concern. However, they are essentially a one-way means of communication and must be well designed and the results carefully analysed if they are to elicit useful information. **Focus groups** are effective for in-depth investigation of a particular topic but may favour expertise over representativeness, while larger **public meetings** can encompass a variety of issues but may feel intimidating for some participants. A useful "hybrid" method is the single-issue **forum**, which enables a wider group of participants to focus on more tractable subsets of a complex whole.

Once the university's sustainability commitment and vision have been defined, a **SWOT analysis** may be used to identify institutional strengths, weaknesses, opportunities and threats which can help or hinder progress towards achievement [43]. **Advisory panels** or committees are particularly valuable during the practical implementation stage, and are discussed further in Section 3.

These methods are best understood as *complementary* – they are designed to achieve different outcomes and are applicable at different stages, but appropriately combined can present a comprehensive and transformative approach.

The Association of University Leaders for a Sustainable Future (ULSF) has developed a university *Sustainability Assessment Questionnaire* [44], which is discussed further in Section 4 in relation to the development of a performance "scorecard". The issues raised in the questionnaire can also serve as helpful prompts during the early stages of establishing a commitment and vision, to initiate engagement around what constitutes best practice. Table 2.2 summarises the main sustainability criteria targeted by the ULSF.

One of the most perceptive questions / prompts is:

> *"What do you see when you walk around campus that tells you this is an institution committed to sustainability?"* [44].

Equally it could be asked: "What do you see when you walk around campus that suggests **opportunities for improvement and action**?" A guided campus walk is simple and instructive engagement strategy for observing and assessing (at a very general level) what is, as a guide to considering what could and should be.

Table 2.3: University sustainability prompts for community engagement, adapted from ULSF *Sustainability Assessment Questionnaire* [44].

Dimension	Topic for discussion
Curriculum	Courses which address topics related to sustainability
	Integration of sustainability into traditional disciplines
	Learning about the campus as a socio-environmental system
Research and scholarship	Staff and student research and scholarship relating to sustainability
	Interdisciplinary structures for sustainability research, education and policy development
Fabric and operations	Building construction and renovation
	Energy and water conservation
	Waste minimisation
	Sustainable food programs
	Sustainable landscaping
	Sustainable transportation
	Green purchasing
	Minimisation of toxic materials
	Environmental / sustainability auditing

	Integration of operational practices with learning and teaching
Staff development and rewards	Sustainability criteria for hiring and promotion
	Staff development opportunities
Outreach and service	Sustainable community development at regional, national and international levels
	Partnerships with schools, local government and local business
Student opportunities	Orientation on sustainability for students
	Student environmental centre
	Student groups with sustainability focus
	Career counselling focused on sustainability
	Student involvement in campus sustainability initiatives
Administration, mission and planning	Commitments to sustainability in terms of reference for university organisational units
	Positions and committees dedicated to sustainability issues
	Staff orientation programs
	Socially responsible investment practices
	Regular environmental audits
	Sustainability related events

3. Tools for delivering transformation

This Section of the Toolkit sets out step by step guidance for universities seeking to translate their commitment to, and vision of sustainable development into reality. The format follows the familiar Plan-Do-Check-Act "Deming cycle" of continual improvement [39] which reflects the globally acknowledged management system models developed by the International Organization for Standardization (ISO) [45-48]; the Global Reporting Initiative guidelines [49]; and a range of best practice initiatives drawn both from practical experience and from the literature.

An important "bridging" stage between initial commitment as an institution to take the sustainable development path and the development of detailed policies and strategies to effect delivery is to adopt a **time scale** for the transition to sustainability. Definition and adoption of a time scale which is both challenging and appropriate to a particular university requires serious engagement with the members of that university, for example as part of a visioning process, as discussed in Section 2.

It is arguable that objective reality is defining the time scale for us. Over the past few decades it has become obvious that anthropogenic environmental impacts are global in scope [50, 51]. The landmark *Millennium Ecosystem Assessment* [52] revealed that some 60% of ecosystem services which provide the basis for life on Earth have been degraded or are being used unsustainably, and emphasised that humans have changed ecosystems more rapidly and extensively in the past 50 years than at any other period. Increasing evidence of global warming, predicted "peaking" of oil, phosphorus and other natural resources and an extinction rate which rivals the great extinctions of the deep geological past [53] reinforce the need to take action now.

Universities have been described as microcosms of the environmental problems which face society as whole [54], from greenhouse emissions to noise pollution. The previous sections of this Toolkit have emphasised that achievement of a sustainable campus represents a paradigm shift in institutional thinking and practice. While as noted in Section 2, "little victories" can pave the way for "systemic transformation" [6], it is necessary to keep the destination in mind. From that perspective, setting long term stretch goals can provide a framework for necessary action.

Campus sustainability integrates the cultural/institutional and the biophysical, and different strategies – and stretch goals – are required in each case. In relation to the quantitative, there are four broad categories for which both long and short-term targets can be defined and presented:

- Energy, carbon and climate change;

- Water consumption;

- Use of land – campus ecology, planning, design and development; and

- Material flows – procurement, toxicity and pollution, waste disposal and recovery.

Taking energy consumption as an example, the proportion of energy derived from renewable sources (hydro, wind, solar, geothermal, biofuels) globally was approximately 8% in 2010 [55]. A university which is genuinely sustainable in terms of its energy consumption is one

which derives 100% of its energy needs for heating, cooling and transport from renewable sources. The difference between 100% and 8% (or perhaps a higher baseline, if the university is already using more than 8% renewable energy) represents the "sustainability gap" for energy which the university can close by setting an ultimate target date and meeting a step-by-step schedule of intermediate targets until the final goal is achieved (Figure 3.1). The Technical Appendix describes a mathematical model for deriving these targets from baseline energy consumption.

Transition to renewable energy

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Renewable energy	10%	20%	35%	50%	65%	80%	90%	95%	100%
Conventional energy	90%	80%	65%	50%	35%	20%	10%	5%	0%
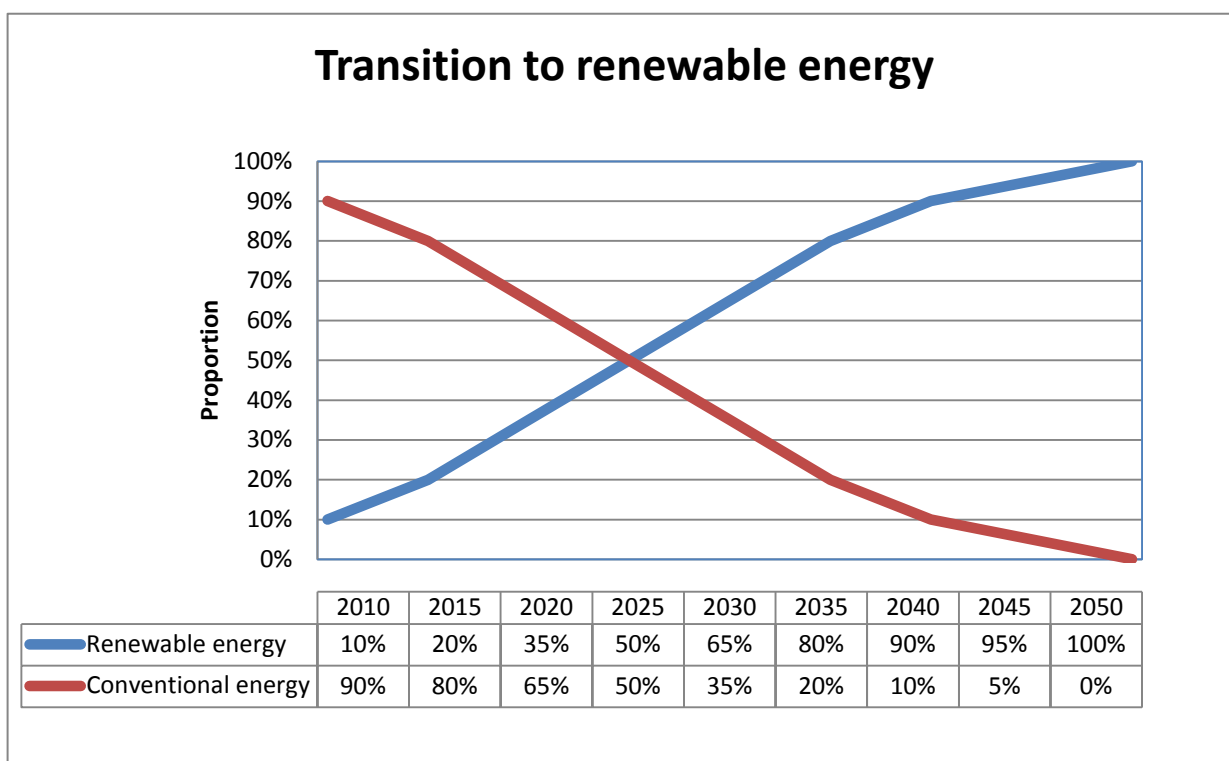
Figure 3.1: Example of planning the transition to 100% renewable energy consumption through staged application of 5-year targets. Each university needs to set its own targets and timelines.

Similar transitional strategies can be defined for water consumption (not exceeding the sustainable yield of the catchment within which the university is located), land use (campus planning and development), and management of material flows (zero net waste). For present purposes, the primary issue is to establish agreed stretch goals and target dates; the methodology is explained in detail in the Technical Appendix.

Energy, water, land and materials are defined in terms of direct biophysical outcomes. Other aspects of sustainable university practice are characterised by their social and cultural outcomes. The biophysical impact of embedding sustainability in research and teaching, governance and administration and community outreach is long term and indirect. Suitable stretch goals in these areas may be qualitative or quantitative, and will be more closely linked to management decisions – 100% of goods and services procured by the university to meet some sustainability accreditation target, 100% of students to have completed an introductory sustainability course, and so on.

The question of a sustainability policy has not been discussed to this point. Policy development represents the first stage of implementing the university's vision. While still articulated at the "overview" level (for example, referencing the stretch goals mentioned above) an organisation's policy should be the driver for setting intermediate objectives and targets, and giving the context for action plans around the issues identified through community engagement. Policies in general apply to the medium term, and are subject to regular review.
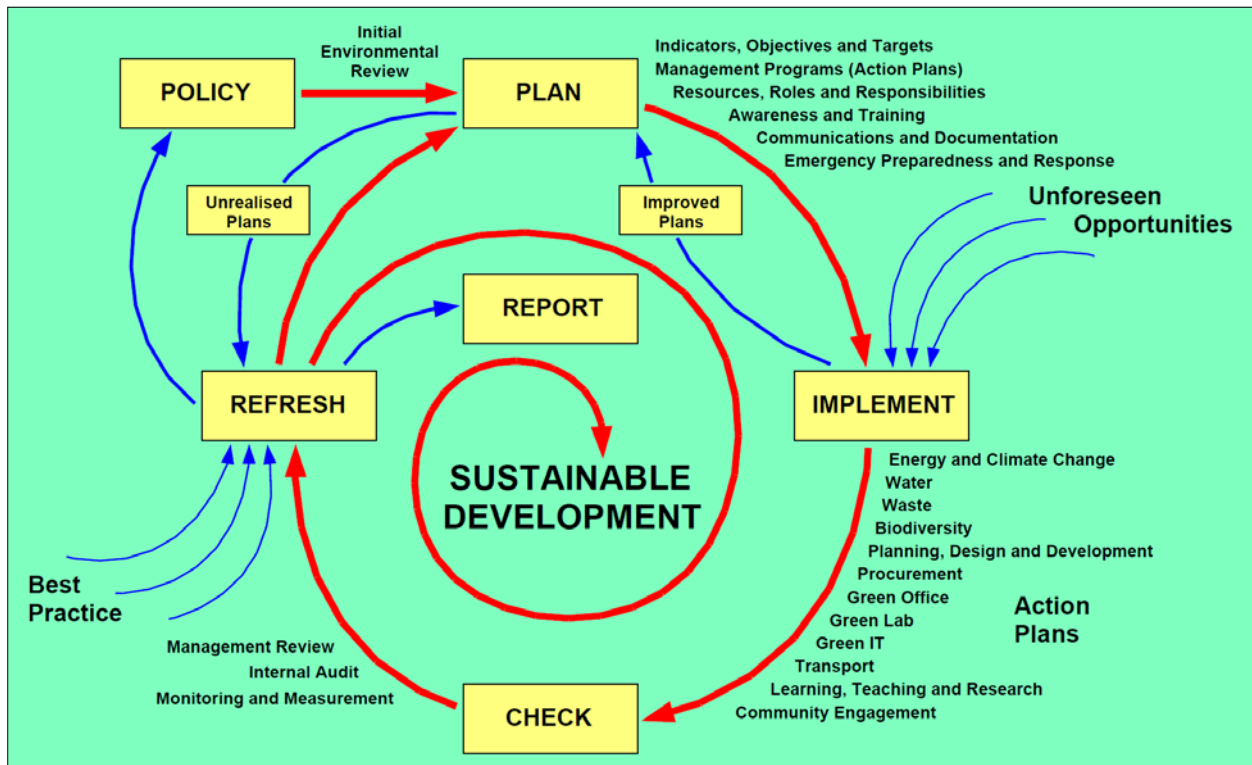
Figure 3.2: The university sustainability continual improvement cycle [45-49, 56-58]. The red spiral represents the main plan-do-check-act sequence, the blue arcs indicate secondary feedback loops and information inputs.

Figure 3.2 maps the structure of the continual improvement cycle, synthesised from a variety of sources [45-49, 56-58] and including a set of management programs (ISO 14001 terminology) or action plans specific to this toolkit. In summary:

- The university's **sustainability policy** (Section 3.1) drives the cycle. Also discussed in this Section are the structures necessary to ensure delivery: a cross-campus **sustainability committee** and the dedicated personnel assigned the task of managing implementation – the **sustainability team**.

- An **initial environmental review** ((ISO 14001 terminology) or **sustainability review** determines the baseline conditions and enables issues to be prioritised for action (Section 3.2).

- The policy ("where do we want to be?") and the initial review ("where are we now?") informs the planning phase ("how do we get from where we are to where we want to be?"). This includes identification of appropriate **performance indicators** (Section

3.3), **objectives and targets** (Section 3.4) and **sustainability action plans** (Section 3.5). Planning as per ISO14001 also includes **awareness and training** (Section 3.6), **communications and documentation** (Section 3.7) and **emergency preparedness and response** (Section 3.8).

- The implementation phase refers to the "doing" element of the plan-do-check-act cycle. This entails carrying out the context-specific action plans prepared during the previous phase of the cycle, and also taking advantage of any unforeseen opportunities which may have emerged [58] since the original plans were prepared. In addition, defects in existing plans can be identified in implementation, and this information fed back into the planning process.

- The checking phase represents the closing of the loop: **monitoring and measurement** of progress, **internal audits** and **management review** (Section 3.9) enables rejuvenation of the entire cycle. Outcomes from benchmarking against best practice and any planned actions which have not been achieved inform the next round of planning; the policy is re-assessed for relevance and currency; and the progress to date is documented in the university's **sustainability report**.

3.1 Sustainability policy, governance and administration

ISO 14001 specifies environmental management system elements applicable to all types and sizes of organisations under diverse geographical, cultural and social conditions. Success depends on commitment from all levels of the organisation. There must be demonstrated dedication to establishing and assessing the effectiveness of environmental policy, objectives and procedures, and to achieving conformance and demonstrating it to others. Thus the aim of ISO 14001 is to **support environmental protection in balance with socio-economic needs**. It should be emphasised that ISO 14001 does *not* establish absolute requirements for environmental performance beyond commitment to compliance with applicable legislation and regulations and to continual improvement. ISO 14001 also does not address the broader social, economic or cultural issues pertinent to a holistic approach to university sustainability; these aspects, however, may be incorporated into the relevant sections of the EMS Standard (policy, objectives and targets, action plans, training etc) with only minor adjustments required to facilitate implementation.

An organisation's sustainability policy is the essential tool for setting short- and long-term sustainability goals **against which all subsequent actions will be judged**. ISO 14001 requires an organisation's *environmental* policy to:

- Be developed by top management and cover the scope of the EMS (in the university context, "top management" refers to the President / Vice-Chancellor and those senior executives who report directly to him/her);

- Be appropriate to the nature, scale and environmental impacts of the organisation's activities, products and services (i.e. linked to the overall mission of the university);

- Include a commitment to continual improvement and prevention of pollution;

- Commit to compliance with applicable legal requirements and with other requirements to which the organisation subscribes which relate to its environmental aspects;

- Provide the framework for setting and reviewing environmental objectives and targets;

- Be documented, implemented and maintained;

- Be communicated to all persons working for or on behalf of the organisation (which includes contractors, temporary staff etc – and in the case of universities, students);

- Be available to the public.

Adaptation of the above points to address a university's *sustainability* policy (i.e. to explicitly include social, economic and cultural elements) will not substantially change the *structure* of the policy statement, although it will obviously affect the content.

UNIVERSITY OF NAIROBI ENVIRONMENTAL POLICY STATEMENT

The University of Nairobi is firmly committed to protection of the environment as an integral part of good institutional practice. To enable us to do this, we shall develop and sustain an Environmental Management System that will lead to sustainable development and will advance positive effects on both human health and the environment for the university community and our neighbours.

Believing this goal to be fully achievable, at the University of Nairobi:

- We are totally dedicated to preventing pollution by minimizing waste generation through enhanced adoption of Cleaner Production methods and development and implementation of effective programs and practices

- We are committed to reducing our energy consumption, implementing energy conservation programmes and promoting energy efficiency

- We are committed to increasing water use efficiency in our campuses and reducing the quantity of waste water released to the environment

- We are committed to improving indoor and outdoor air quality by implementing effective programmes where appropriate to mitigate negative effects, use of materials in building construction and renovation that protect and improve indoor air quality and minimizing greenhouse gas emissions from University-related activities.

- We will examine the operations of University-owned vehicles and identify and implement alternatives that will reduce environmental impacts

- We are committed to maintaining all noise within national guidelines

- We will ensure that we comply with, and where possible exceed, applicable environmental laws and regulations.

- We will review our environmental objectives and targets from time to time in order to minimize resource consumption and improve our environmental performance

- We will review and revise this Policy, if necessary, every two years to ensure that our activities, products and services are appropriate and have no adverse effects on human health and the environment

- We will ensure through education and training that each employee and student is aware of our environmental objectives and can fulfill them

- We will communicate our Environmental Policy to all our stakeholders

Prof. G.A.O Magoha
VICE-CHANCELLOR
01 October 2009

Apart from these broad criteria, the contents of a university's sustainability policy can include any matters which the institution wishes to emphasise and address. Policies are "high level" documents; hence they should deal with the general rather than the specific ("The University of XYZ will minimise energy consumption" rather than "The University of XYZ will replace its incandescent lamps with compact fluorescents"). As noted in ISO 14001, the policy provides a *framework* for setting objectives and targets, it is not itself a list of objectives and targets. As high level documents, university sustainability policies should also be brief and to the point.

3.1.1   The sustainability committee

It has been stressed throughout this Toolkit that top management commitment is a prerequisite for the transition to a sustainable university. An objective assessment of the budgetary implications of waste disposal and energy consumption, and the potential financial risks associated with environmental accidents or legislative non-compliance seems to be a useful exercise for convincing senior managers of most organisations. Most importantly, ISO 14001 requires management not just to commit, but to ensure the availability of resources to develop and implement a sustainability management system.

While not a requirement of the EMS standard, creation of a sustainability steering committee with representation (in the case of a university) from students, academic and operational staff is for all practical purposes essential. The steering committee may also include representation from external stakeholders – for example the local community, government bodies and/or significant local employers of the university's graduates.

The actual title of this group is of course a matter for the particular institution; the main issue is its *function*. The terms of reference for the steering committee should include as a minimum, responsibility for input to and review of the policy, objectives and targets and sustainability action plans, for final approval by senior management. Depending on the level of stakeholder engagement practiced by the university (see Section 2.4 of the Toolkit), the committee may play a formal role in the university's governance structure, with delegated powers to approve policy and related high level documentation. Irrespective of the extent of delegated powers, the committee should be chaired by a member of senior management, with the person directly accountable for implementation of the sustainability management system in an executive role. In addition, the committee should act as a conduit from the university community to senior management in relation to overall sustainability issues.

3.1.2   The sustainability team

A member of the university's top management group should maintain overall oversight of the sustainability "portfolio", and top management should assign responsibility for the overall implementation and effectiveness of the system to a competent senior person with sufficient authority, resources and freedom to act. This person – the "management representative" in the language of ISO 14001 (or in other words, sustainability manager) – should be accountable for:

- Ensuring that environmental management system requirements are established, implemented and maintained in accordance with the standard, and any additional social / economic / cultural sustainability aspects adopted by the university are also addressed within the overall management framework provided by the system;

- Reporting on the performance of the system to top management for review and as a basis for continual improvement.

The sustainability manager – depending on the size and resources of the university – may head a professional sustainability unit and/or coordinate a team of staff and student volunteers.

In many universities the environment or sustainability manager / team is organisationally located in a major operational area such as the Estates / Facilities Management unit; less commonly, the role is embedded in an academic unit. An operational location provides direct access to the university's day-to-day campus management and administrative activities – on the other hand, an academic role can facilitate the nexus between education for sustainability and practical campus sustainability. In either case, the key criterion is the position's level of authority, accountability and ability to deliver on approved sustainability policies and plans. While this is certainly linked to the adequacy of budgetary and other resources, it is fundamentally an organisational rather than financial issue. Ideally, the sustainability manager will report directly to a member of the top management group, a situation which is still quite rare, but is characteristic of those universities which take the transition to sustainability seriously.

**OFFICE OF THE PRO VICE-CHANCELLOR (SUSTAINABILITY)
LA TROBE UNIVERSITY, AUSTRALIA**

In 2010 the University announced the creation of the Office of the Pro Vice-Chancellor (Sustainability) headed by Professor Carol Adams. Replacing the Sustainability Taskforce that had existed in 2009, the Office is the driver behind La Trobe's determination to make sustainability central to everything we do.

Climate Change, unsustainable resource use and increasingly inequitable access to the benefits of economic development are some of the major challenges that have to be tackled on a global scale.

Issues of Sustainability and social responsibility will affect everyone's career in the future. La Trobe and the Office of the PVC (Sustainability) will make a difference.

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A sustainability team's workload may be structured on the basis of particular *impact* areas (energy and climate change, water, biodiversity, transport etc), university *functional* areas (green office, green lab, procurement, IT etc) or some combination of the two – there is no "right way" or "wrong way", it is a question of ensuring alignment with the way the particular university is governed, its vision and mission. Section 3.5 below, which deals with sustainability action plans, covers both impact and functional aspects but is not intended to imply a particular organisational template.

Economic sustainability is conventionally a matter for the university's Finance Department, and the function of sustainable procurement may either sit there, or with the sustainability team. The objective is to ensure integration of triple bottom line criteria in the university's financial management, which can be tackled organisationally in a variety of ways. Similarly, universities frequently address **social and cultural** aspects of sustainability through policies and personnel involved in student services, human resources, equal opportunity and the like. Again, it is critical to ensure appropriate alignment and communication between those

charged with delivering outcomes across the different facets of sustainable development, whether these have been explicitly identified as "sustainable" or simply as part of good management practice.

3.2 Determining the baseline: initial environmental/sustainability reviews

The ISO 14001 EMS standard offers flexibility to organisations to develop their own means of identifying the significant environmental impacts of their activities. ISO 141001 does not stipulate the method to be used, only that it has to be applied systematically. Standards Australia's *HB* [Handbook] *206 Initial Environmental Review (IER)* provides structured guidance to organisations seeking to determine their current baseline environmental status [59], and may be adapted to include additional sustainability aspects beyond the specifically environmental. The results of the review can be used to assist the organisation in developing or improving its environmental policy, setting the scope of its environmental / sustainability management system, establishing its sustainability objectives and targets, and determining the effectiveness of its approach to maintaining compliance with applicable legal and other requirements. Less formally, an initial review will answer the question "Where are we now and what do we have to do to get where we want to be"?

The review is intended to provide sufficient information for a preliminary identification of the significant environmental (and other sustainability) aspects and impacts associated with the activities of, and services provided by, the university. "Environmental aspects" are identified as elements of an organisation's activities, products or services which can *interact* with the environment, for example energy consumption or waste generation. An impact, on the other hand, is any *change* to the environment (positive or negative) resulting from this interaction. In addition, the review identifies how these aspects are currently being managed, including legal compliance and emergency response, and can also reveal opportunities for improvement.

A systematic initial sustainability review of a university will entail five phases:

- **Planning** – setting the scope and objectives, schedule, resources and personnel;

- **Review of existing information** (i.e. documentation review) – organisational, physical (site) and functional (detail of activities, including teaching, research and operations);

- **Confirmation of existing information and collection of new information** – site inspections, questionnaires, interviews, discussions;

- **Evaluation of the information**, for example in relation to potential environmental risks, compliance with legal requirements and adequacy of existing policies, procedures and management practices (gap analysis);

- **Reporting and recommendations** – summary of the methods and findings and presentation of opportunities for improvement (how to get from "where we are" to "where we want to be").

The review can be conducted using checklists, process flowcharts, interviews, direct inspection, past and current measurements, and where available, the results of previous audits or reviews. An initial review does not involve site contamination audits, direct sampling and analysis of environmental media (soil, water, air) or detailed life cycle assessment of products or services. However, if a need for any such investigations is identified, it should be flagged in the recommendations.

3.2 1 Prioritization of issues to be addressed

Not all environmental or sustainability aspects and impacts are equally important – determination of their significance is necessary to enable prioritisation of responses, for example through sustainability action plans. Qualitative evaluation of the significance of environmental aspects and impacts is commonly achieved through application of **risk assessment** techniques, which identify the **consequences** of a particular impact (severity, spatial and temporal scale), and the **probability** (likelihood) of it occurring, to determine the overall risk (Figure 3.3). The particular criteria used to define the consequences may include effects on people, property and ecosystems, monetary value and reputation.

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Severe
Almost certain	M	H	H	E	E
Likely	M	M	H	H	E
Possible	L	M	M	H	E
Unlikely	L	M	M	M	H
Rare	L	L	M	M	H

Figure 3.3: Probability / consequences matrix, indicating Extreme, High, Medium and Low risk.

In the case of readily quantifiable aspects such as energy and water consumption, waste production and procurement of high volume goods such as paper or construction materials, the significance of the associated environmental impacts may be ascertained more directly. Typical methods include calculation of operational greenhouse gas emissions, embodied energy and material balances for particular goods (e.g. the amounts of paper purchased, used, recycled and disposed of to landfill). These figures can also be used to generate sustainability **indicators** (Section 3.3), particularly when coupled with appropriate denominators (e.g. tonnes CO_2 per square metre of floor space, or per student).

Given the wide range of universities at which this Toolkit is aimed, it is impossible to set out a checklist of activities, aspects, impacts, management responses and levels of significance relevant to all; the *methodology* is the critical factor here. To take one common (but by no means universal) activity: grounds maintenance – Table 3.1 outlines some potential (but again, not universal) sustainability issues to consider in an initial review. The matrix format can provide a useful template to assess the vast variety of activities relevant to any given university, which may encompass anything from student housing to research on genetically modified organisms.

3.3 Selecting and defining indicators

What gets measured gets managed. Measurement of progress against agreed performance indicators enables a university to benchmark against others, but more importantly, against the sustainability targets it sets for itself [60].

Indicators provide the mileposts on the journey to sustainability. As such, they need to fulfill certain criteria. The World Health Organisation [61] points out that the criteria used to select a particular indicator depend on the *purpose* of that indicator. Indicator selection is thus both a technical and a normative decision; linking the two provides an opportunity to facilitate dialogue and learning, which "provides the foundation for developing shared meanings of sustainability, the role of indicators, and how they will function" [62].

Sustainability indicators need to incorporate, but go beyond, considerations of "eco-efficiency" (or environmental performance). An eco-efficiency energy indicator, for example, would measure energy conservation – a sustainability indicator would record total greenhouse gas emissions against a goal of zero. The difference is between incremental and systemic change; eco-efficiency ends with the incremental, sustainability integrates both [60].

Indicators may also be grouped and weighted to form **indices** of environment or sustainability performance. Ecological footprint analysis (the amount of land necessary to provide the necessary resources and assimilate the wastes and pollutants generated by a population [63]) is a well-known index which has been extended from its original role in comparing national and regional impacts to include application to public and private sector organisations, households and the comparison of consumer products. It has also been adapted to focus on specific criteria of environmental concern, for example carbon and water footprints.

The advantage of the ecological footprint lies in the comprehensibility and educative value of the measure; the disadvantage is that despite extensive data collection and analysis requirements, the end result is a metric which enables comparability between places, but not a high degree of accuracy. It is not discussed further here – a wide range of online and other resources is available for those wishing to explore and apply footprint analysis in their institutions.

The development of an indicator set typically proceeds from the general to the particular: from the overall concepts to the main **themes**, to the specific, measurable **indicators**. The themes serve to organise and contextualise the indicators. More detail on the process of indicator selection, which as suggested above, should involve a participatory dialogue with the university community – is given in the Technical Appendix.

The biophysical aspects of university sustainability can be condensed into four key themes, as noted above: energy use, water use, land use and material flows. Although climate change crosses multiple themes, for ease of data collection and reporting it is included here with energy, to create a theme of "Energy, carbon and climate change". In addition to the themes where physical outcomes are *directly* measureable, there are a further four themes which relate to more qualitative (but indirectly measurable) aspects of change: research, learning and teaching (education for sustainability), governance and administration and community outreach (Table 3.2). The "range of variables" column indicates potential areas for the definition of quantitative or qualitative indicators.

Table 3.1: Sustainability aspects and impacts, significance and potential management responses in relation to the maintenance of campus grounds.

Activity	Aspect	Impact	Significance	Management
Grounds maintenance	Water use	Resource depletion	Depends on climate and geography – will be of major significance for some sites	Use recycled water and/or captured rainwater Select low water requirement plants
	Fuel use	Resource depletion GHG emissions Air pollution	Depends on extent of mechanised maintenance, impacts likely to be moderate	Substitute biofuels for fossil fuels Purchase fuel-efficient equipment Reduce use of mechanical equipment Improve equipment maintenance, training
	Fertiliser use	Resource depletion Damage to soil structure Runoff / eutrophication	Impacts generally moderate, but may be more significant where a university is located near sensitive natural ecosystems	Replace artificial fertilisers with organic products
	Herbicide / pesticide use	Resource depletion Effects on non-target species Runoff / water pollution Spillage	Generally as above; however the impact of a spill may represent a major risk	Reduce chemical use Substitute non-persistent for persistent chemicals Improve chemical safety – storage, handling, training
	Biodiversity and ecosystem services	Biodiversity and ecosystem services may be maintained, enhanced or reduced, depending on maintenance regime	Positive or negative impacts range from relatively low to high, depending on location (urbanised vs. natural ecosystems)	Specify local native species Preserve significant vegetation during building works Avoid monocultures Avoid environmental weeds
	Soil disturbance	Erosion Compaction Dust	Generally low, but may be moderate, again depending on location	Apply mulch Use no-till methods
	Garden organics (green waste)	Reduction of landfill space GHG emissions Impacts of transport to landfill Land and aquifer contamination Production / use of compost	Moderate negative impacts from landfill, but these will increase as landfill space runs out in many regions Moderate positive impact of composting	Process garden organics to generate mulch and compost
	Campus amenity	Impact on work/study environment, productivity, quality of life	Moderate positive impacts	Continually improve maintenance standards, training
	Local employment	Impact on local economy	Range from low to relatively high, depending on location	Hire grounds staff from local area

Table 3.2: Potential themes and indicative measurable variables relating to university sustainability.

Theme	Indicative range of variables
Sustainability in research	Grant funding, publications, conferences and seminars, commercialisation
Education for sustainability	Cross-disciplinary courses, sustainability literacy, curriculum integration
Governance and administration	Sustainability policies, environmental management plans and systems, environmental auditing, recruitment and staff development, ethical investment, local economic development, student access and equity
Community outreach	Service learning, collaboration with other institutions, community development projects
Energy, carbon and climate change	Operational energy, embodied energy, transport energy, greenhouse gas emissions
Water use	Potable water, water reuse, rainwater collection
Land use	Green buildings, space planning, ecosystem services, biodiversity
Material flows	Contract specification and evaluation, supply chain management, life cycle assessment, waste minimisation, air and water pollution

The focus of this Toolkit is on the **sustainable planning, design, development and management** of the university campus as distinct from the core business of teaching, research and outreach, which is the subject of a separate initiative by UNEP's Environmental Education and Training Unit (Higher Education Guidelines for Curriculum Review and Reorientation towards Sustainability). Hence the indicators proposed here will be restricted to the four themes which encompass the physical aspects of university sustainability, together with the critical enabler – **governance and administration**.

Every university has its individual goals and priorities, and every university exists in a national and regional context, as has been emphasised throughout the Toolkit. Hence to suggest a "one size fits all" indicator set would be inappropriate and unworkable. However, there are clearly a number of core indicators – such as carbon emissions – which are relevant to *all* universities. Each university can supplement these core indicators with additional metrics which measure particular attributes which the university community deems are worth tracking on its journey towards sustainability.

Table 3.2 lists a recommended core set of indicators of environmental performance, which are identified as relevant and applicable to almost all universities, irrespective of size or location (one minor exception include use of natural gas, which will be irrelevant to some). The task of collecting the initial baseline data should be used to develop an effective procedure for regular data collection to inform action planning and target setting – annually for most indicators, and typically monthly for energy, water and waste.

Table 3.2: Recommended core university environmental performance indicator set.

Element	Metric	Units[*]	Comments
Energy, carbon and climate change	Scope 1 and 2 greenhouse gas emissions	tCO_2e/capita	Measurement of Scope 1 & 2 emissions disaggregated to source is regarded as the minimum requirement. Best practice will include Scope 3.
	Electricity consumption	kWh/m^2 floor space kWh/capita	In most cases, this will be the largest contributor to a university's GHG emissions. Proportion of electricity derived from onsite and/or renewable sources should be separately recorded.
	Natural gas consumption	GJ/m^2 floor space GJ/capita	Any natural gas used in cogeneration and trigeneration should be separately recorded.
	Transport energy consumption	kL fuels Passenger kilometres	Minimum requirement for measurement is the university vehicle fleet. Best practice will include air travel and commuter travel modal split.
Water use	Potable and non-potable water consumption	kL/m^2 floor space kL/capita	Should include consumption of collected rainwater and any other sources of water reuse.
	Wastewater production	kL/capita	Volume of greywater and blackwater which is reused is captured by the previous indicator
Land use	Proportion of certified green buildings by floor area	m^2/m^2	This indicator is assumed to integrate the workplace health, environmental and productivity benefits of green buildings.
	Proportion of pervious / impervious surfaces	m^2/m^2	Proxy metric for anthropogenic impact on hydrological cycles and urban microclimate.
	Vegetation cover	m^2/m^2	Proxy estimate of vegetation ecosystem services. May be supplemented by measurement of leaf area index (LAI) which enables a more refined estimate (see Technical Appendix).
Material flows	Solid waste disposal	kg/capita	Can be disaggregated into categories, e.g. municipal solid waste, construction and demolition, hazardous, e-waste, etc.
	Solid waste recovery	kg/kg (diversion rate)	Can be disaggregated into material types where required.
	Material use	kg/capita	Typically one or a few representative materials such as paper will be selected. Best practice will require a more comprehensive material balance.

*Given as SI units here, actual units employed will depend on country. Note that "per capita" refers to the total population of the university (staff + students).

In addition to these biophysical metrics, the following **management indicators** are recommended as a basic core on which individual universities can build. These are adapted from the University Leaders for a Sustainable Future Sustainability Assessment Questionnaire for Colleges and Universities [44].

- Existence of a university Sustainability Policy

- Existence of a Sustainability Management Plan

- Existence of a Sustainability Steering Committee or equivalent institution-wide strategic body

- Responsibility for oversight of sustainability matters allocated to member of senior management

- Appointment of a Sustainability Manager or equivalent position

- Orientation programs on sustainability for academic and operational staff

- Existence of socially responsible purchasing and investment practices and policies

- Regularly conducted environmental audits

A new initiative to be launched at the Rio + 20 Conference, the Higher Education Sustainability Initiative, sets out similar core criteria with respect to teaching and research, campus greening, community outreach and also sharing knowledge through international frameworks such as the UN's education and training structures. (http://www.uncsd2012.org/rio20/index.php?page=view&nr=341&type=12&menu=35)

3.4 Setting objectives and targets

ISO 14001 defines an environmental **objective** as an overall goal, arising from the environmental policy, which an organisation sets itself to achieve and which is quantified where practicable. An environmental **target** is defined as a detailed performance requirement, quantified where practicable, applicable to the organisation or parts thereof, which arises from the environmental objectives and which needs to be set and met (annually, five yearly etc) in order to achieve these objectives. Similar criteria will apply to objectives and targets which address the economic, social and cultural dimensions of sustainability.

Objectives and targets are typically linked to indicators, to enable tracking of progress. Targets should be "challenging but achievable", and should reflect the university's commitment to sustainable *development* and the ultimate achievement of a sustainable university. The introduction to this Section proposes a combination of stretch goals (e.g. zero net imported energy and water, zero net waste) and staged transitional strategies to achieve them – see for example Figure 3.1. To support the implementation of sustainability action plans, objectives and targets should be set and regularly reviewed for each relevant function and level of the university; for example an overall objective to reduce energy use may be disaggregated to include individual annual targets for specific buildings or services such as lighting or HVAC.

Objectives and targets must be relevant to the university's significant environmental / sustainability aspects and impacts, discussed in Section 3.2 above. Priorities will vary according to the economic, social, geographic, etc circumstances for each university, although it is clear that carbon emissions and climate change will represent a common

priority for the great majority of institutions. ISO 14001 also requires organisations to consider legal, financial, operational and business requirements in setting its objectives and targets, and the views of "interested parties". In the university context, the interested parties are students, staff and the wider community, who should be purposely engaged in the target setting process (see Section 2, *Strategies for initiating transformation*).

3.5 Developing and implementing sustainability action plans

Sustainability management programs or action plans are the engine room for change. Plans are time-bound, and developed and reviewed on a regular basis in line with the sustainability targets. Each university will have its own targets and its own organisational structures for delivery. The structure developed for this Toolkit integrates models from many individual universities, university associations and other organisations reported in the literature, and practical experience in preparing and implementing environmental / sustainability action plans. It is designed to address:

- The core **biophysical** aspects – energy, carbon and climate change; water consumption; waste generation; and biodiversity protection and enhancement – which are pertinent to the great majority of the university's operations and activities;

- The main **activity-specific** aspects – campus planning, design and development, procurement of goods and services, sustainability of offices, laboratories and IT services, and transport (university related and commuter).

Table 3.3 maps four of the five sustainability themes – energy/climate, water, land and materials – against the portfolio of management programs / action plans. The depth of the shading indicates the strength of the connection between the theme and the plan, in other words the extent to which each plan addresses the objectives and targets set under each theme. The fifth theme – governance and administration – is implicit across all plans. Action plans for learning, teaching and research and community engagement are outside the scope of this Toolkit.

Table 3.3: Sustainability themes mapped onto management programs.

MANGEMENT PROGRAMS \ SUSTAINABILITY THEMES	Energy & Climate Change	Water	Land	Materials
Energy, Carbon and Climate Change				
Water				
Waste				
Biodiversity and ecosystem services				
Planning, Design & Development				
Procurement				
Green Office				
Green Lab				
Green IT				
Transport				
Learning, Teaching and Research				
Community Engagement				

The remainder of this Section summarises the possible content of action plans under the categories set out above – acknowledging also that some actions logically could be placed under more than one plan. Guidance is kept general, and is provided as a set of "prompts" (in tabular format) to initiate discussion rather than a blueprint. Examples and sources of further information are given where relevant. Most of the plans suggest employment of a dedicated position (Energy Manager, Green Procurement Manager etc) – depending on the size of the university and available resources, some or all of these roles may be combined.

3.5.1 Energy, Carbon and Climate Change

The challenge of climate change can serve as a fulcrum for institutional transformation. The ultimate necessity for carbon neutrality anticipates myriad opportunities for organisational learning across all aspects of higher education [64].

As noted above in Section 3.3 *Selecting and defining indicators*, measurement of Scope 1 and 2 emissions disaggregated to source is regarded as the minimum requirement to support climate change action planning. Best practice will address at least some Scope 3 emissions[1].

Development of a climate action plan – assuming the necessary policy, governance and administrative structures are in place (see Section 3.1) will commence with the development of a GHG inventory. Where the focus is limited to Scope 1 and 2, this will include reference to utility billing data, and measurement or modelling of fugitive emissions of minor greenhouse gases such as refrigerants used in air-conditioning systems and methane produced by any farm animals on campus (information on minor GHGs is available from the Intergovernmental Panel on Climate Change website). Emission offsets such as tree planting and renewable energy credits also need to be included in the inventory. Inclusion of Scope 3 emissions will require significantly more detailed data collection – and rather than attempting to evaluate the emissions from *all* goods and services procured by the university, it is more practicable to start with one or a small number of high visibility examples, such as paper.

A climate action plan limited to Scopes 1 and 2 will focus mainly on energy use; inclusion of Scope 3 will extend the system boundary to include solid waste management, transport (air travel, commuting) and procurement. The *Cool Campus* climate planning guide [43] produced by the Association for the Advancement of Sustainability in Higher Education (AASHE) describes suitable methods for collecting and calculating Scope 3 emissions, and another NGO, Clean Air-Cool Planet, has produced a free downloadable campus carbon calculator.

The major source of campus emissions in most cases will be purchased energy, hence the primary focus of a university climate action plan will generally be on **energy management**. Energy management can be split into three discrete categories, which provide the framework for the energy-related elements of the climate action plan:

- Energy conservation – policy interventions and behaviour change programs;

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[1] Scope 1 refers to direct emissions, e.g. CO_2 released by burning fossil fuels on site or in university vehicles, and fugitive emissions of minor greenhouse gases; Scope 2 refers to indirect GHG emissions, resulting from purchased electricity, heat or steam; and Scope 3 refers to indirect emissions other than those covered by Scope 2, such as emissions associated with the production of goods and services purchased by the university, waste-related emissions and emissions from business travel or employee commuting in vehicles not owned or controlled by the university.

- Energy efficiency opportunities – maintenance and capital works;
- Renewable and alternative energy solutions.

The specific detail of the actions identified under each of these headings will of course depend on the context of the individual university. Table 3.4 outlines some significant opportunities under the headings listed above, adapted from the *Cool Campus* climate planning guide [43] and practical experience. Note also that there will be some overlap with other action plans.

Table 3.4: Climate action planning – some common energy-related actions.

Category	Action
Energy conservation (policy and behaviour change)	Employment of Energy Manager.
	Energy efficiency standards for new construction and refurbishments.
	Energy efficiency purchasing standards.
	Staff energy conservation training.
	Improved space utilisation to avoid new construction or heating/cooling of underutilised space.
	Thermal comfort policy (e.g. widening heating/cooling temperature settings).
	Financial strategies to assign energy costs incurred – and savings achieved – to the responsible cost centres.
	Energy / climate change awareness programs – posters, stickers, events and competitions, websites, awards and incentives for switching off, reporting waste etc.
	Establishment of "energy champions" network across campus buildings.
Energy efficiency (maintenance and capital works)	Detailed energy audit to identify priority areas.
	Periodic recommissioning and building tuning to optimise energy efficiency.
	Building retrofitting – installation of external shading devices, sealing, insulation, double glazing, low emissivity window film, light coloured paint.
	Lighting – delamping, installation of high efficiency lighting fixtures, use of task lighting, lighting controls (timers/sensors).
	Heating, ventilation and air-conditioning (HVAC) – high efficiency chillers, boilers, motors, pumps and air handling units, variable speed drives, variable air volume fan systems, recommissioning, tuning and regular maintenance, heat recovery systems.
	Laboratory ventilation and fume hoods – ventilated storage cabinets for storage, variable air volume and low-flow hoods.
	Installation of building management and control systems (BMCS) and sub-metering for major building energy uses, energy use displays.
Renewable and alternative energy	Purchase of certified "green power".
	Installation of photovoltaic, wind, biomass etc systems.
	Installation of cogeneration and trigeneration.
	Fuel switching – conversion of electric space or water heating to natural gas.
	University managed revegetation program to offset greenhouse emissions.

University energy management probably offers the best opportunities for achieving the "little victories" necessary to enable "systemic transformation" [6]. An important consideration here is developing a business case which itemises costs and savings. Many energy actions (like switching off lights and equipment when not in use) are effectively cost free. Others will involve upfront cost which are paid back over time – and payback calculations should take account of energy price inflation, project life span and other monetary and non monetary savings such as reduced maintenance, impacts on health or comfort and pedagogic value (life cycle cost analysis) [43].

One useful method is to establish a **revolving loan fund**, whereby savings accruing from energy conservation and efficiency actions (and other sustainability initiatives) are placed in an account to fund other projects.

Other potential actions to save energy and reduce greenhouse emissions can include outreach programs such as collaboration with schools, local government and community organisations; service learning activities for students; engagement in the public policy process; and programs to support students and staff to reduce their own residential energy consumption [43].

The above recommendations focus on reducing emissions from stationary energy – electricity and gas. Universities may wish to combine a suite of emission-reducing actions around transport, waste, building design, procurement, office and laboratory practices and IT into a single climate action plan, or include them in separate action plans around the abovementioned issues (which is the format given here). Either option is entirely valid.

DISTANCE LEARNING AND GREENHOUSE EMISSIONS

In the UK, distance learning requires 87% less energy and generates 85% fewer CO_2 emissions than full-time courses on campus, and part-time campus-based courses reduce energy and CO_2 emissions by 65 and 61% respectively compared with full-time [65]. The lower impacts of part-time and distance learning is due mainly to a reduction in student travel, elimination of significant energy consumption from students' housing and more efficient campus site utilisation.

E-learning appears to offer only relatively small energy and emission reductions (20 and 12% respectively) compared with mainly print-based distance learning courses, mainly because online learning requires more energy for computing and paper for printing.

The most striking finding from this project was that distance learning can dramatically reduce the energy and emissions involved in studying to only 13-15% of those arising from an equivalent full-time, face-to-face campus-based course [65]. While these outcomes are specific to a particular time and place, they suggest that university sustainability programs should be extended beyond addressing campus site impacts and greening the curriculum, and that the role of distance education should be further evaluated as a potential sustainability initiative.

3.5.2 Water

Depending on location and climate, availability and conservation of adequate supplies of clean drinking water may be the most critical sustainability issue for a university. As well as conservation (policy and behaviour change) and efficiency measures (maintenance and capital works), water management for sustainability generally includes actions to reuse and

recycle potable water for potable or non-potable purposes. Table 3.5 outlines some typical opportunities for managing campus water use, adapted from the University of New South Wales *Water Savings Action Plan* [66].

Table 3.5: Actions for water conservation, efficiency, reuse and recycling.

Category	Action
Water conservation (policy and behaviour change)	Employment of Water Manager (can be combined Energy / Water Manager position).
	Water efficiency standards for new construction and refurbishments.
	Water efficiency purchasing standards.
	Staff water conservation training (can combine with energy conservation training).
	Financial strategies to assign water costs incurred – and savings achieved – to the responsible cost centres.
	Water conservation awareness programs – posters, stickers, events and competitions, websites, awards and incentives.
	Extension of "energy champions" network to incorporate water conservation.
Water efficiency (maintenance and capital works)	Detailed water audit and campus water balance to identify priority areas.
	Active maintenance program of early detection and repair of faulty plant, equipment and fixtures.
	Retrofitting of water saving devices – timed flow taps, waterless urinals, dual flush cisterns, eater efficient shower heads.
	Underground pipework leak detection and repair.
	Use of pervious paving.
	Specification of low water use species for campus grounds.
	Laboratory water use – mechanical vacuum infrastructure to replace use of aspirators, closed loop cooling water systems, water efficient reverse osmosis plant.
	Installation of building management and control systems (BMCS) and sub-metering for major building water uses, water use displays.
Water reuse and recycling	Capture and reuse of rainwater from roofs and other hard surfaces for non-potable uses (irrigation, laboratories, toilet flushing, cooling towers, construction works, swimming pools etc) – may also be treated to potable standard.
	Substitution of borewater for non-potable uses, when combined with managed aquifer recharge to ensure more water is returned to the aquifer than extracted (see also Section 7 of the Toolkit, *Global exemplars*).
	Installation of greywater recycling system for treatment of kitchen, laundry and shower water for non-potable uses.
	Composting toilets and urine recovery for fertiliser.
	Installation of blackwater recycling system to treat sewage for non-potable uses.
	Recovery and reuse of fire system test water, vehicle washdown water etc.

3.5.3 *Waste*

The central *objective* of a university solid waste action plan is to maximise resource recovery (i.e. the proportion of solid waste stream recovered for high resource value use), with the corollary that this minimises waste disposal to landfill. The main *strategy* is to apply the "waste hierarchy" – avoid purchasing products which will end up as waste, repair and reuse, then recycle, and finally if there are no other options, dispose. This also recognises that environmentally preferred procurement is a major factor in avoiding waste in the first place.

Since the environmental impact of responsible waste management is inherently beneficial, continually improving the delivery of the service itself represents a positive sustainability action. Waste management is data intensive – but unlike energy and water, there are no "waste meters" to track performance. Hence regular data collection and audits are necessary. The first step will usually be a full waste characterisation study to describe the waste stream, evaluate existing waste management practices and identify gaps, with the aim of informing the development of additional systems for avoidance, reuse and recovery.

UNIVERSITY OF VIRGINIA FOOD COMPOSTING PROGRAM

March 3, 2010 – The University of Virginia plans to expand its pioneering food composting program to two more dining halls.

Food waste from the Observatory Hill Dining Hall has been composted since November 2008. A student-run operation hauls about 2.5 tons of organic waste from the dining hall to Earlysville's Panorama Farms each week, where it is composted and sold locally as a fertilizer and soil amendment.

"We've reduced Observatory Hill's trash service by half," said Bruce "Sonny" Beale, recycling superintendent for the University. "We were picking up six to 10 tons a week. Now we are getting six to eight tons every two weeks."

A second food pulper has been installed in Newcomb Dining Hall. The pulp is placed in special 30-gallon containers, which the recycling office hauls to Panorama Farms.

"This takes landfill material and turns it into a useful product," said Jeff Sitler, environmental compliance manager at the Office of Environmental Health and Safety. "And it reduces greenhouse gases because food waste in a landfill generates methane gas. When you compost it is broken down by different microbes and does not produce methane."

He also noted that the material is composted locally and used locally in growing food and flowers. "This is a student-initiated learning tool," Sitler said. "They collect the data and write all the reports."

Report edited from http://www.virginia.edu/uvatoday/newsRelease.php?id=11152,
accessed 25/3/2012

Engagement with the university community requires a focus on best practice, accountability and transparency. Waste management systems must be more convenient to use than the alternative of throwing things away – because there is no "away". So adequate *information* is crucial to progressing "towards zero waste", and where dedicated off-site processing is available, it will reduce the need for user-unfriendly source separation systems on site.

The university solid waste stream is usually extremely diverse, ranging from food organics to electronic waste and laboratory glassware, and actions to deal with these varied components need to be prioritised according to impact. Table 3.6 lists some common elements of a waste management action plan.

Table 3.6: Actions to maximise resource recovery and minimise waste to landfill.

Category	Action
Policy and behaviour change	Employment of Waste Manager.
	Sustainable procurement standards which address longevity, durability, repairability recyclability and recycled content.
	Financial strategies to assign waste costs incurred – and savings achieved – to the responsible cost centres.
	Waste management awareness programs – posters, stickers, events and competitions, websites, awards and incentives.
	Programs targeting teaching and research to minimise generation of hazardous wastes.
Waste management	Waste characterisation study to identify waste stream components and prioritise response.
	Individual staged and prioritised programs for waste minimisation which address each component of the university waste stream according to environmental impact.
	Performance-based waste management contracts to specify resource recovery targets.
	In-house collection of recyclables (e.g. paper / cardboard) where practicable, to support local job creation.
	Provision of adequate storage spaces for waste and recyclables.
	Secure storage spaces for hazardous wastes to minimise risk of spillage / leakage.
Closing the loop	Campus based exchange and reuse programs – e.g. office furniture, stationery, lab equipment, computers and office equipment.
	On-site composting of food and garden organics for reuse on campus grounds.
	Campus based programs to process collected recyclables – e.g. shredding of food-contaminated paper, broken furniture etc for compost and mulch.

3.5.4   *Biodiversity and ecosystem services*

University campuses are located in practically every bioregion on the planet. Even in the most urbanised setting, a campus usually contains some greenery – trees, lawns and garden beds.

Costanza *et al* identify 17 major categories of **services** provided by natural ecosystems, from climate regulation to pollination and recreation [67]. They estimate these services (via economic valuation methods, which they stress are hedged by uncertainties) as worth at least $US33 *trillion* annually worldwide. Their valuation was in 1994 US dollars, equivalent to at least $50 trillion in today's money. Greater **biodiversity** enhances the resilience and productivity of these ecosystem services.

Urban spaces in particular import ecosystem services from vast areas; "Eventually, human services in urbanized areas decline as ecosystem services locally and globally are reduced by the increasing pressure posed by urbanization" [68].

Objectives for the design and management of campus green space should therefore address three distinct aspects: extending the *area* of vegetation where possible (which may include, for example, the installation of green roofs; increase the *density* of vegetation, e.g. as measured by leaf area index, i.e. available photosynthetic surface; and enhance the *diversity* of vegetation. Targets can be set for all three aspects. "Ecologically engineered" green infrastructure systems [69] (of which green roofs and walls are two examples) provide a means of addressing these aspects simultaneously. Similarly, development of productive landscape systems to provide food, fibre and/or timber (e.g. through permaculture design) can address the economic, social and environmental bottom lines of sustainability at the same time.

Finally, the specifically human element cannot be ignored – the design of the campus landscape should acknowledge the restorative effect of green spaces, and incorporate opportunities for quiet contemplation and relaxation, community interaction and more active recreation, to enhance health and wellbeing in an environment which can often be intense and stressful.

In relation to green infrastructure **management**, the key is to design in such a way as to minimise the ongoing impacts of maintenance (material and energy inputs and waste outputs). Table 3.1 discusses a range of sustainable management and maintenance opportunities.

Table 3.7 outlines some potential action plan responses relating to biodiversity and ecosystem services policy, design and development.

Table 3.7: Actions to preserve and enhance campus biodiversity and ecosystem services.

Category	Action
Policy, design and development	Survey and evaluation of campus biodiversity and ecosystem services.
	Extension of campus green space (consolidation / intensification of campus buildings over time, installation of green roofs / walls).
	Increase density of campus vegetation, e.g. through additional tree planting.
	Enhance diversity of campus vegetation.
	Green infrastructure / ecological engineering projects (green roofs / walls, designed wetlands for wastewater treatment, phytoremediation of contaminated land, indoor landscapes for biofiltration / indoor environmental quality).
	Development of productive landscape systems (permaculture, aquaponics) to provide food / fibre / timber.
	Restorative and enabling landscapes for contemplation, recreation and wellbeing.
	Campus grounds and green infrastructure used in teaching and research.
Management and maintenance	Refer to Table 3.1 for typical management and maintenance actions. Note that specialised green infrastructure (green roofs, designed wetlands etc) require specialised maintenance, which can both provide opportunities for local job creation and valuable student learning experiences.

3.5.5 Planning, Design and Development

Sustainability action plans relating to the planning, design and development of the university campus provide the greatest opportunity to support the transition to sustainability over the longer term. Campus **planning** enables consideration of the effective campus-wide use of space to optimise the efficiency of built form, climate-appropriate location and orientation of new buildings, the extent and overall configuration of campus green space, interaction between the campus and the wider community, and many other criteria central to sustainable development. The design of individual **buildings and infrastructure** offers the chance to implement and showcase best practice principles and technologies and address the university's largest single source of greenhouse emissions and other environmental impacts. Although not of the same scale, the **construction process** itself is a significant generator of emissions, wastes and other adverse impacts, which can be minimised through appropriate actions.

The physical, climatic and other attributes of university campuses vary enormously, but while recognising site specificity it is equally important, in facilitating implementation, not to "reinvent the wheel". So the *starting point* – especially for buildings – is to design and construct to the relevant "green building" rating system which applies in the given jurisdiction. The pertinent term here is "starting point". With every new university building or major refurbishment the aim should be to include at least one feature which goes *beyond* the requirements of the rating system, ideally drawing on the expertise of the university itself, and thereby serving to *extend* the definition of a "green building" within the built environment industry.

Table 3.8 sets out some generic actions for planning, design and development; detailed actions will be site-specific. Note that actions relating to biodiversity and ecosystem services may be equally appropriately included in an overall planning, design and development action plan, or (as in Section 3.5.4) treated separately – the main criterion should be efficiency of implementation in the given context.

Table 3.8: Actions to support sustainable campus planning, design and development.

Category	Action
Campus planning	Campus-specific sustainability objectives included in all campus planning instruments (i.e. considering climate and weather patterns, topography, geology/soils, hydrology, urban design context).
	Space planning at campus, precinct and building scale to optimise flexibility, adaptability, diversity and multifunctionality of spaces.
	Investigation of non-building solutions to accommodate university growth.
	Physical accessibility of the campus to the external community, different age groups and people with a disability.
Campus building design	Design to the appropriate green building rating system as the minimum starting point.
	Each new building / major refurbishment to incorporate at least one innovative sustainability feature beyond the requirements of the green building rating system.
Campus construction management	Construction contractors certified to ISO 14001.
	Contractor staff inducted to the university's sustainability management system.
	Management of campus construction/demolition to minimise on- and off-site impacts.

3.5.6 Procurement

Sustainable procurement is a major driver for sustainable development. It also makes good business sense and is good risk management. Strategic procurement aligns supply contracts with the university's strategic aims, thus embedding sustainability into procurement embeds it into the university's core business.

Sustainable procurement specifications may be *performance based* (e.g. incorporating an outcome driven target for reducing energy use) or *technical* (e.g. requirement for a particular certification or eco-label). In practice, specifications for goods or services frequently combine both approaches. In summary, sustainable procurement is about preference for purchased goods and services which minimise life cycle environmental impacts, meet ethical and OHS criteria and provide value for money.

GLOBAL ECOLABELLING NETWORK

The Global Ecolabelling Network (GEN) applies the Voluntary Environmental Performance Labelling ISO (1420 –1425) definitions to a range of goods and services:

TYPE I: a voluntary, multiple-criteria based, third party program that awards a license that authorizes the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations

TYPE II: informative environmental self-declaration claims

TYPE III: voluntary programs that provide quantified environmental data of a product, under pre-set categories of parameters set by a qualified third party and based on life cycle assessment, and verified by that or another qualified third party.

**Reproduced from the Global Ecolabelling network,
http://www.globalecolabelling.net/what_is_ecolabelling/ accessed 25/3/2012**

The procurement process can usefully be divided into three main stages: the initial tendering process (specification writing), tender evaluation; and contract management. Sustainability criteria need to be addressed in all three stages. Specifications for provision of goods or services will necessarily include details specific to the product or service in question. Tender evaluation in addition will usually seek to identify more general sustainability information. Best practice contract management will often utilise target-driven "service level agreements" which provide incentives for improved performance and disincentives for poor performance.

Standard sustainability criteria for tender evaluation include:

- **Internal sustainability management practices** – ISO 14001(environmental) / 9000 (quality) certification; existence of signed sustainability policy; any actions or findings against the supplier in past 2 years.

- **Fair employment practice** – initiatives promoting women and/or minorities to senior roles; any employment related convictions or actions in past 2 years, including OH&S.

- **Public reporting** – corporate social responsibility / Global reporting Initiative / greenhouse gas and energy reporting, including activities, strategies, plans.

- **Sustainability strategies *and* plans** – must include objectives, targets, actions and timeframes); examples of achievements; waste, water, energy, transport reduction strategies and action plans.

- **Services / goods sustainability attributes** – certification to a robust environmental label; providers who offer eco-design /eco-manufacture in the use of recycled content, tight management of GHG emissions, , design for disassembly and recycling, best practice e-waste management, product / packaging take-back, recyclable packaging.

Table 3.9 lists the "framework" actions necessary for a sustainable procurement action plan –actions relating to individual goods and services will fit within these frameworks.

Table 3.9: Core elements of sustainable procurement action planning.

Category	Action
Developing specifications	Evaluation of university contracts for procurement of goods and services on the basis of cost, complexity and actual/potential sustainability impacts to determine priorities.
	Staged development of sustainable procurement standards / specifications based on identified priorities.
	Inclusion of sustainability criteria in tender specifications for procurement of goods and services.
Tender evaluation	Inclusion of sustainability criteria in tender evaluation procedures.
Contract management	Inclusion of sustainability objectives and targets in contract management documentation, and regular monitoring of progress.
	"Second party" audits of providers to drive continual improvement through the supply chain.

3.5.7 Green Office

Universities are largely office-based institutions, and Green Office programs / action plans deal with the sustainability transformation of office practices. The Green Office "mandate" or terms of reference cross over into energy, water, waste, procurement and IT services. The focus is typically on education, training and awareness; the methods may include seminars and online discussion groups, websites, social media, newsletters and other promotion material, events and competitions.

Specific actions – switching off appliances when not in use, turning off lights in vacant rooms, default double-siding for printing and copying, etc, when implemented university-wide may represent considerable monetary savings as well as a significant cumulative reduction in environmental impacts.

Table 3.10 lists some generic Green Office actions around policy and behaviour change and improvements to office practices.

Table 3.10: Actions to reduce the impacts of office work.

Category	Action
Policy and behaviour change	Employment of Green Office Manager.
	Sustainable procurement standards for office equipment and consumables.
	Education, training and awareness programs – induction of new staff, seminars and discussion groups, posters, stickers, events, websites, social media.
	Establishment of "Green Office champions" network across campus buildings as the vehicle for the energy and water conservation network proposed in Sections 3.5.1 and 3.5.2.
Office practices	Campus- wide audit of office practices disaggregated to department level – paper use, energy consumption, deployment and use of office equipment, procurement of consumables, office waste management.
	Establishment of department-specific targets for (e.g.) paper use, office waste, equipment left on overnight, etc; monitoring of progress; and competitions between departments to drive continual improvement, including awards and incentives.

3.5.8 Green Laboratories

Laboratories are complex environments which may stock hundreds or thousands of chemicals, compressed gases, biological agents, radioactive materials, fume hoods, biosafety cabinets, centrifuges, autoclaves, vacuum systems, lasers, sophisticated electrical equipment and any number of other research items [70]. University labs commonly cater for researchers who are independently funded through external grants. These labs must continually accommodate new equipment and procedures; constant change makes it difficult for occupational health and safety, energy efficiency and other sustainability issues to be adequately and routinely addressed.

Laboratory planning and design represents a key opportunity to minimise environmental impacts, particularly those relating to energy consumption – labs typically consume 4-5 times more energy than similarly-sized commercial spaces [70]. The **Laboratories for the 21st Century** (Labs21) program provides extensive guidance on the design and management of high performance labs. Strategies include using life-cycle costing to identify energy efficiency opportunities, separating energy intensive processes and spaces from those which are less intensive to optimise mechanical and electrical design, "right-sizing" equipment and installing energy monitoring, control and recovery systems.

Fume hoods are the primary means by which lab personnel minimise their chemical exposure. A typical fume hood in a research lab runs 24 hours a day, 365 days a year and uses 3.5 times more energy than the average (western) house [70]. Careful planning for the number, size, location, and type of fume hoods is critical to efficient laboratory performance. Water use is another major concern – a useful principle to adopt is that no potable water be used "once-through" for any laboratory equipment, unless it is required as direct contact process water. Best practice also demands that universities develop systems to track the inputs and outputs of hazardous materials, and establish procedures to eliminate, minimise, substitute, recycle and safely dispose of these materials [71].

LABORATORY GREENING ONLINE

Behaviour change opportunities abound in the university laboratory setting **[70]**. The Green Lab Program at the University of New South Wales in Sydney, Australia was one of the first of a growing number of specialist initiatives focusing on higher education labs. The program provides mandatory online environmental compliance training for research staff and students, covering environmental best practice behaviour as well as legal obligations. Researchers learn to prepare a comprehensive risk assessment before initiating new experiments, manage hazardous materials and wastes and conserve energy and water. This may involve the redesign of experiments to reduce material and energy use and toxic byproducts, utilise safer solvents and allow for greater reuse and recycling, for example through application of the principles of green chemistry.

Table 3.11 describes some typical Green Lab actions relating to the three main areas of policy and behaviour changes, laboratory practice and maintenance and capital works. Note that some actions also are listed in the Energy and climate change, Water and Waste action plans.

Table 3.11: Actions to support laboratory "greening".

Category	Action
Policy and behaviour change	Employment of a Green Lab manager.
	Development of a "green chemistry" program.
	Sustainable procurement standards for lab equipment and consumables.
	Green Lab online and face-to-face training.
Laboratory practice	Campus wide audit of university laboratories – energy, water, input and output of chemicals, hazardous waste management.
	Establishment of lab-specific prioritised targets for improvement.
	Development of online tracking system for chemical management (inputs, processes and outputs).
	Establish lab equipment / consumables exchange program to minimise waste.
Maintenance and capital works	Development of green laboratory design standards, e.g. referencing Labs21.
	Laboratory ventilation and fume hoods – ventilated storage cabinets for storage, variable air volume and low-flow hoods.
	Laboratory water use – mechanical vacuum infrastructure to replace use of aspirators, closed loop cooling water systems, water efficient reverse osmosis plant.
	Secure storage spaces for hazardous wastes to minimise risk of spillage / leakage.

3.5.9 *Green IT*

Information technology (IT) or more broadly, information and communication technology (ICT) is a pervasive element of most universities. IT integrates a spectrum of sustainability aspects – energy use, procurement, waste management, and even campus development (consideration of computer heat loads in building design). Actions to address the impacts of information technology may thus be spread across a number of action plans, or conversely, recognising the common *management* context, they may be amalgamated into a separate "Green IT" plan.

The growing energy demand associated with the proliferation of IT services has prompted the development of a number of national and globally recognised standards and assessment tools (see box below).

STANDARDS AND ASSESSMENT TOOLS
The **IEEE 1680-2009 Standard for Environmental Assessment of Electronic Products** [72] establishes environmental performance criteria for the design of electronic products and provides a valuable tool for developing contract specifications. The **Electronic Product Environmental Assessment Tool (EPEAT®)** offers a rating system for suppliers and a global registry to help purchasers identify greener electronic products [73]. It combines comprehensive criteria for design, production, energy use and recycling with ongoing independent verification of manufacturer claims. The **Electronics Environmental Benefits Calculator (EEBC)** was developed to help organisations assess the environmental benefits of greening their purchase, use and disposal of electronics [74]. The EEBC estimates the environmental and economic benefits of purchasing EPEAT registered products and improving equipment operation and end-of-life management practices.

Actions around green IT can be conveniently grouped into two categories – policy and behaviour change and IT management and capital works. Table 3.12 lists some generic suggestions.

Table 3.12: Actions to support the "greening" of university information technology.

Category	Action
IT policy and behaviour change	Adoption and implementation of IT purchasing standards (e.g. IEEE, EPEAT etc).
	"Switch off when not in use" awareness programs – posters, stickers, events and competitions, websites, awards and incentives.
	Standard operating environments (hardware and software).
IT management and capital works)	Reduce frequency of computer replacement programs – substitute software upgrades for hardware upgrades where possible.
	Centralised / dedicated server space(s) to avoid dispersing server heat loads across multiple buildings.
	Computer reuse program, e.g. donation to community groups / schools.
	E-waste program.
	Ensure energy saving features are enabled.

3.5.10 Transport

Sustainability action planning around transport will probably involve the greatest variation between universities based on location, existing public transport infrastructure and the extent to which residential and other services are provided on campus for students (and in some cases for staff).

The two main areas – flagged in Section 3.5.1 *Energy and climate change* – are commuter travel and travel on university business (air or land-based). In relation to the former, the most

effective action is to increase the proportion of student housing and related services provided on campus, to eliminate the need to commute to the university each day. In relation to the latter, the increasing availability and sophistication of video conferencing facilities can be utilised to substitute "virtual" for physical travel in many cases – and enable considerable savings on escalating travel costs. Table 3.13 outlines some generic actions to reduce greenhouse emissions and other environmental impacts of transport.

Table 3.13: Actions to reduce impacts of commuter and business travel.

Category	Action
General	Employment of Transport Manager.
	Development of university transport policy.
Commuter transport	Student housing and services on or close to campus.
	Awareness and promotion of alternatives to private transport – posters, stickers, events and competitions, websites, awards and incentives.
	Regular liaison with public transport providers to optimise services to the campus.
	Incentives for staff committing to forego use of private commuter transport.
	Secure, undercover bike racks, and shower facilities, lockers and bike repair workshop for cyclists.
	Car pooling programs.
	Reduction of car parking spaces and provision of dedicated spaces for car pool vehicles and electric vehicles (and also charging points).
	Establishment of shuttle bus service where the university has multiple campuses.
	Acknowledgement that for reasons of social equity, disability etc some staff and students will still need to use private vehicles to access the campus.
	Pedestrian-friendly campus to minimise internal motor vehicle trips.
Travel on university business	Acquisition and promotion of video conferencing technology to staff and students.
	University managed revegetation program to offset emissions for air travel, and/or commitment to "third party" carbon credit / carbon offset program.
	Purchase of fuel efficient vehicles for university fleet.
	Regular maintenance to optimise motor vehicle fleet fuel efficiency.

3.6 Awareness and training

Awareness building and training opportunities need to be build into every sustainability action plan. Staff at all levels and new students should be introduced to sustainability awareness training as part of regular induction procedures, explaining the university's sustainability policy and action plans, the impacts of the university's activities (particularly around priority areas such as climate change) and the importance of compliance with relevant legislation and regulations.

3.6.1   Student and staff development

ISO 14001 requires organisations to identify training needs associated with their environmental aspects for all persons performing tasks for or on behalf of the organisation, i.e. contractors, subcontractors, agency staff, etc as well as the permanent workforce. As with all aspects of the EMS, training details and competence levels must be clearly documented, and documentation kept up to date. While training for (e.g.) office staff may be covered by the "general awareness" discussed above, it is essential that staff performing tasks with the potential to cause (or prevent) significant environmental impacts are appropriately trained and examined with respect to the appropriate competencies.

Personnel performing specialised environmental management functions must have appropriate education, competence, experience and training. It is important that such personnel are exposed to the most recent technology and knowledge base relevant to the organisation's significant environmental impacts. This includes those staff with responsibilities for delivering particular tasks associated with actions specified in the university's sustainability action plans. Development plans which address these issues should be incorporated into the university's human resources policies and procedures (e.g. in relation to recruitment, performance review, promotion, etc).

Training and development opportunities should also be provided for students working as volunteers or interns on environmental or other sustainability projects. This may be integrated with, or managed separately from, the university's usual curriculum, and may be run as an incentive scheme (e.g. fee-free) to encourage participation. University student associations are often well-placed to offer training and development, which can help to reinforce their stake in sustainable campus development.

3.6.2   The campus as living laboratory

The Introduction to the Toolkit notes that "universities can teach and demonstrate the theory and practice of sustainability through taking action to understand and reduce the unsustainable impacts of their own activities. Historically, the demands of teaching and research resulted in the structural separation of academic staff from campus management. This has led to the view that focusing on campus issues is a distraction from the core mission of the university. In fact, the campus itself can become a feedback mechanism for the teaching and research practice to "achieve mission alignment between teaching, research and campus operations, harnessing the vast collective learning process that is currently underway within its walls, to benefit its own systems" [6].

Such projects broadly reflect the philosophy of *experiential learning*. Kolb [75] offers a concise summation: "Learning is the process whereby knowledge is created through the transformation of experience". This definition emphasises process as distinct from content or outcomes, and importantly, the *transformative* nature of that process, in both an objective and a subjective sense. Within this experiential framework, environmental learning is best served by an approach which is both *context-based*, responsive to social context and setting [76]; and *problem-based*, characterised by the use of "real world" problems as the context for students to learn critical thinking and problem-solving skills [77].

The literature and many university websites offer a substantial and growing inventory of examples of the university campus as living laboratory (and lecture theatre) for applied sustainability interventions. Examples include projects from first year to PhD level, and include all aspects of sustainability – environmental, social, economic and cultural.

UNIVERSITY OF SONORA CERTIFIED SUSTAINABILITY MANAGEMENT SYSTEM

One of the most successful efforts in Latin America to transform a higher education institution into a more sustainable organisation has come from the University of Sonora in Mexico.

Sustainable practice at the University of Sonora is inspired by the institutional vision and mission and reflected in the sustainability policy which fosters a culture of protecting natural resources and preventing, reducing and/or eliminating environmental and occupational risks.

The University's sustainability initiatives address the full scope of its activities – teaching, research, outreach and partnership and campus greening. A Sustainability Management System (SMS) provides the framework for greening campus operations. The SMS achieved ISO 14001 certification in 2008, enabling the University of Sonora to become one of the few higher education institutions in the world with this certification, and the first in Latin America.

The SMS is not only directed at sustainable operations, but also strives to enhance Engineering College students' education through practical apprenticeships with an integrated triple bottom line focus. From the start, the system has been linked to the substantive functions of teaching and research in order to transform the campus into a living laboratory for continual learning. Areas of attention include efficient use of water and energy, laboratory safety and hazardous materials management as well as the reduction, reuse, and recycling of non-hazardous materials such as paper, plastic and organic waste.

A quarterly report provides the basis for review and evaluation of the SMS to ensure its effectiveness. Strong emphasis is put on continuous improvement and overall performance shown by sustainability indicators. The appropriateness of the sustainability policy is also reviewed, as well as achievement of the objectives and targets, regulatory compliance, corrective and preventive actions and the findings of internal audits.

Text adapted from Velázquez, L., Munguía, N., Esquer, J. and Zavala, A., 2011. "Sustainable Good Practices in the University of Sonora, Mexico", Global University Network for Innovation http://www.guni-rmies.net/news/detail.php?id=1750; Image from Universidad de Sonora/University of Sonora website http://www.uson.mx/noticias/default.php?id=6511, accessed 21/08/2011.

For universities embarking on the transition to sustainability, logical opportunities to pursue include determination of the university's baseline environmental / sustainability performance through an initial environmental or sustainability review, preparation of a sustainability report, or conducting a carbon footprint analysis, as assessable components of an environmental science or engineering program. Generally these tasks would be class based; individual or small team based studies could include post-occupancy evaluation of a specific campus building, energy, water or waste audits of particular activities, life cycle assessment of goods or services procured by the university or life cycle costing of proposed sustainability actions.

Even this brief summary indicates the potential to involve different disciplines individually and collectively in campus based projects. Sociologists and historians can explore the background to university sustainability management with a view to informing current policy; law students can research the applicability of environmental legislation to campus operations; medical students can address issues of public health; psychologists can investigate opportunities and barriers to organisational change and the adoption of sustainable behaviours – and this is just a partial list.

There are several different models for implementing "living laboratory" initiatives:

- Student internships, paid or unpaid, with the sustainability team. These would include an appropriate level of academic credit awarded for successfully completed projects.

- Inclusion of teaching and assessment material on campus sustainability in an existing course.

- A specific course focused on campus sustainability. Ideally this would be cross-disciplinary, and open to students from different fields of study.

- Integration of teaching and assessment material on campus sustainability across a number of courses, covering a range of disciplines and coordinated with implementation of the university's sustainability action plans. This is the preferred model to support the university's ongoing transition to sustainability, and will likely require several iterations of the sustainability planning cycle to achieve.

The campus can also function as a living laboratory for staff and student **research**, with similar scope as in learning and teaching. The advantage here is that the outcomes are likely to be more long-lasting, for example involving potentially major innovations affecting the campus fabric and operations, and also providing new resources for learning and teaching into the future. The main criterion – whether in relation to teaching or research – is that living laboratory programs are integral to the university's sustainability management system and action plans.

3.7 Communications and documentation

"**Communications**" in this context refers to internal communications relevant to the development, maintenance and continual improvement of the university's sustainability management system. Strategies for communication with internal stakeholders should consider the range of variables addressed in Section 2.4 of the Toolkit relating to community engagement. Each sustainability action plan will need to incorporate a communications strategy to facilitate engagement of the university community and maximise the chances of success – although in practice some of these may be combined.

ISO 14063: 2006 *Environmental management - Environmental communication - Guidelines and examples*, one of the International Organization for Standardization "family" of environmental management standards [78], gives guidance to an organisation on general principles, policy, strategy and activities relating to both internal and external environmental communication. For example, communications activities should enhance two-way communication, promote consensus, provide opportunities to address issues in depth and promote education and awareness. ISO 14063 suggests setting targets for communication, for example in terms of stakeholder participation and feedback obtained. Approaches and tools may include minuted meetings (possibly with an independent facilitator where the

issues are particularly complex), newsletters, social media, focus groups and workshops, displays and exhibitions.

Responsibilities for communication with the university community around sustainability issues should be defined and allocated, and should also include media / communications staff responsible for other areas of internal university communications. The effectiveness of communication activities should be regularly evaluated to help drive the continual improvement cycle.

"**Documentation**" – in the context of ISO 14001 – simply refers to the need for all aspects of the university's sustainability management system to be documented, and the records to be centrally maintained and kept up to date. Documentation includes obvious material such as policies, plans, minutes of meetings and training records – but importantly, the EMS standard (and good management practice) requires that system *procedures* be documented and maintained. This includes procedures for stakeholder engagement, identifying and assessing the significance of environmental impacts, conducting initial reviews and internal audits, setting objectives and targets, and so on.

Section 1.5 points out that "…the loss of corporate memory through staff turnover and the transience of the student population can mean mistakes are repeated, previous high performing initiatives are not emulated and it becomes difficult to build on progress…" Ensuring comprehensive and current documentation minimises this scenario.

3.8 Emergency preparedness and response

Universities are not usually associated with environmental emergencies such as spills or inadvertent release of air pollutants. However, the range of hazardous materials stored on many campuses, the variety of teaching and research endeavours in which these materials are used, and also the scope of operational activities, highlights the need to be prepared for potential emergencies.

ISO 14001 outlines the requirements for emergency preparedness and response for organisations subscribing to an environmental management system, and this advice is relevant to universities which have committed to the path of sustainable development. As a minimum, documented procedures should be established, maintained and periodically reviewed for identifying hazards and risks, responding to accidents and emergency situations and for preventing and mitigating the potential environmental impacts associated with them. Periodic exercise of such procedures should be undertaken where practicable.

Emergency preparedness and response needs to be included in the training provided to those staff (and contractors) responsible for teaching, research or operational areas with the potential to cause significant environmental impacts, and those providing specialised environmental management services for the university.

3.9 Closing the loop: monitoring, evaluating and communicating progress

Regular monitoring, evaluation and communication of progress are integral aspects of mainstream business culture, and thus should be integral to sustainability as a mainstream university activity. **Audits** provide a way of tracking progress towards achievement of objectives and targets and – through implementation of audit recommendations – driving continual improvement. **Management review** enables update of policies and objectives to align with changing circumstances, and the effectiveness of the system overall.

Sustainability reporting informs the university and wider community of what has been achieved, and equally, what remains to be achieved [79]. Figure 3.2 illustrates the functions of auditing, review and reporting in the overall context of the sustainability management system.

3.9.1   Internal audit

ISO 14001 *Environmental management systems – Specification with guidance for use* requires organisations to conduct internal audits at planned intervals to objectively verify the adequacy and effectiveness of the EMS. These are *system* audits which are aimed at continual improvement in the performance of the system, hence only *indirectly* address continual improvement in the objective sustainability performance of the university. Best practice suggests combining internal system audits with periodic evaluation of the university's sustainability performance as required to inform production of the sustainability report. This is effectively a repeat of the initial review conducted to determine the institution's baseline performance, and matters to consider will include:

- Measurement of performance against agreed sustainability **indicators** (see for example the list of recommended core indicators in Table 3.2);

- Extent of achievement of detailed sustainability **targets**;

- Any changes in relation to sustainability **impacts** and their significance, as a result of changes in internal or external circumstances since the last audit (for example a new research project which requires storage, use and disposal of hazardous materials);

- Any changes to the university's **fabric or operations** which may affect overall sustainability performance (for example increase in greenhouse emissions resulting from the construction of a new building).

- Any **organisational** changes which may affect overall sustainability performance.

System documentation should include procedures for internal audits which cover the audit scope, frequency and methodology, as well as the responsibilities for implementation and reporting results. Internal auditors must demonstrate objectivity and impartiality, ideally by being independent of the organisational unit responsible for the establishment and day-to-day management of the system being audited.

Table 3.14 Shows an internal audit checklist which covers the common *system* attributes of a sustainability management system. The heading "Corrective and preventive action" refers to system issues; potential environmental incidents are addressed under the heading "Emergency preparedness and response" (noting of course that system nonconformities may give rise to environmental incidents).

Each university will have its own individual system attributes which require checking; similarly, the combination of indicators, targets, significant impacts etc will be unique to every university, so the content of an internal sustainability audit will invariably be unique to the given institution.

Table 3.14: A basic sustainability management system audit checklist.

System element	The auditor is looking for evidence that…
Sustainability policy	There is top management commitment; the policy is distributed internally; the policy is available to the public
Organisational structure	Management responsibility is assigned; specific roles / responsibilities are defined at each level / function; roles / responsibilities are understood and communicated
Training and awareness	Training needs are identified; appropriate training is conducted at each level / function; competence is determined; training records are kept
Sustainability aspects / impacts	Sustainability aspects / impacts are identified; significance is determined; procedures exist to update information
Legal requirements	Legal and regulatory requirements are identified; this information is accessible; procedures exist to update information
Objectives and targets	Appropriate objectives and targets are set at each level / function; objectives and targets are regularly reviewed; views of the university community are considered in setting objectives and targets
Sustainability action plans	Responsibilities are designated at each level / function; appropriate resources are allocated and time frames are set; plans are reviewed and updated
Documentation and document control	Core system documentation exists, is up to date and controlled; documentation is cross-referenced; documentation is reviewed and approved; documents are available where needed; procedures exist for creation and modification of documents
Communication and reporting	Procedures exist for communicating internally and externally; there are records of internal and external communications
Emergency preparedness and response	There are documented emergency procedures; capability exists for emergency response and mitigation; procedures are tested and reviewed
Corrective and preventive action	There are procedures for preventing, recording, handling and investigating nonconformities and preventing recurrence; effectiveness of corrective and preventative actions is reviewed; changes are made to documented procedures arising from corrective/preventive actions; roles, responsibilities and authorities are established for handling nonconformities
Internal audit	There is an internal audit program and audit procedures; internal audit responsibilities are set and understood; audit reports exist and recommendations are followed up; internal auditors demonstrate objectivity and impartiality
Management review	Management review is occurring; follow-up actions from management review are implemented; recommendations from management reviews are incorporated into the system

3.9.2   Management review

In addition to regular internal audits (usually annual, or otherwise aligned with the frequency of publication of the sustainability report), the university's senior management is expected to implement a high level review of the sustainability management system at defined intervals. A four or five yearly cycle should generally be adequate. The intent is that core elements of the system such as the university's sustainability policy, objectives, resourcing arrangements

and so on are reviewed at the level of management which defined these elements in the first place.

Matters to be considered in a management review will include:

- The continuing relevance of the sustainability policy, and sections which may need to be updated in the light of changing internal or external circumstances (for example new teaching or research priorities or government greenhouse legislation);

- The overall performance of the system, and in particular the extent to which objectives and targets have been met;

- Establishment of new, high level objectives and targets (the setting of more detailed and specific targets is addressed in the development of sustainability action plans rather than at senior management level);

- The status of corrective and preventative actions relating to any environmental incidents or regulatory non-compliances which may have occurred;

- Relevant communications from external stakeholders (government bodies, industry, the local community etc);

- Any follow-up actions from previous management reviews;

- Any other recommendations for improvement.

3.9.3   Preparing a sustainability report

Sustainability reporting has been defined as "the practice of measuring, disclosing, and being accountable to internal and external stakeholders for organizational performance towards the goal of sustainable development... A sustainability report should provide a balanced and reasonable representation of the sustainability performance of a reporting organization – including both positive and negative contributions." [49].

The *Global Reporting Initiative* (GRI) is an independent international foundation based in The Netherlands. It has developed a comprehensive sustainability reporting framework, based around a set of principles and performance indicators which organisations can use to measure and report their economic, environmental, and social performance.

The GRI promotes a standardised approach to sustainability reporting which has been used by thousands of organisations worldwide. All GRI Reporting Framework documents are developed using a process that seeks consensus through dialogue between stakeholders from business, the investor community, labour, civil society, accounting, academia and others [49].

The GRI Framework consists of the *Sustainability Reporting Guidelines*, *Sector Supplements* and the *Technical Protocol - Applying the Report Content Principles*. The *Guidelines* set out Performance Indicators and Management Disclosures which organisations can adopt voluntarily, flexibly and incrementally, enabling them to be transparent about their performance in critical sustainability areas. *Sector Supplements* address sector-specific issues, and the *Technical Protocol* provides process guidance on preparing a sustainability report and how to define the content.

A university sustainability report should reflect both the institution's mission and activities, and the expectations of the university community and other stakeholders. Thus the context –

if not the content – is consistent with accepted global practice such as represented by the GRI. The GRI *Guidelines* are intended to be applicable to most organisations irrespective of size, type, sector or location. However, while many indicators are relevant to universities others are not, and the core university mission of teaching, research and outreach is not addressed.

INTRODUCTION TO BALL STATE UNIVERSITY SUSTAINABILITY REPORT 2010

At Ball State University, we have a long history of identifying and implementing methods to protect and enhance our environment. We are proud to maintain this forward momentum by our active use of the Sustainability Tracking, Assessment and Rating System1 (STARS); a reporting tool now in use by some 675 campuses throughout North America. In fact, we are on schedule to file our first full STARS Report by the close of this calendar year.

As a compliment to this nation-wide collaboration to report on campus sustainability, we have been working through our Ball State University Building Better Communities (BBC) Fellows Program to explore the use of an additional assessment tool: the Global Reporting Initiative2 (GRI). Like STARS, this tool provides a framework for reporting sustainability performance and it is in use today by some 1500 organizations in over 60 countries.

An interdisciplinary team of students working within our BBC Fellows program, under the direction of Dr. Gwen White, Associate Professor in the Miller College of Business, was instrumental in gathering the information necessary to construct this first GRI Sustainability Report for BSU. Through this experience they have become versed in environmental, social and economic sustainability, developed leadership skills, and worked in a collaborative environment. Their efforts contribute to our actions to protect and enhance our environment.

With the country's largest geothermal project underway on our campus, our biennial Greening of the Campus Conference Series and our very active campus-wide Council on the Environment, we maintain a substantial investment in achieving campus sustainability. The use of STARS and GRI for annual Sustainability Reporting extends that work as a valuable resource for our full academic community: our students, faculty, staff and administrators.

Jo Ann Gora
President
Ball State University

Sustainability Report accessed 24/3/2011 at
http://cms.bsu.edu/Academics/CentersandInstitutes/COTE/Sustainability/GRI.aspx,

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The GRI defines the base content which should appear in a sustainability report ("standard disclosures") as follows [49]:

- **"Strategy and Profile:** Disclosures that set the overall context for understanding organizational performance such as its strategy, profile, and governance.

- "**Management Approach:** Disclosures that cover how an organization addresses a given set of topics in order to provide context for understanding performance in a specific area.

- **"Performance Indicators:** Indicators that elicit comparable information on the economic, environmental, and social performance of the organization."

Table 3.15 Illustrates a generic table of contents for a university sustainability report based on the above criteria.

Table 3.15: Table of contents for a university sustainability report consistent with the GRI .

Table of contents	Description of contents
1. **Foreword**	Signed statement from the University Vice-Chancellor / President.
2. **Organisational profile and governance**	Brief description, background, mission and explanation of the governance structure of the University.
3. **Strategy and analysis**	Strategic summary of how the University is addressing the challenges of sustainable development (e.g. vision, policy, sustainability management system).
4. **Reporting parameters**	Scope, system boundary and methodology of the report.
5. **Environment** 6. **Society** 7. **Economy**	The substantive subject matter of the report. These sections (divided into subsections which reflect the detailed content of the University's sustainability management system) will report on movements in the indicators, achievement of objectives and targets and progress in implementation of action plans. They will generally contain a combination of narrative and quantitative material (including graphics).
8. **Conclusions**	Summary of the report and its findings. This section can usefully include a gap analysis (what was planned but not achieved, and what opportunities have emerged during the reporting period which can inform the next round of sustainability action planning).

Other key principles embraced by the GRI, and which are relevant to university sustainability reporting, are:

- **Materiality** – defined as "the threshold at which topics or Indicators become sufficiently important that they should be reported";

- **Stakeholder inclusiveness** – or how the reporting organisation has responded to the reasonable expectations and interests of its stakeholders;

- **Sustainability context** – the report should present the organisation's performance in the wider context of sustainability;

- **Completeness** – coverage should be sufficient to reflect significant economic, environmental and social impacts and enable stakeholders to assess the reporting organisation's performance for the reporting period.

Further, the GRI has established a set of principles for defining the **quality** of a sustainability report: balance, comparability, accuracy, timeliness, clarity and reliability.

3.9.4   *Marketing, promotion and celebrating success*

This Section does not aim to provide guidance on *how* to market and promote the university's sustainability initiatives or celebrate successes. There are probably as many

ways of doing this as there are universities engaging with sustainable development. The Section is simply intended to reinforce the importance of these factors.

Especially at the outset, the transition to sustainability can seem a daunting prospect. Sustainable development in many instances is still seen as outside the mainstream, unconnected to the teaching / research mission, perhaps an optional extra to be "appended" to core business but not core university business in and of itself. Reality imparts a harsher message; sustainability is not "optional", it is not an "extra", it is an imperative we neglect to the detriment of our environments, our societies and ultimately our economies.

That said, presentation of "doom and gloom" scenarios may help to *initiate* transformation, but cannot *sustain* it. Sustained transformation requires motivated champions. Motivation requires hope for the future. Strategies for transformation demand affirmation and reinforcement of motivation at every stage. *Knowledge* helps drive motivation, and in this universities are ideally placed.

Moreover, champions are necessary, but insufficient on their own. The great bulk of the university community must be engaged in the transition to sustainability for there to be any chance of success. Collective celebration of victories big or small reinforce the *sense* of community, that together we can transform our institutions – and ourselves – one step at a time.

Finally, universities do not exist in a vacuum, they are part of an environment, a society, an economy. So for example the transient nature of the bulk of the university community – the student body – is at once a weakness and a strength. While sustainability strategies and campaigns must continually be reinvented to cope with the regular changeover of the campus population, graduating students each year bring all that they have learnt to the wider world of work, citizenship and new responsibilities.

As emphasised in the Introduction to this toolkit, "**The sustainable university can help catalyse a more sustainable world**".

Section 4: Recognising and rewarding progress

Having achieved initial successes in sustainable development it is natural that universities will want to see how they compare with their peers, from both a benchmarking and a marketing perspective. Benchmarking against comparable institutions promotes continual improvement; public recognition can attract funding, students and high quality academic and operational staff. However, the operative word here is *comparable*. As noted throughout this Toolkit, universities operate in a wide range of circumstances, with huge disparities in geography and climate, resources, curriculum, student and staff numbers, research profiles and so on.

Most benchmarking and award programs are managed through individual national university sustainability associations, although growing international collaboration is beginning to extend the scope of such programs across national boundaries. At present though, the pool of potential award winners is fairly restricted by the selection criteria for the awards. Establishment of a truly global scheme presupposes a level playing field. Clearly conventional quantitative benchmarking – the "scorecard" model – is inappropriate in this context.

The alternative is a "continual improvement" model, which rewards universities based not on absolute performance but on measured improvement against self-identified objectives, incorporating evaluation of creativity and innovation and normalised against economic, social and climatic factors. This model will need further research and considerable discussion between national and international university sustainability organisations to bring to fruition.

The most widely recognised existing award programs are briefly summarised below.

The [International Sustainable Campus Network](#) (ISCN) established the International **Sustainable Campus Excellence Awards** in 2009. These awards recognise projects which demonstrate leadership, creativity, effectiveness and outstanding performance in the areas of Building, Campus, Integration and Student Initiatives.

The **Green Gown Awards** now in their 7th year, recognise exceptional initiatives being taken by universities and colleges across the UK to become more sustainable. Now run by the UK's [Environmental Association for Universities and Colleges](#) (EAUC), the Awards were created to recognise and reward those institutions making a positive impact towards sustainability within the education sector. In 2010 there were 12 Award categories, including continuous improvement, student initiatives and campaigns, social responsibility, carbon reduction and courses. Building on this success and keen to embrace international collaboration, [Australasian Campuses Towards Sustainability](#) (ACTS) formally launched the **Green Gown Awards Australasia** in 2010. The categories cover continuous improvement, learning and teaching, student campaigns, Technical and Further Education (TAFE) colleges and smaller institutions, and the ACTS Award of Excellence.

The [Association for the Advancement of Sustainability in Higher Education](#) (AASHE) presents two **Campus Sustainability Case Study Awards**, one Faculty Sustainability Leadership Award, one Innovation in Green Building Award, one Student Sustainability Leadership Award, and one Student Research on Campus Sustainability Award annually. The awards are presented at AASHE's annual conference. The Association comprises member institutions across 18 countries.

4.1 The proposed Green/Sustainable Universities Award Scheme by UNEP's Environmental Education and Training Unit (EETU) – suggested framework

The following criteria are proposed to establish an initial framework and indicative terms of reference for an international award scheme to be managed by UNEP's Environmental Education and Training Unit. They are broadly derived from common elements of the award schemes discussed above. This framework should be seen as a work in progress, as both the context and the content will need extensive consultation, review and refinement to ensure suitability and acceptance internationally.

Five broad categories are proposed for consideration (Table 4.1): university fabric; university management and operations; sustainability in teaching and research; community engagement and outreach; and student leadership and participation.

Table 4.1: Framework / terms of reference for UNEP EETU award scheme.

Category	Description	Terms of reference (indicative)
University fabric	Initiatives which demonstrate excellence in the planning, design and refurbishment of campus buildings, landscape and infrastructure	Certification to relevant green building ratings; energy efficiency / carbon emissions; protection / enhancement of natural systems; integration of green technologies; efficiency of space utilisation; adaptive reuse
University management and operations	Excellence in university management, including both high level strategic leadership and management / administration of the campus estate and day-to-day operational activities	Management system certification; operational energy efficiency / carbon emissions; operational water efficiency; waste minimisation; office and laboratory greening; sustainable procurement; ethical / sustainable investment; green IT; behaviour change programs; commuter transport / travel planning and management; sustainability reporting / communication
Sustainability in teaching and research	Excellence in the integration of sustainability criteria in learning / teaching and research	New teaching programs targeting general or specific aspects of sustainability; integration of sustainability into existing teaching programs; new sustainability research initiatives; use of the campus as "living laboratory" for teaching / research
Community engagement and outreach	Initiatives which provide significant benefits for local communities, disadvantaged groups and / or society as a whole	New forms of stakeholder engagement and/or knowledge transfer; significance of benefits to the local and/or wider community; dissemination of benefits beyond initial target group; focus on disadvantaged groups
Student leadership and participation	Outstanding student-initiated projects relating to campus fabric and operations, student life on campus and/ or community outreach	Awareness campaigns; campus / community volunteering activities; greening of student housing

All categories of awards should be assessed against the sustainability triple bottom line – including cost effectiveness and socio-cultural impact (in relation to staff and students, and where relevant, the wider community) as well as environmental benefits. Other criteria applicable to all categories are **innovativeness** and **transferability** (the extent to which initiatives are capable of being adapted and effectively applied by other institutions in their own context). Applicants should provide adequate quantitative evidence of the benefits of initiatives submitted for awards, and demonstrate a **causal relationship** between activities undertaken and improvements achieved (a point highlighted in the preamble to the Green Gown Awards).

Section 5: Resources for change

The emergence and diffusion of individual campus greening initiatives in the late 1980s soon led to existing university coalitions and associations adding sustainability criteria to their terms of reference, establishment of new organisations, convening of conferences, adoption of high level declarations and charters and the publication of a rising tide of print and online resources. This Section of the Toolkit brings together and summarises the material: associations; international commitments; online tools; books and journals; and sustainability award programs. The list does not attempt to be all-inclusive – this is a rapidly expanding field – but includes the most widely recognised, readily available and relevant resources for university senior management, academic and operational staff and students to support the transition towards sustainability.

5.1 International associations

This list includes only those bodies which are international in scope – i.e. with member universities across several countries. Many nations have their own university sustainability organisations, and many generalist university organisations include sustainability interest groups or activity streams.

Global Higher Education for Sustainability Partnership (GHESP)

"Four international organisations with a strong commitment to making sustainability a major focus of higher education have formed the Global Higher Education for Sustainability Partnership (GHESP). The four founding partners of the initiative – the International Association of Universities, the University Leaders for a Sustainable Future, Copernicus Campus and UNESCO – combine forces in a unique effort to mobilise universities and higher education institutions to support sustainable development in response to Chapter 36 of Agenda 21."

University Leaders for a Sustainable Future (ULSF)

"The mission of the Association of University Leaders for a Sustainable Future (ULSF) is to support sustainability as a critical focus of teaching, research, operations and outreach at colleges and universities worldwide through publications, research, and assessment."

Association for the Advancement of Sustainability in Higher Education (AASHE)

"AASHE is helping to create a brighter future of opportunity for all by advancing sustainability in higher education. By creating a diverse community engaged in sharing ideas and promising practices, AASHE provides administrators, faculty, staff and students, as well as the business that serve them, with: thought leadership and essential knowledge resources; outstanding opportunities for professional development; and a unique framework for demonstrating the value and competitive edge created by sustainability initiatives."

Global University Network for Innovation (GUNI)

"The Global University Network for Innovation - GUNI is composed of the UNESCO Chairs in Higher Education, higher education institutions, research centers and networks related to innovation and the social commitment of higher education. 179 institutions from 68 countries are GUNI members."

International Sustainable Campus Network (ISCN)

"*The International Sustainable Campus Network (ISCN) provides a global forum to support leading colleges, universities, and corporate campuses in the exchange of information, ideas, and best practices for achieving sustainable campus operations and integrating sustainability in research and teaching. The ISCN sponsors a biannual symposium, conferences, several standing committees, has developed a charter that more than 20 world leading universities have endorsed, and is dedicated to building a gallery of outstanding projects that showcase excellence and leadership from all continents.*"

COPERNICUS Alliance

"*The COPERNICUS Alliance is the European Network on Higher Education for Sustainable Development. The vision of the COPERNICUS Alliance is to promote the role of Sustainable Development in European Higher Education to improve education and research for sustainability in partnership with society.*"

International Alliance of Research Universities (IARU)

"*The International Alliance of Research Universities (IARU) is a collaboration between ten of the world's leading research-intensive universities who share similar visions for higher education, in particular the education of future leaders... The Alliance has identified sustainable solutions on climate change as one of its key initiatives. As a demonstration of its commitment to promote sustainability, IARU has sought to lead by example through the establishment of the Campus Sustainability Programs aimed at reducing the environmental impact of our campus activities.*"

Alianza de redes iberoamericanas de universidades por la sustentabilidad y el ambiente - ARIUSA

"*ARIUSA is a network of environmental university created in Bogota October 26, 2007 by a group of University Networks in Environment and Sustainability (RUAS), collected during the "Fourth International Congress University and Environment", organized by the Colombian Network of Education environmental (RCFA).The basic purpose or mission is to promote and support ARIUSA coordination of actions in the field of environmental education superior, and the scientific and academic cooperation between University Networks for Environment and Sustainability*".

5.2. International agreements and declarations

Since the formulation of the Talloires Declaration in 1990, regional and international university conferences have generated a range of agreements, declarations and charters on university sustainability. As at 2011 universities and intergovernmental institutions had developed some 30 university sustainability declarations, and more than 1400 universities worldwide had signed such a document [40]. A declaration represents a high level statement of commitment to a sustainable future; as such it can offer general guidance, but is not designed to provide specific direction. The most widely adopted examples are listed below.

Talloires Declaration

"Composed in 1990 at an international conference in Talloires, France, this is the first official statement made by university presidents, chancellors, and rectors of a commitment to environmental sustainability in higher education. The Talloires Declaration (TD) is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities. It has been signed by over 400 university leaders in over 50 countries."

Copernicus Charter

The University Charter for Sustainable Development is an instrument created by Copernicus, an inter-university co-operation programme on the environment, established by the *Association of European Universities*. *The Charter expresses a collective commitment on behalf of a large number of universities. It represents an effort to mobilize the resources of institutions of higher education to further concept and objective or sustainable development.*

Halifax Declaration

"Over the period 8-11 December 1991, the presidents and senior representatives of 33 universities from 10 countries on 5 continents met in Halifax, Canada to take stock of the role of universities regarding the environment and development. They were joined by a number of senior representatives from business, the banking community, governments, and non-governmental organizations. The meetings were sponsored by the *International Association of Universities, the United Nations University, the Association of Universities and Colleges Canada and Dalhousie University, Canada."* *Creating a Common Future: The Halifax Declaration and Action Plan* was released at the end of the conference.

Swansea Declaration

"At Swansea, Wales, in August 1993, participants in the *Association of Commonwealth Universities (ACU) 15th Quinquennial Congress drawn from over 400 universities in 47 different countries met to address the challenge of 'People and the Environment - Preserving the Balance'. They engaged in a quest for the ways by which the universities of the ACU, their leaders, scholars and students might engage and deploy their unique common traditions and comity to respond appropriately to this challenge."*

Kyoto Declaration

"The Kyoto Declaration on Sustainable Development was issued following the Ninth *International Association of Universities Round Table in 1993. Linked to Agenda 21 and the*

outcomes of the United Nations Commission on Environment and Development Conference in Rio de Janeiro, the Declaration called for universities to seek, establish and disseminate a clearer understanding of sustainable development."

5.3 Online tools and resources

There is a growing list of online resources designed to help universities to develop sustainably. These include self-assessment reporting frameworks and questionnaires, guidelines and case study databanks. Most national sustainable campus associations provide at least some best practice case studies and checklists for reference. The list below includes the more widely known and internationally relevant examples.

Charter and Guidelines (ISCN)

"The ISCN promotes continuous improvement through learning and innovation on all aspects of sustainability on campus. Key goals in this respect are summarized in the ISCN-GULF Sustainable Campus Charter, which is complemented by a detailed Charter Report Guidelines document. The Charter was developed to support universities in setting targets and reporting on sustainable campus development goals and performance."

Sustainability Tracking and Rating System (STARS) (AASHE)

"*The Sustainability Tracking, Assessment & Rating System™ (STARS) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance. STARS® was developed by AASHE with broad participation from the higher education community… The STARS framework is intended to engage and recognize the full spectrum of colleges and universities in the United States and Canada – from community colleges to research universities, and from institutions just starting their sustainability programs to long-time campus sustainability leaders.*"

Sustainability Assessment Questionnaire (ULSF)

"*The Sustainability Assessment Questionnaire (SAQ) is designed to assist you in assessing the extent to which your college or university is sustainable in its teaching, research, operations and outreach. "Sustainability" implies that the major activities on your campus are ecologically sound, socially just, economically viable and humane, and that they will continue to be so for future generations.*"

Sustainable development on campus: Tools for campus decision makers (IISD)

"*The International Institute for Sustainable Development (IISD) is a Canadian-based, public policy research institute that has a long history of conducting cutting-edge research into sustainable development. IISD's Sustainable Development on Campus Tool Kit has been compiled in support of a Memorandum of Understanding between IISD, the International Association of Universities (IAU), and the Earth Council, in which the Association of Canadian Community Colleges (ACCC) has also participated, to assist institutions of higher education to meet the challenges of the Kyoto Declaration.*"

International Alliance of Research Universities campus sustainability toolkit (IARU)

"*The six-point toolkit includes strategies to address the following elements: mapping current situation and developing a governance structure; measuring environmental impacts; integrating campus activities; determining goals and a strategy for the process; establishing strategies to create a sustainable campus; and education and awareness. Accompanying*"

the online toolkit are resources, strategies, and case studies on sustainability efforts by IARU members." IARU is an alliance of ten of the world's leading research-intensive universities.

Learning in Future Environments (LiFE) **(UK and Australasia)**

"Learning in Future Environments (LiFE) is a comprehensive performance improvement and benchmarking system developed specifically to help colleges and universities to manage, measure, improve and promote their social responsibility and sustainability performance... The system reflects not only the specific nature of the Further and Higher Education Sector but also the uniqueness of each institutional, their context and their individual approaches to embedding sustainability and social responsibility... LiFE is developed and delivered by the Environmental Association for Universities and Colleges in partnership with Australasian Campuses Towards Sustainability.

Second Nature **(USA)**

"Second Nature's mission is to accelerate movement toward a sustainable future by serving and supporting senior college and university leaders in making healthy, just, and sustainable living the foundation of all learning and practice in higher education. Second Nature is a Commonwealth of Massachusetts nonprofit public benefit corporation, and a tax-exempt charitable organization as described in section 501(c)(3) of the United States Internal Revenue Code."

Higher Education Associations Sustainability Consortium **(USA)**

"HEASC is an informal network of higher education associations (HEAs) with a commitment to advancing sustainability within their constituencies and within the system of higher education itself. The current member associations that make up HEASC see the need for developing in-depth capability to address sustainability issues through their associations and have decided to work together in this effort. HEASC hopes to involve all higher education associations to get the broadest perspectives and produce the greatest effectiveness and synergy in our efforts."

Healthy Universities Toolkit **(UK)**

"A Healthy University aspires to create a learning environment and organisational culture that enhances the health, wellbeing and sustainability of its community and enables people to achieve their full potential…This toolkit comprises a collection of resources created by the Developing Leadership and Governance for Healthy Universities Project and is designed to support Higher Education Institutions (HEIs) that wish to adopt and/or embed a whole system Healthy University approach."

Good Campus **(UK)**

"We provide guidance (e.g. cases, guides, white papers), networking and tools on sustainability - and especially energy and resource efficiency - in knowledge-intensive organisations. We began, and retain a strong presence, in universities but now also work in health, hitech, pharma and similar areas."

Sustainable University 21 One-stop Shop (Asitha Jayawardena, UK)

"This website is a one-stop shop for resources for initiatives in sustainability in higher education in the UK and outside. And it strives to promote the Sustainable University concept around the world – within and outside universities."

Sustainable Procurement Centre of Excellence for Higher Education (UK)

"The Sustainable Procurement Centre of Excellence for Higher Education (SPCE) is a 4 year project funded by the Higher Education Funding Council for England (HEFCE). The project began in October 2009 and intends to make demonstrable changes to the ways Higher Education Institutions (HEIs) embed sustainable procurement into their standard procedures, practices and policies."

Environmental Association for Universities and Colleges Resource Bank (UK)

"Built up by the sector for the sector, the Resource Bank is a hugely important and useful long-term resource. The Bank is comprised of 11 key sector areas, in each you will find a growing collection of sector generated resources plus related case studies, forthcoming events and current news."

Sustainable Development on Campus – Tools for Campus Decision Makers (International Institute for Sustainable Development, Canada)

"These tools will help you to learn more about sustainable development and its relevance to you and your institution. There are learning modules, case studies, action plans, environmental policies, resources, forums and contacts - all designed to help you, as part of the administration, as a student, or a member of faculty, implement sustainable development on your campus."

Virtual Sustainability Platform in Universities (www.projetosustentabilidade.sc.usp.br)

(Consortium: University of São Paulo, Brasil; Autonomous University of Madrid (Spain) and the Pontifical Catholic University of Rio Grande do Sul (Brazil))

*The **Virtual Sustainability Platform** is a digital space created to stimulate the participation of the university community in evaluating and learning about sustainability in the campus. In it, users register and share personal, group and institutional initiatives concerning sustainability. The platform has also a sustainability test, which poses questions to the reader about his/her university related to institutional commitment, management (waste, energy, water, mobility, buildings, green purchasing, green areas), curriculum greening and participation in decision making. After each block of questions the user receives information of the situation in his/her campus, previously prepared by the staffs of the universities involved. The results are shared and discussed with managers and directors to improve activities, projects and programs towards sustainability.*

5.4 Books and journals

From a base of virtually no published material 20 years ago, accumulating practical experience and theoretical reflection on university sustainability has generated a lively and expanding literature which includes a small shelf of books, a dedicated, peer-reviewed journal and hundreds of specialist papers published in education, environmental, policy and other publications. The key published sources of information (as at 2011) are listed below. The explanatory text is taken from the relevant websites.

International Journal of Sustainability in Higher Education **(IJSHE)**

"*The IJSHE is the first fully refereed academic journal for the analysis of environmental and sustainability programs and initiatives at colleges and universities worldwide… The journal will be of special interest to higher education institutions and to those working on them.*"

Solutions

"Solutions *is an online and hard-copy journal and magazine providing substantive discussion on the integrated design and analysis of human social and economic systems, ecological systems, urban environments and building and all other components of the earth system to achieve a desirable and sustainable human future.* Solutions *is a ULSF partner."*

Higher Education Quarterly

"*Higher Education Quarterly *publishes articles concerned with policy, strategic management and ideas in higher education. A substantial part of its contents is concerned with reporting research findings in ways that bring out their relevance to senior managers and policy makers at institutional and national levels, and to academics who are not necessarily specialists in the academic study of higher education.*"

Journal of Education for Sustainable Development **(JESD)**

"*The* Journal of Education for Sustainable Development *(JESD) is a forum for academics and practitioners to share and critique innovations in thinking and practice in the emerging field of Education for Sustainable Development (ESD). A peer-reviewed international journal, JESD aims at global readership and is published twice a year.*"

Perspectives: Policy & Practice in Higher Education

"*Perspectives: Policy & Practice in Higher Education *provides higher education managers and administrators with innovative material which analyses and informs their practice of management.*"

Campus Ecology, by April Smith and the Student Environmental Action Coalition (1993)

"*This book is designed to take the environmental issues and principles currently being studied in the classroom and move them outside the classroom doors into the campus community and the larger world. By making environmental knowledge part and parcel of campus environmental practice, students, faculty, and administrators have an extraordinary opportunity to act as agents of environmental education and change.*"

Ecodemia: Campus Environmental Stewardship at the Turn of the 21st Century, by Julian Keniry (1995)

"*At campuses around the country, staff, administrators, faculty, and students are redesigning the basic principles on which their institutions operate from day to day. The winners in this*

transformation are the global environment, local communities, campus morale, and the institutions' fiscal bottom-line. Now, the [US] National Wildlife Federation's Campus Ecology Program has documented these management innovations in a comprehensive new book based on extensive interviews with the people behind the green practices."

[**Greening the Ivory Tower**](#), by Sarah Hammond Creighton (1998)

"*Universities can teach and demonstrate environmental principles and stewardship by taking action to understand and reduce the environmental impacts of their own activities.* Greening the Ivory Tower*, a motivational and how-to guide for staff, faculty, and students, offers detailed "greening" strategies for those who may have little experience with institutional change or with the latest environmentally friendly technologies.*"

[**Sustainability and University Life**](#), edited by Walter Leal Filho (1999)

"Sustainability and University Life*, as the title implies, identifies various ways by which sustainability may be brought closer to a university´s routine. By means of critical analyses, case studies and examples from North American, European and African universities, the book not only discusses the problems faced with the promotion of sustainability at institutional level, but also shows how sustainability is being put into practice by a number of higher education institutions.*"

[**Planet U: Sustaining the World, Reinventing the University**](#), by Michael M'Gonigle & Justine Starke (2006)

"*Planet U *places the university at the forefront of the sustainability movement. Questioning the university's ability to equip society to deal with today's serious challenges such as economic growth, democratic citizenship and planetary survival, it calls for a new social movement to take a lead in reforming the university - the world's largest industry.*"

[**Degrees that Matter**](#), by Ann Rappaport and Sarah Hammond Creighton (2007)

"*Universities and colleges are in a unique position to take a leadership role on global warming. As communities, they can strategize and organize effective action. As laboratories for learning and centers of research, they can reduce their own emissions of greenhouse gases, educate students about global warming, and direct scholarly attention to issues related to climate change and energy.* Degrees That Matter *offers practical guidance for those who want to harness the power of universities and other institutions, and provides perspectives on how to motivate change and inspire action within complex organizations.*"

[**Reinventing Higher Education: Toward Participatory and Sustainable Development**](#) (UNESCO, 2007)

In 2007, the Asia-Pacific Programme of Educational Innovation for Development (APEID), UNESCO Bangkok, convened the 11th UNESCO-APEID Conference entitled "Reinventing Higher Education: Toward Participatory and Sustainable Development." This volume contains selected papers from that conference, held in Bangkok from 12 to 14 December 2007.

[**Financing Sustainability on Campus**](#), by Ben Barlow and Andrea Putman (2009)

"*In* Financing Sustainability on Campus*, Ben Barlow, with guidance from Andrea Putman, provides higher education leaders with a comprehensive handbook to financing sustainability with real world examples, creative strategies, and clear explanations of a wide variety of financial tools and programs.*"

Section 6: Greening your university brochure

[This is proposed as a tri-fold A4 brochure which will provide a contextual summary and diagrammatic step-by-step guide derived from the Toolkit. It is suggested that this task be included in the UNEP editing process.]

Front

Back

Section 6: Greening your university brochure
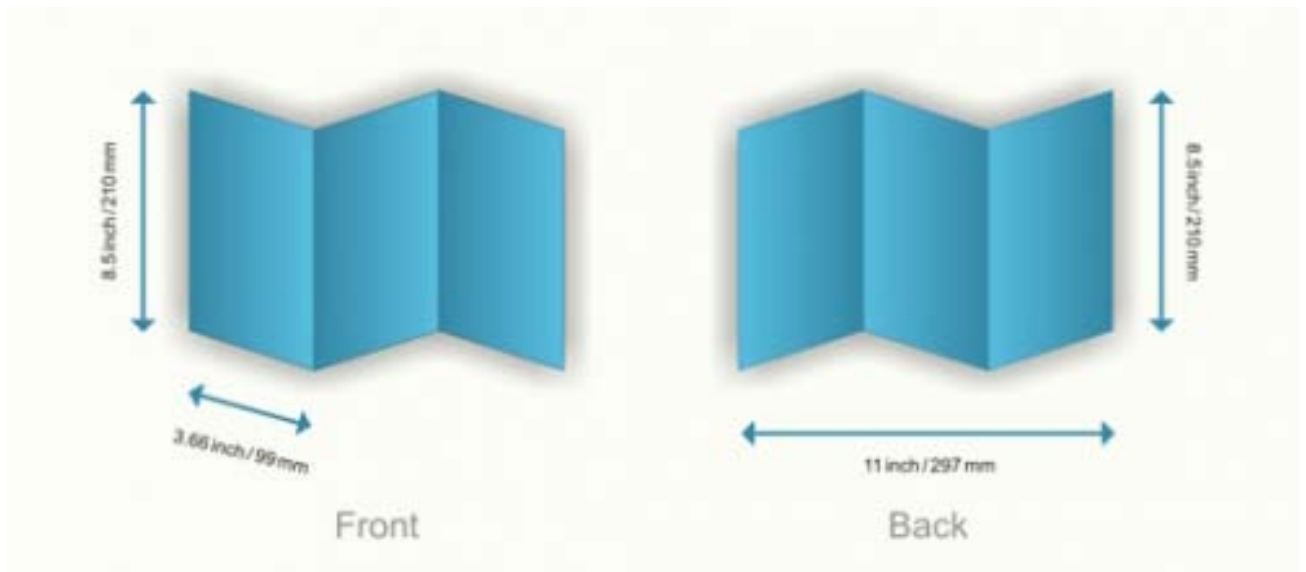
Section 7: Global exemplars

As part of this toolkit's goal to provide information that can assist those universities that are beginning their journey of campus greening, this section provides a compilation of various case studies of exemplary campus greening initiatives from around the world.

The objective of this section is,

- to inspire, encourage and facilitate learning through real-world examples.

- to acknowledge different physical, socio-economic and environmental contexts

- to document different ways and aspects of greening

    o   issues and opportunities

    o   strategies and initiatives

    o   benchmarks and performance indicators

The information on each case study is presented in a concise and standard format, which has three broad sections. The first one presents a general background or context to the project, lists target beneficiaries, and outlines UNEP thematic priority area as well as the area of the greening. The second section outlines various issues identified, initiatives implemented and outcomes achieved or expected. The third section presents quick facts of the project: evidence of measured improvement; size, cost and year of implementation; funding; and finally information source for this case study.

As discussed earlier, evidence based study is essential in avoiding greenwash. The following case studies, therefore, clearly list any specific targets of greening initiatives and specify any evidence of measured improvements in the project's environmental performance.

This list of global exemplars is expected to grow over time as more and more examples of campus greening initiatives are implemented and accurate information is made available for inclusion in this toolkit.

CASE STUDY: AUSTRALIA

Tyree Energy Technologies Building (TETB), University Of New South Wales (UNSW)

General Description:

- The University of New South Wales (UNSW) each year educates more than 50,000 students from over 120 countries in eight faculties.
- The Tyree Energy Technologies Building (TETB) is located on the university's main campus on a 38-hectare site in Kensington.
- The six storey building of the TETB, which is used largely by the Faculty of Engineering, features teaching and learning spaces, workshops and display spaces, research spaces including wet and dry labs and a cafe.
- The TETB's laboratories will support the ongoing research of UNSW researchers in world record-breaking solar photovoltaic technologies, sustainable clean fuels, smart grids, energy storage, energy economics and policy analysis.
- The TETB is also an educational hub for undergraduate and postgraduate students, providing an optimal learning environment for expert engineers and analysts.

Target beneficiaries:

Community largely at university and regional level, but also at global level.

UNEP thematic priority area:

Climate change; Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Research & Development
- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

Indoor environmental quality; energy consumption; water conservation; and carbon emission

Outcomes:

- Environmental Management – The head Contractor, Brookfield Multiplex, is ISO 14001 certified ensuring that sound environmental practices are involved in all decision making processes associated with the design and construction of the building
- Waste Management – The construction waste management plan and agreements with waste contractors ensured over 80% of the construction waste being recycled or re-used.
- Indoor Environment Quality – Furniture and finishes have been carefully selected to reduce off-gassing of Volatile Organic Compounds and Formaldehyde, and improve air quality.
- Tri-generation – A tri-generation plant is installed not only to service the TETB but also to export both electricity and chilled water to surrounding buildings. This ensures that the tri-generation system operates for longer hours and maximises the benefit of the reduced carbon emissions provided by this method of power and chilled water production.
- Energy Efficiency – Air conditioning load is reduced by linking the air conditioning controls to motion sensors and carbon dioxide sensors in all spaces. An underground labyrinth and borewater is also used to pre-cool/warm incoming outside air.
- Energy Production – In addition to the tri-generation system it is also furnished with 1,000sqm of photo-voltaic panels which will produce up to 150KW of electrical energy.
- Water re-use – An existing bore feeds into a storage tank which also collects rainwater from the roof. This systems feeds into the campus borewater system which is then treated and returned to buildings as non-potable water. This is used in TETB for toilet flushing, laboratory water and makeup to the evaporative cooling systems. Fire system testing water and run-off from hardstand area is also returned to the aquifer through the percolation chamber.
- Water efficiency – Water efficient fixtures are used throughout the building, including waterless urinals. The cooling of the tri-generation system is provided by a hybrid Muller 3C cooling tower which only uses water for evaporation when ambient conditions are extreme and loads are high. This is fed by non-potable, treated borewater and rainwater.

Evidence / Assessment / Rating:

'6 Star Green Star Design' rating (World Leadership) for an Education facility by the Green Building Council of Australia.

Size of implementation: Approx. 15,000 sqm facility

Cost of implementation (US $): Approx. $81.6 million

Year of implementation (construction): February 2010 – February 2012

Funding partners:

Education Investment Fund Initiative of the Australian Government ($75 million),
Sir William Tyree, who donated $1 million and pledged a further bequest of $10 million

Source:

UNIVERSITY OF NEW SOUTH WALES. n.d. *Key Projects: Tyree Energy Technologies Building* [Online]. Available: http://www.keyprojects.unsw.edu.au/project/tyree-energy-technologies-building [Accessed 18 March 2012].

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP) 2011. Innovations and Best Practices on Education for Sustainable Development and Sustainability in Universities – Success Stories from Around the World.

CASE STUDY: CANADA

Centre for Interactive Research on Sustainability (CIRS), University of British Columbia (UBC) Vancouver Campus
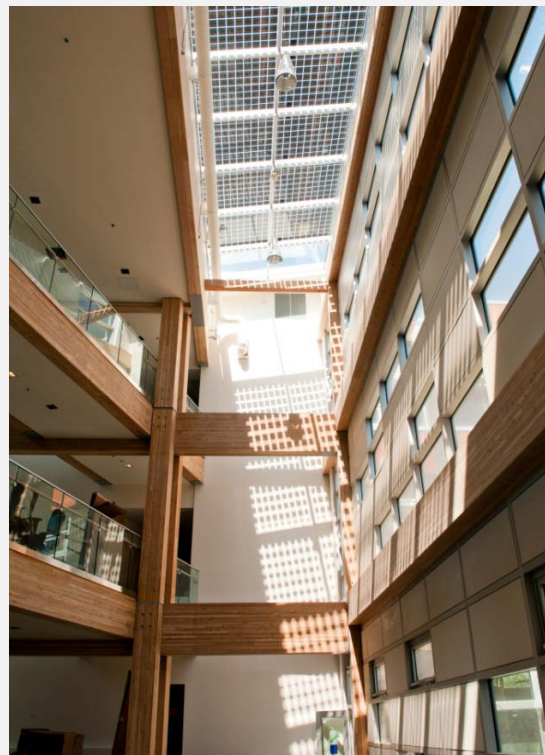
General Description:

- The Vancouver Campus of the UBC educates more than 47,000 students each year in hundreds of academic programs through 12 faculties and 14 schools.
- CIRS will house more than 200 inhabitants from several academic disciplines, including applied science, psychology, geography, forestry and business.
- CIRS is also the home of the UBC Sustainability Initiative (USI), which promotes and integrates UBC's sustainability efforts in teaching, learning, research and campus operations.
- Major features of the four-storey, 60,000 square-foot facility include: a four storey atrium and lobby areas for display and demonstrations, BC Hydro Theatre with advanced visualization and interaction technologies to engage audiences in sustainability and climate change scenarios, Policy Lab, Building Simulation Software Lab, Solar Simulation Daylighting Lab, Sustainability Education Resource Centre, Building Monitoring and Assessment Lab with a building management system that shares building performance in real-time, 450-seat CIRS Lecture Hall, CIRS Inhabitants' space, and the Loop Café that uses no disposable packaging and serves local and organic food.

Target beneficiaries:

Community largely at university and regional level, but also at global level.

UNEP thematic priority area:

Climate change; Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Research & Development
- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

Urban population explosion; unprecedented demand for housing, amenities and necessities in the coming decades; increased consumption of natural resources; although working hard to find and implement solutions, the public, private and not-for-profit sectors are largely working in isolation, not benefiting from each other's discoveries.

Outcomes:

- North America's greenest building by being net positive on energy, water self-sufficient, having 100% access to daylight and superior natural ventilation amongst many other sustainability features.
- It will be an international centre for research, partnership and action on sustainability issues, including green building design and operations, environmental policy and community engagement.
- CIRS is used as a platform to test and showcase the technical performance and usability characteristics of the building's technologies and systems, and to generate new knowledge about how to construct and maintain sustainable buildings using building itself as the lab.
- All of the CIRS building systems, as well as the behaviour of its inhabitants, will be the subject of extensive and ongoing research, to study building performance and how people interact with the space over time making it a 'living laboratory'.
- CIRS will be the only place in the world combining three activities – sustainable building design and operations, sustainability-focused partnerships and the development of interactive community engagement processes – under one umbrella.

Evidence / Assessment / Rating:

LEED Platinum rating. Aims to achieve 'The Living Building Challenge' certification with the help of its various regenerative features that create 'Net Positive' environmental impacts.

Size of implementation: Approx. 5,600 sqm (60,000 square-foot) facility

Cost of implementation (US $): 37 million (less than 10% over equivalent LEED Gold rated building)

Year of implementation (construction): March 2009 – August 2011

Funding partners:

Major funding partners include British Columbia Knowledge Development Fund (BCKDF), British Columbia Ministry of Advanced Education, British Columbia Ministry of the Environment, Canada Foundation for Innovation (CFI), Federation of Canadian Municipalities, Kresge Foundation, McCall MacBain Foundation, Metro Vancouver, National Research Council - Institute for Fuel Cell Innovation, Natural Resources Canada, Real Estate Foundation, Sustainable Development Technology Canada (SDTC), etc.

Source:

THE UNIVERSITY OF BRITISH COLUMBIA. *Sustainability* [Online]. Available: http://www.sustain.ubc.ca/ [Accessed 15 January 2012].

CASE STUDY: DENMARK
University of Copenhagen

General Description:

- The University of Copenhagen was founded in 1479.
- The University has about 1,000,000 sqm premises on four campus areas in central Copenhagen. The University consists of 8 faculties and more than 100 departments and research centres. It has more than 7,000 employees and over 37,000 students.
- The University is working towards becoming one of the Europe's most green campus areas.
- The University's Green Lighthouse, Denmark's first carbon-neutral public building, is located at the Faculty of Science. It has been built in less than a year and it houses the Student Service Centre. The Green Lighthouse also hosts The Copenhagen Innovation and Entrepreneurship Lab (CIEL). It is the place of work of 19 people.

Target beneficiaries:

Community largely at university and regional level, but also at global level.

UNEP thematic priority area:

Climate change; Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Research & Development
- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

The university, considering its size and research profile, recognises its 'green responsibility' and wishes to become one of the greenest campuses in Europe.

Outcomes:

- The university aims to reduce its energy consumption and greenhouse gas emissions by 20% between 2006 and 2013.
- Ongoing engagement and collaboration with both internal and external partners to achieve more sustainable campus; active involvement of faculties and student organisations.
- Improving thermal performance of existing buildings, energy smart installations in buildings, facilitating energy smart conducts by employees and students, and energy efficient purchases.
- The energy savings projects are expected to result in annual reduction of 1700 tons of CO_2 emissions and annual saving of DKK 4.6 million.
- Global collaboration to communicate and share own experiences with the sustainability efforts with other universities such as through International Alliance of Research Universities (IARU) collaboration and International Sustainable Campus Network (ISCN).
- By 2013, at least 75% of all purchases via purchase agreements to require sustainability.
- The University develops an annual Green Campus Action Plan.
- Partnered in creating the Green Lighthouse, Denmark's first carbon-neutral public building, which provides for its total energy needs with 35% of solar energy and 65% of district heating with heat pump. 76m^2 of solar cells on the roof power the building's lighting, ventilation and pumps.

Evidence / Assessment / Rating:

Green Lighthouse is a CO_2 neutral building in operation.

Size of implementation: 1,000,000 sqm for all premises and 950 sqm for Green Lighthouse.

Cost of implementation (US $): Approx. $6.6 million (DKK 37 million) for Green Lighthouse; Approx. $1.8 million (DKK 10 million) for energy and climate efforts; Approx. $45,000 (DKK 250,000) for student sustainability initiatives.

Year of implementation (construction): 2008 –2009 (Green Lighthouse)

Funding partners:

The Ministry of Science, Technology and Innovation (DKK 33 million); VELUX, VELFAC, Windowmaster and Faber (DKK 3.5 Million); and Rockwool, Veksø, Knauf and Danogips (DKK 500,000).

Source:

UNIVERSITY OF COPENHAGEN. n.d. *Green Campus* [Online]. Available: http://climate.ku.dk/green_campus/ [Accessed 18 March 2012].

VELUX. n.d. *Experiment # 2 - Green Lighthouse* [Online]. Available: http://www.velux.com/sustainable_living/model_home_2020/green_lighthouse [Accessed 24 March 2012].

CASE STUDY: KENYA
University of Nairobi

General Description:

- The University of Nairobi, the only institution of higher learning in Kenya, has so far offered academic programs and specialisation in approximately 200 diversified programs on its seven campuses in the capital city.
- The University recognizes that it has a responsibility to manage its activities in a way that reduces the negative environmental impacts and enhances positive impacts.
- Inspired by the above, the key aspects of its greening include: Strategic planning and implementation; Education and Awareness; Safety and Health; Monitoring and Reporting; Communication; Purchasing Policy and; Environmental Management System.
- The University is committed to developing and sustaining an Environmental Management System (EMS) based on the International Standard ISO 14001. The EMS, together with the ISO 9001- 2000 Standard, have been adopted for achieving the University's Environmental Policy, including compliance with legislative requirements and the measurement of continual improvement targets and outcomes. An environmental audit was carried out in 2008 as per the requirements of the Environmental Management and Coordination Act 1999, and the Environmental Impact Assessment and Audit Regulations 2003.
- The audited areas include Waste management; Energy management; Water management and economy of use; Noise evaluation and control; Indoor air quality; Emergency prevention and preparedness; Staff/student environmental awareness and training; environmental management system, and a University Environmental Policy.

Target beneficiaries:

The University and local communities as well as the global community.

UNEP thematic priority area:

Climate change; environmental governance; harmful substances and hazardous waste; and Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

The environmental audit highlighted that:
- The University does not have an Environmental Policy to guide its operations.
- The measurement culture at the University is weak as far as resource use and waste generation are concerned.
- Although there is a procurement policy which is informed by the Government Act, environmental considerations do not seem to be important in the procurement of goods and services for the different University units.
- The University does not have an asbestos management plan despite having buildings with asbestos roofing.
- No recycling takes place at the University.
- There has been no air quality or noise monitoring at any site in the University.
- There is need for staff awareness and training in environmental matters.

Outcomes:

- The University developed its environmental policy in 2009; and a maintenance policy for all assets owned by the University in 2010 mainstreaming environmental considerations.
- Following the initiative, top management in the University are now aware, supportive and committed to improving the environmental performance of the University.
- All units of the university, as well as to some degree the students, have embraced environmentally sustainable practices.
- The University intends to appoint a Standing Environmental Policy Steering Committee and allocate budgets for environmental management as stated in the Environmental Policy.

Evidence / Assessment / Rating:

Only university in Kenya to conduct an environmental audit of its products and services.

Size of implementation: To be provided

Cost of implementation (US $): To be provided

Year of implementation (construction): 2008 – Ongoing

Funding partners: To be provided

Source:

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP) 2011. Innovations and Best Practices on Education for Sustainable Development and Sustainability in Universities – Success Stories from Around the World.

UNIVERSITY OF NAIROBI. 2011. *Introduction* [Online]. Available: http://www.uonbi.ac.ke/about [Accessed 24 March 2012]

UNIVERSITY OF NAIROBI. 2010. *Annual Report 2010* [Online]. Available: http://www.uonbi.ac.ke/sites/default/files/UON%20AR%202010%20WEB.pdf [Accessed 24 March 2012].

CASE STUDY: TURKEY
Middle East Technical University (METU)

General Description:

- The Middle East Technical University (METU) is located on a 4500 hectare Campus about 20 km from the centre of Ankara; it includes 3043 hectare of forest area and the Lake Eymir.
- ETU runs about 206 programs serving over 24,500 students including more than 1,700 students from over 85 different countries.
- METU plays a key role in the greening of Ankara through its comprehensive re-forestation program. Preliminary planning for the METU Re-forestation and Landscaping Program began in 1958 in response to two major incentives: First, being that the capital city Ankara, which is surrounded by hills, suffers from heavy air pollution. Second was that, the Turkish law supports for green zone next to Ankara. This law states that forest land cannot be expropriated, thereby encouraging the creation of newly planted woods to limit urban sprawl.
- The Re-forestation Program has led to the successful planting of some ¾ of the campus area. Every year, over 20,000 trees are planted by students, staff and alumni.
- The initiative was further inspired by the fact that 4500 hectares were available for this purpose. The area was formerly a degraded, barren pasture of wheat fields once covered with primal forests. By 1960, the university's department of landscaping had tested tree species that would be appropriate, and in 1961, the re-forestation program commenced.

Target beneficiaries:

Community largely at university and the residents of the city of Ankara.

UNEP thematic priority area:

Climate change; Ecosystem management; Environmental governance; Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

Disappearance of wilderness, degradation of biodiversity and extinction of species due to urbanisation and other human processes.

Outcomes:

- The area with non-irrigational plants now covers 3000 hectares. Plants that require irrigation cover 800 hectares, and are located within the built environment of the Campus where they form a beautiful landscape along the pedestrian network. The remaining 500 hectares consist of lakes and ponds. The flora at METU consists of more than 250 species, some of them native, others from other parts of Turkey.
- The forest area created not only contributes to the quality of campus life for the users, but also to the urban quality of life for the entire Ankara region. Additionally, and more importantly, it provides a broad range of other environmental services.
- The METU green area helps purifying Ankara's air, filters wind and noise, stabilizes the microclimate; i.e. makes the city much more sustainable and livable. In 1995, the Re-forestation Program received the Aga Khan Award for Architecture. The habitats created by the planted area, step and lake-shore areas provide living conditions for many species of mammals, birds, fish and butterflies. A recent research found out that two endemic butterfly species are living on the METU Campus.
- The built environment in METU has been created in line with sustainable design principles and includes the use of local construction materials. One of the buildings under construction is designed to include photovoltaic panels that will provide energy for the operation of the basic equipments within the building.
- The University, with an active participation of students, staff and alumni, organises an annual afforestation festival on the Campus.
- The University has an Afforestation and Landscape Department which provides maintenance and implementation strategy for plants. Decision-making on the sustainable development of the Campus belongs to the Presidency and its related offices. The Commission for University's Spatial Strategy and Development focuses on the preservation of greenery, while responding to the spatial development needs of the Campus.

Evidence / Assessment / Rating:

Specific research on heat island in and around Ankara has shown beneficial cooling effect around METU campus.

Size of implementation: Approx. 4,500 hectare campus

Cost of implementation (US $): To be provided

Year of implementation (construction): 1958 – Ongoing

Funding partners:

National government's Ministry of Forestry provided trees during the 1960s; General Directorate of Afforestation and Erosion Control annually provids 20000-25000 tree seedlings; and Business and Industry provides grants for new energy-efficient buildings.

Source:

MIDDLE EAST TECHNICAL UNIVERSITY. n.d. *General Information* [Online]. Available: http://www.metu.edu.tr/general-information [Accessed 21 March 2012].

UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP) 2011. Innovations and Best Practices on Education for Sustainable Development and Sustainability in Universities – Success Stories from Around the World.

CASE STUDY: USA
Princeton University

Before   After

General Description:

- Princeton University was originally established in 1746.
- The university's main campus in Princeton Borough and Princeton Township consists of approximately 180 buildings, spanning more than four centuries, on 500 acres. The university follows a residential college system and 98% of the undergraduate students live on the campus.
- The university's more than 1,100 faculty members educate more than 7,500 students each year in 34 departments and 46 interdisciplinary certificate programs.
- The campus is expected to serve as a model for advanced practices and as a laboratory for students and faculty to test new approaches.
- The Princeton Sustainability Committee consisting of students, faculty, and staff was established in 2002, and the Office of Sustainability was set up in 2006, which prepared a Sustainability Plan in 2008 identifying three priority areas for the campus: Greenhouse Gas Emission Reduction, Resource Conservation, and Research, Education and Civic Management.

Target beneficiaries:

Community largely at university, but also at regional and global level.

UNEP thematic priority area:

Climate change; Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Research & Development
- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

University's environmental impacts; responsibility as a major research university to contribute to shaping the national sustainability agenda, to promote the development of sustainability on its campus, and to prepare its students.

Outcomes:

- The university aims to reduce its greenhouse gas emissions to 1990 levels by 2020, while expanding its campus by 185,000 m^2.
- All non-laboratory buildings are expected to be 50% more energy-efficient than required by regulations. Implementation of its Energy Master Plan has resulted in annual savings of $1.7 million in energy costs and 10,000 metric tons of CO_2.
- The university will provide incentives to the faculty and students to reduce the number of cars coming to the campus by 10%.
- All residence halls have low-flow water fixtures, which are estimated to have cut water use from 2006 by 30%.
- The university purchased 29% less paper in 2011 than in 2008. A total of 83% of the paper purchased in 2011 was of 100% post-consumer recycled chlorine-free paper.
- Various resource conservation initiatives have increased sustainable food purchases to about 66%, and about 59% of the food served in the dining halls comes from within 250 miles radius.
- In the past one year more than five acres of woodlands were restored with 215 new trees and 197 new shrubs.
- Greening of the curriculum has resulted in over 50 classes having a sustainability component. There has been an increase in the number of students receiving Environmental Studies certificates by 300%.

Evidence / Assessment / Rating:

Life Cycle Cost Analysis (LCCA), including a CO_2 tax, informed decision making process is applied to new construction and major renovations on the campus. It strives for LEED Silver equivalency wherever applicable. About 30 staff members are LEED-Accredited Professionals. The University has signed on to the Sustainability Tracking, Assessment and Rating System (STARS), a transparent, self-reporting framework for colleges and universities to measure their sustainability performance

Size of implementation: Approx. 500 acres campus

Cost of implementation (US $): $45 million between 2009 and 2017 under its Energy Master Plan initiative. Since 2008 $5.3 million have been invested in energy saving and emission reduction projects.

Year of implementation: 2008 – 2020

Funding partners:

High Meadows Foundation

Source:

PRINCETON UNIVERSITY. *Sustainability at Princeton* [Online]. Available: http://www.princeton.edu/sustainability/ [Accessed 12 February 2012].
THE PRINCETON REVIEW. 2011. *Guide to 311 Green Colleges* [Online]. The Princeton Review. Available: http://www.princetonreview.com/uploadedfiles/sitemap/home_page/green_guide/princetonreview_greenguide_2011.pdf [Accessed 12 February 2012]

CASE STUDY: CHINA
Tongji University, Shanghai

Shanghai campus

Architectural Design & Research Institute

General Description:

- Tongji University has four campuses, with the total area of 1,501,281 m^2, and 420 buildings where around 39,000 students study every year in 29 faculties.
- The University recognizes that it has a responsibility to manage its activities in a way that reduces the negative environmental impacts and promotes sustainability.
- Tongji University established a Management Committee, an Expert Committee and a Management Office to share the responsibilities of the sustainable campus construction, and identifies three priority areas for sustainable campus construction, namely energy conservation in research, management, and education.
- Tongji University initiated the setting up of the China Green University Network (CGUN), which consists of 8 core universities and 2 research institutes and Tongji University acts as the first chairmanship. CGUN is leading the construction of sustainable campuses in China and its influence is growing fast in the world.

Target beneficiaries:

Community largely at university and regional level, but also at global level.

UNEP thematic priority area:

Climate change; Resource efficiency (sustainable consumption and production).

Project/Innovation area:

- Research & Development
- Greening of University infrastructure/facilities/operations
- Community collaboration
- University management
- Student participation/engagement

Identified issues:

The need to take responsibility as a major research university to contribute to shaping of the national sustainable campus agenda. The need to promote sustainability on its campuses in terms of energy use, research, education, student engagement, and social service.

Outcomes:

- Campus energy management system (CEMS) is established to monitor and report energy use of the whole university, and 182 buildings have online monitoring.
- Commissioned by Chinese government, Tongji University composed five national technical guidelines for the construction and operation of CEMS, which are implemented in 120 universities.
- In total 91 course have been developed that include sustainability in their curricula.
- Various initiatives on sustainability have effectively stimulated students' interest in sustainable design; they have successfully designed a bamboo solar house and a container solar house showing good sustainable concepts in Solar Decathlon in 2010 and 2011.
- Building retrofit of total area of 296,647 m^2 is on progress since 2009, which includes the use of sewage source heat pumps, water recycling projects, vertical and roof greening, etc. in addition to energy and water efficiency measures.
- One of the retrofit projects included renovation of an existing abandoned car parking building, which was originally planned to be demolished, into an office building of five stories and 68,000 m^2. The building, for Architectural Design & Research Institute (ADRI), is now a demonstration building with a 630KWp BIPV system and a centre of education on energy conservation and renewable energy technologies.
- The University intends to publish an annual report on sustainable campus innovations implemented that year.

Evidence / Assessment / Rating:

- In 2007, The University received a national award of annual demonstration project of building energy conservation in China.
- In 2008, it received the 1st prize of the Progress Award in Science and Technology issued by the Ministry of Education in China - Demonstration and Integration of Technologies in Sustainable Campus Construction.
- Per capita energy and water use has been reduced by 5.6% and 14.8% respectively between 2010 and 2011.
- The BIPV system on the ADRI building covers 6600 m^2 of the roof area, generates 535MWh of electricity every year and provides an annual reduction in CO_2 emission by about 566 tons.

Size of implementation:

Campus energy management system in approx. 1.16 million m^2 in 182 buildings; Total floor area of building retrofits of about 296,647 m^2. Adaptive reuse of the existing car parking building into an office building of 68,000 m^2 for ADRI.

Cost of implementation (US $):

$1.3 million for the establishment of Campus energy management system; $7.62 million for building retrofit projects; $16 million ADRI.

Year of implementation: Overall campus initiatives: 2003 – Ongoing; ADRI: 2009 – 2010

Funding partners:

Ministry of Housing and Urban and Rural Development (MOHURD); World Bank Loan Program; and Shanghai Government.

Source:

Information provided by Dr. Shuqin Chen from Tongji University, based on
Acceptance report on Demonstration Project of Solar PV Buildings for Ministry of Finance and Ministry of Housing and Urban and Rural Development (MOHURD); and
Annual Report of Sustainable Campus Innovation of Tongji University, 2011.

Additional case studies:

Bond University Mirvac School of Sustainable Development, Australia
http://www.bond.edu.au/faculties-colleges/institute-of-sustainable-development-architecture/about-the-institute/facilities/index.htm

University of Sao Paulo, Brazil
www.projetosustentabilidade.sc.usp.br

Pontifical Catholic University of Rio Grande do Sul, Porto Alegre (city), Brazil
http://www.isabelcarvalho.blog.br

University of Northern British Columbia, Canada
http://www.unbc.ca/green/energy.html

TERI University, India
http://www.teriin.org/index.php?option=com_content&task=view&id=32

Harvard University, USA
http://green.harvard.edu/node/899

Washington University in St. Louis, Missouri, USA
http://www.aashe.org/resources/case-studies/getting-net-zero-energy-lessons-learned-living-building-challenge

University of Texas at Dallas, USA
http://www.aashe.org/files/resources/student-research/2009/supplemental_materials.pdf

Section 8: Technical Appendix

The sustainability literature documents a wide variety of methods for selecting indicators, setting objectives and targets and other quantitative aspects of sustainability management. In addition, many universities have developed their own approaches. This Appendix sets out some models which may offer additional guidance. It is envisaged that as with the case studies presented in this Toolkit, universities will be able to submit examples of their own models and methods, by way of contributing to continual improvement in university sustainability management practice. This may also provide a useful framework to support learning and teaching in sustainability and to stimulate research.

8.1. Selecting indicators

In general, an optimal indicator set can be described in terms of several desirable characteristics (for example the five characteristics comprising the well-known "SMART" model (Simple, Measurable, Accessible, Relevant and Timely). A more detailed consideration of indicator selection is given in the *Bellagio Principles concerning selection of sustainability indicators* [80]. Table 8.1 outlines a set of five characteristics of an optimal indicator set derived from a synthesis of the SMART test and the *Bellagio Principles*, together with the detailed criteria which define these characteristics.

Multi-criteria analysis has proved to be a useful method to achieve broad agreement around a suitable indicator set. A typical definition of multi-criteria analysis is "a decision-making tool developed for complex multi-criteria problems that include qualitative and/or quantitative aspects of the problem in the decision-making process" [81] or simply, a tool for comparative assessment of options, accounting for several criteria simultaneously. The key advantages of MCA are that it directly involves stakeholders in decision making, obliges users to think holistically as well as within their discipline, and enables consideration of a large number of criteria.

The characteristics of a good indicator are not necessarily equally important, hence each is given a percentage **weight** to indicate its relative importance – i.e. the higher the weighting, the more significant the particular characteristic in helping to select an optimal indicator set. The combined weights must add up to 100%, and the first task of the indicator selection team is to identify the relative (weighted) importance of each characteristic. Note that in MCA these characteristics are often referred to as **categories**.

These characteristics/categories tend to be multi-dimensional, therefore each is best described in terms of a number of specific **criteria** which together provide a full explanation of the given category. So the next stage is to score each potential indicator against the individual criteria associated with each category. This involves the application of a **numerical rating** from 1 to 5, where the higher the score, the more closely the indicator aligns with the given criterion.

Table 8.1: Characteristics and criteria to inform selection of sustainability indicators.

Characteristics of an optimal indicator set	Criteria which qualify and explain the categories	
Purposefulness	Focused	Guided by and contributes to a clear vision of "triple bottom line" sustainability
	Implementable	Can be linked to discrete objectives and targets
	Meaningful	Able to provide pertinent feedback to decision makers
Efficiency	Simple	Easily interpreted and monitored
	Accessible	Data are already collected or institutional capacity exists for easy collection
	Practical	Measurement is standardised to facilitate comparison
Effectiveness	Measureable	Statistically verifiable, reproducible and shows trends
	Relevant	Directly addresses agreed issues of concern
	Timely	Able to capture change at the relevant timescale to determine trends
Communicability	Clear	The information conveyed can be understood by a wide range of users
	Transparent	Data collection and analysis methods are readily comprehensible
	Explicit	Uncertainties in data and interpretation can be made apparent and minimised
Responsiveness	Adaptable	Responds to change and uncertainty
	Scalable	Aggregated city scale data are valid at State and national scale
	Replicable	Data collection and analysis methods can be repeated across different urban jurisdictions

The MCA method proposed here is a simplified weighted sum model which assigns a numerical value to each indicator based on multiplying the category weights by the sum of the scores for each of the criteria. The weighted category values are then summed to give a final numerical value for the indicator:

$$V(q) = \sum_i \left(W_i(q) \sum_i S_i(q) \right)$$

where $V(q)$ is the numerical value for indicator q, $W(q)$ is the category weight and $S(q)$ is the criterion score for each indicator.

When these calculations have been completed for all indicators, the final stage of the process is to rank the indicators from highest to lowest priority according to their numerical values. A cut-off point may then be applied, with indicators falling below this point being discarded. Note that the calculated numerical values are **relative** (i.e. to enable ranking), not absolute.

8.2. Quantifying indicators, objectives and targets

Section 3 of the Toolkit, *Tools for delivering transformation*, notes that what gets measured, gets managed. Energy, water, materials and ecosystem services represent four critical dimensions of sustainability which are amenable to measurement – in the last-mentioned case, through "proxy" metrics such as vegetation coverage or leaf area index (defined as the leaf area of a plant divided by the projected canopy area). Some straightforward methods for setting and quantifying indicators, objectives and targets to support the transition towards sustainability across these four areas are discussed below.

8.2.1. Operational energy

Identify current operational stationary energy use E_o including both conventional (E_c) and renewable energy (E_r):

$E_o = E_r + E_c$

Identify year to achieve 100% renewable energy goal (zero net operational greenhouse emissions):

$E_o = E_r$

Set intermediate percentage targets (annual, biannual etc) for the proportion of energy derived from renewable sources towards the final goal of 100%, where:

$$T = \frac{E_r}{(E_r + E_c)}$$

and

$$\lim_{T \to 1} f(T) = E_o$$

8.2.2. Water use

Identify current operating water use W_o including external potable supply W_e and any recycled/reused water W_r (i.e. captured rainwater, greywater and blackwater)

$W_o = W_e + W_r$

Water sustainability is most appropriately assessed at the watershed (catchment) level, so the next step is to identify the catchment in which the university is located, determine its spatial extent and human population, and the average precipitation rate (which controls the basic rate of supply) [82]. Sustainable use may be defined as staying within the sustainable yield of the catchment Y_s such that

$Y_s \leq R$

where R = recharge rate for the watershed (precipitation minus evapotranspiration).

For a given catchment the amount available for non-residential usage N is:

$N = R - CP$

where C = adequate minimum standard of per capita water use, and P = population.

Several different amounts have been proposed to meet the basic needs for drinking, sanitation, bathing and cooking, ranging from 50 litres per person per day [83] to 100 L/p/d

[84]. Users of this toolkit should enter a value appropriate to the location and context of their university.

As disaggregated data for non-residential water uses (agricultural, industrial, etc) are frequently unavailable, land area may be used as a proxy for non-residential water allocation. Thus the external sustainable water allocation W_s for a university may be calculated based on the land area occupied by the university A_u minus the area occupied by university housing A_h, divided by the total non-residential land area of the catchment A_n:

$$W_s = \frac{(A_u - A_h)}{A_n} N + CL$$

Where L represents the number of students living on campus.

The final step is to identify the year to achieve sustainable operational water use such that:

$W_o \leq W_s + W_r$

As this goal can be achieved by a combination of *reducing* consumption of externally sourced water and *increasing* the proportion of internally reused/recycled water, intermediate targets may be set for either or both of W_s/W_e and W_r/W_o as per the methodology outlined above for operational energy.

8.2.3   Material flows

A university's use of materials may be defined in terms of **inputs** (procurement of equipment, consumables, building materials etc), **stocks** (the existing inventory of such items) and **outputs** (solid waste and recyclables). Inputs and outputs are collectively regarded as material **flows**.

Material flow analysis (MFA) is "the systematic assessment of the flows and stocks of materials within a system defined in space and time" [85] to help quantify the environmental impacts of human activities. It developed out of mass balance (input-output) methods traditionally used in chemical and process engineering. MFA is predicated on the conservation of matter when subjected to physical or chemical transformative processes:
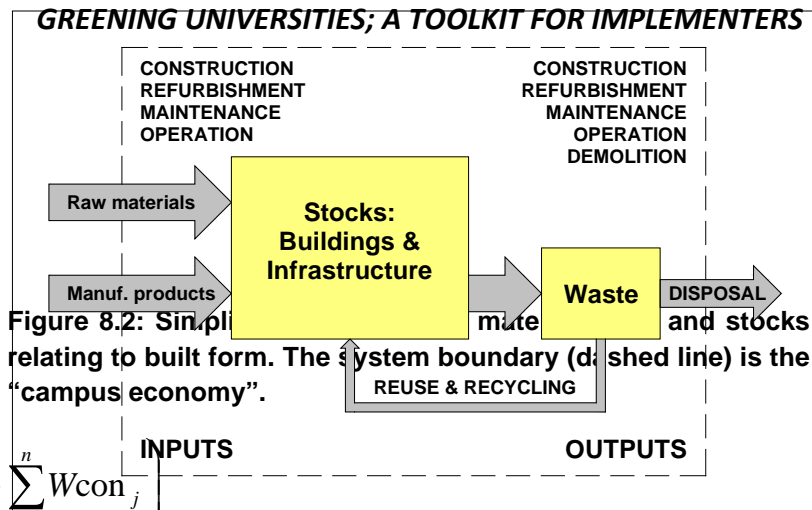
$$\sum_{k_I} m_I = \sum_{k_O} m_O + m_S$$

where m represents mass, k represents the number of flows, I refers to input, O to output, and S to storage (accumulation or depletion of materials).

A bulk MFA typically requires collection of an extensive materials inventory. On the other hand, a "streamlined" MFA, restricted to quantification of the stocks and flows of selected, representative *goods* (defined as substances of positive or negative economic value), can supply sufficient data to enable an initial estimate of environmental impact [86], and support the development of targets to reduce that impact.

Applying MFA to built form, stocks equate to the total mass of construction materials, which may be disaggregated by material type – concrete, steel, glass etc. This may be quantified in relation to building volume, gross floor area, number of occupants, activities etc for a given time period. Inputs include raw materials and prefabricated or manufactured components, and outputs include wastes and pollutants, some of which may be recycled (Figure 8.2).

The building life cycle can thus be characterised as a set of mass balance equations [86]:

CONSTRUCTION REFURBISHMENT MAINTENANCE OPERATION

CONSTRUCTION REFURBISHMENT MAINTENANCE OPERATION DEMOLITION

Raw materials

Stocks: Buildings & Infrastructure

Manuf. products

Waste DISPOSAL

Figure 8.2: Simplified material and stocks relating to built form. The system boundary (dashed line) is the "campus economy".

REUSE & RECYCLING

INPUTS   **OUTPUTS**

For the construction phase,

$$\sum_{j=1}^{n} S_j = \sum_{j=1}^{n} I_j - \left(\sum_{j=1}^{n} Rcon_j + \sum_{j=1}^{n} Wcon_j \right)$$

where stocks = inputs minus outputs; S_j represents the stock of material j in the building fabric, Ij is the input of j to the new building project, $Rcon_j$ is the output of j as construction waste which is recovered, and $Wcon_j$ is the output of j as construction waste to landfill.

For the demolition phase,

$$\sum_{j=1}^{n} S_j = \sum_{j=1}^{n} Rdem_j + \sum_{j=1}^{n} Wdem j$$

where stocks = outputs; $Rdem_j$ and $Wdem_j$ refer to demolition waste which is recycled and landfilled respectively.

The construction and demolition (C&D) recycling rate Rr_j (i.e. the mass of material j recovered as a proportion of total waste) is given by:

$$\sum_{j=1}^{n} Rr_j = \sum_{j=1}^{n} \left(R_j \middle/ R_j + W_j \right) = \sum_{j=1}^{n} R_j \middle/ S_j$$

where R_j represents the mass of the combined C&D recycling stream and W_j represents the combined mass of C&D waste to landfill.

Finally, the composition of the C&D recycling stream Cr_j is estimated by multiplying the percentage recovery of specific building materials by their proportionate contribution to the overall mass of the given building type:

$$Cr_j = R_j S_j \sum_{j=1}^{n} S_j \middle/ S_j \sum_{j=1}^{n} S_j \sum_{j=1}^{n} R_j = R_j \middle/ \sum_{j=1}^{n} R_j$$

For each of the above equations, material densities per square metre of floor space are obtained by dividing by the gross floor area (GFA) for a given building or for the totality of buildings on the site. Where multiple buildings are selected this assumes a linear mathematical relationship, which holds only where the buildings are of similar surface area to volume ratio and share similar construction characteristics.

Application of these equations enables calculation of the volume or mass of selected materials embodied in campus buildings, the average annual addition to and subtraction (via demolition) of materials from the existing stock of buildings, C&D recycling and landfill disposal rates and the proportional composition of the waste stream. The

construction/demolition cycle also provides useful information on the durability or *persistence* of campus built form. Knowing the annual addition to and subtraction from the building stock enables calculation of the percentage turnover each year, and hence the average service life of the campus buildings. The material intensity of built form may be measured against the relevant *services* provided by campus buildings [87]. "Units of service" may be defined in terms of student numbers, degrees awarded, research income etc. In other words, how much concrete, steel, glass, aluminium, etc is required to support the core business of the university?

Given that **concrete and steel** have been estimated to be responsible for about two-thirds of the life cycle environmental impacts of buildings [88, 89], a "streamlined" approach limited to these two materials offers a relatively straightforward way to establish performance indicators and set objectives and targets in relation to material intensity per unit of service, average building service life and C&D waste management. The analysis is based on basic building science and on readily obtainable information on building typology, floor area and construction and demolition dates. A corollary to this form of analysis is that the role of the building as *intermediary* in delivering a given service becomes the focus of attention, raising the obvious questions: can the service be delivered without the mediation of any building at all? And if not, what is the minimum material intensity necessary to do the job? For example, to what extent can a combination of online learning, improved space utilisation/scheduling, use of outdoor spaces and small group teaching in preference to large lecture theatres help to "dematerialise" the university campus [86]?

8.2.4   Ecosystem services

The positive impacts of urban vegetation, of which campus vegetation may be considered a subset, covers the full spectrum of environmental, economic, social and cultural benefits, or **ecosystem services**. The amount of vegetation in a given space has typically been measured in terms of canopy coverage. Boon Lay Ong of Melbourne University in Australia has proposed a new architectural and planning metric for urban greenery, which is well suited to application on university campuses. The **green plot ratio** (GPR) is based on **leaf area index** (LAI): the GPR is simply the average LAI of the greenery on site and can be presented as a ratio similar to the building plot ratio (BPR) currently in use in many cities to control maximum allowable built-up floor area in a development [90]. LAI is an indicator of vegetation primary productivity [91], hence a more meaningful measure of the ecosystem services provided by vegetation than simple canopy coverage.

The LAI values recommended in this Toolkit, as with those proposed by Ong, are based on global LAI data compiled from field measurement over a period of nearly 70 years [92]. But whereas Ong sets his measures at 1:1 for grass, 3:1 for shrubs and 6:1 for trees, the metrics recommended here are expressed as decimal numbers rather than ratios, include paved surfaces (LAI = 0) and introduce a distinction between shrubs (LAI = 2) and small trees (LAI = 4). This gives five potential values for LAI.

The GPR method may be applied to a university campus as a whole, or to defined sites within the campus. The LAI value for each site LAI_S is calculated from the formula:

$$LAI_S = \frac{\sum A(LAI_i) \times (LAI_i)}{A(S)} \, , \ i = \{0, 1, 2, 4, 6\} \text{outreach}$$

where LAI_S = average LAI for the given site, $A(LAI_i)$ = area covered by elements of leaf area index i, and $A(S)$ = total area of the site.

In similar manner to the other metrics examined in this section of the Toolkit, the green plot ratio method may be used to define performance indicators for campus green space, and to set quantified objectives and targets for the step-by-step greening of the campus.

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