ACGSA - Action Plan, 2013-2014

1) **Framework for the Arcasia Sustainability Award**

The proposal is for each member Institute to nominate a maximum of 6 projects from their members that they feel have fulfilled some degree/measure of sustainability with respect to the member country. I propose to use SIA's "Attributes of a Sustainable Built Environment" as a starting criterion. We can fine tune the criteria in time to come as there is no one solution that fits all. A copy of the SIA document is attached herewith.

2) '**Sustainability by Design' survey**

The proposal is to update the survey on Arcasia member institutes on an annual basis. The concern is that we may lose track and sight of the good work/effort in the formulation of the survey. The updated survey also allows us to track and record the progress, if any, each member Institute has made year on year. This then becomes part of the Arcasia data bank. A copy of the current survey is attached herewith.

3) **Joint committee workshop at Congress or Forum**

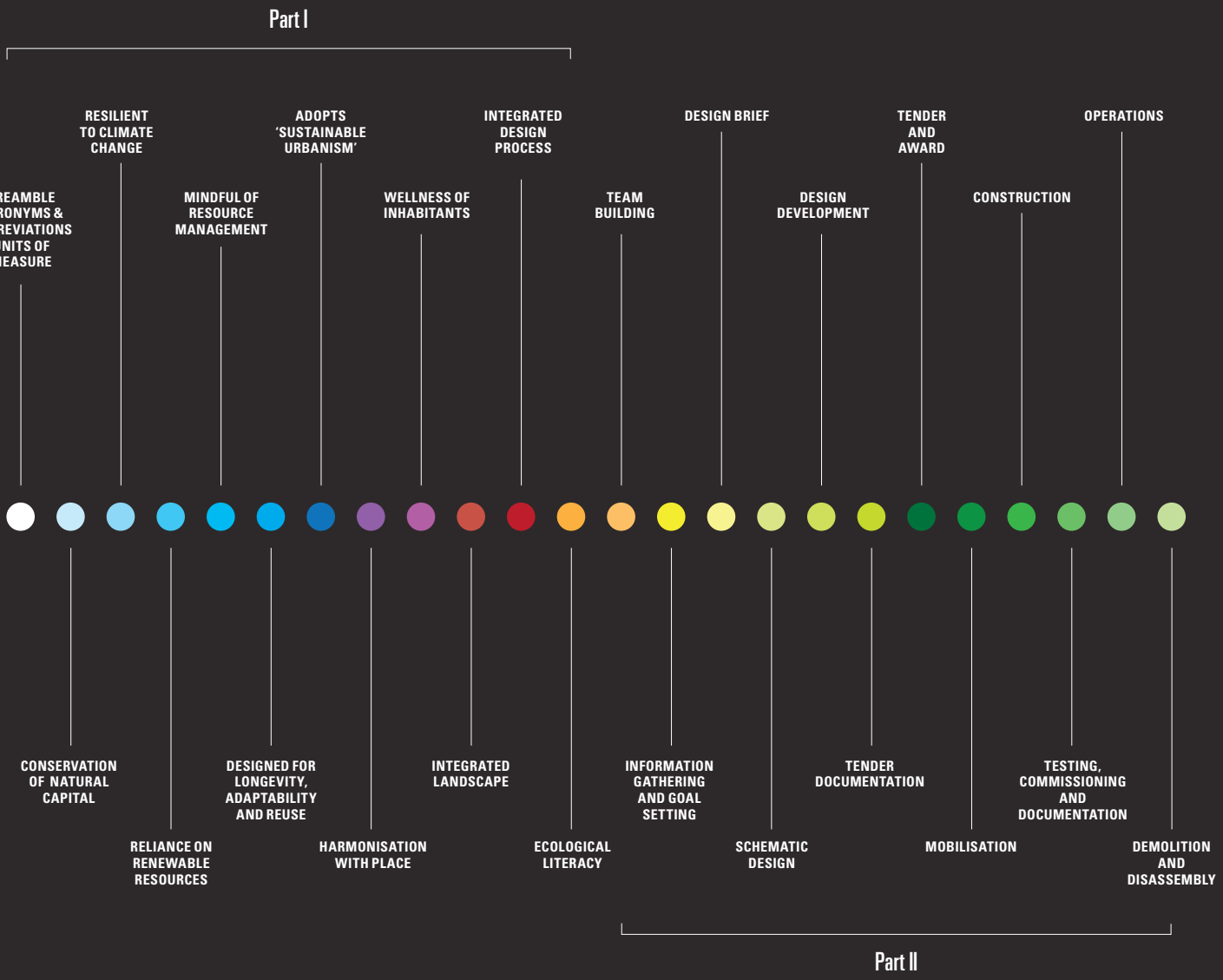
The joint committees had previously proposed that a workshop be held either at a Congress or Forum. The theme and level of participation should be selected by the host country and this should be part of the pitching effort. Let's get moving on this initiative.

4) **Arcasia website/Facebook**

ACGSA can leverage on the above to further the interest and allow exchange of ideas and discourse on matters related to Green and Sustainable approaches.

Prepared by

Ashvinkumar, Chairperson of ACGSA 2013-2015



ATTRIBUTES OF A SUSTAINABLE BUILT ENVIRONMENT

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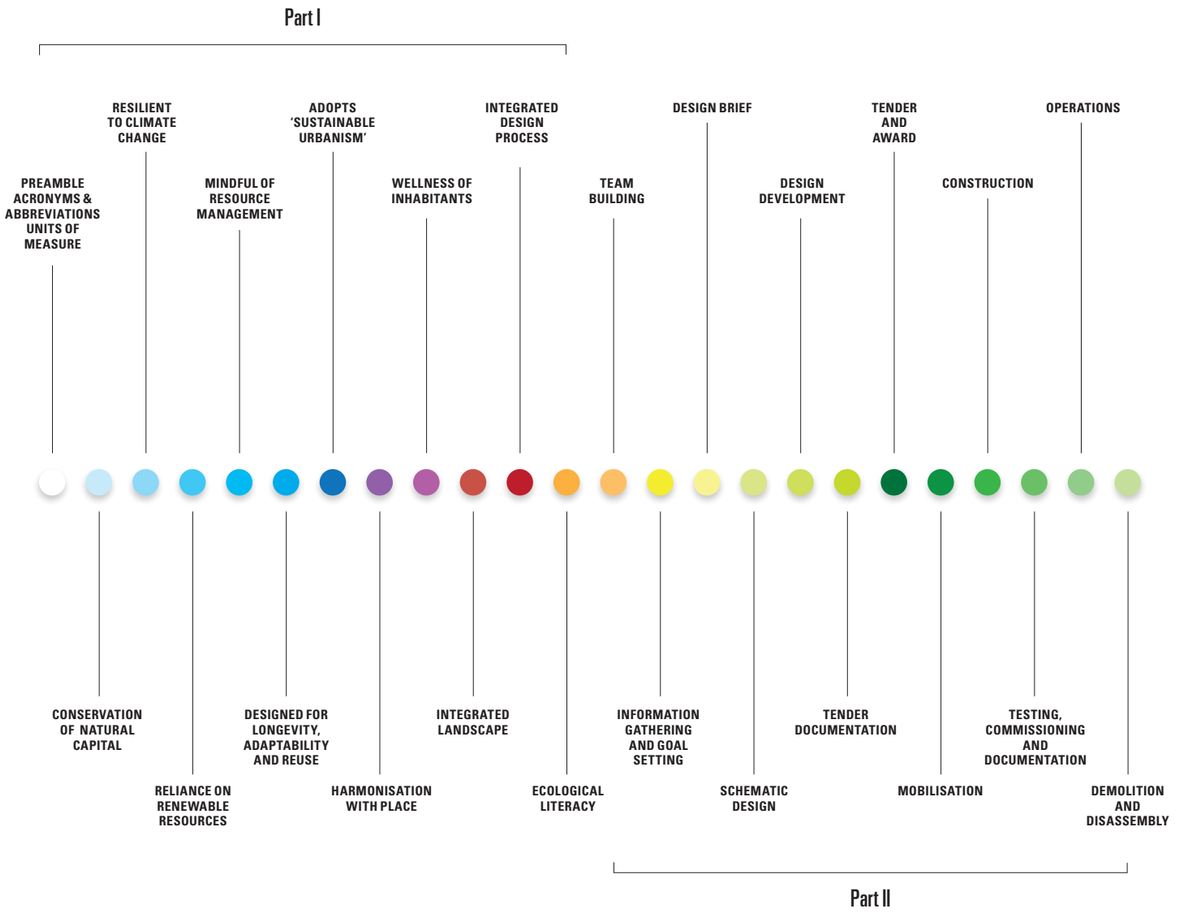

ATTRIBUTES OF A SUSTAINABLE BUILT ENVIRONMENT

SIA PRESS

About Singapore Institute of Architects

The Singapore Institute of Architects (SIA) is a professional organisation established in 1961 with the objective to promote the architectural profession and the built environment in Singapore. The Institute is the sole representative for the architectural profession in Singapore.

SIA acknowledges the efforts of its architectural members as they pursue standards of excellence in their field and continue to create innovative architectural designs. The Institute has played an active role in several major events, such as The World City Summit, Shanghai World Expo 2010 and the Venice Biennale 2010.

SIA is an affiliate of four international associations – International Union of Architects, Architects Regional Council Asia, Commonwealth Association of Architects and ASEAN Association of Planning and Housing. For more information, visit www.sia.org.sg.

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Acronyms & Abbreviations

ABC Active, Beautiful and Clean	BCA Building and Construction Authority (Singapore)	CFC Chlorofluorocarbons	CFD Computational Fluid Dynamic	CO_2 Carbon dioxide
EIA Environmental impact assessment	ESD Ecologically Sustainable Development	GAI Green area index	GHG Greenhouse gas	GnP Greenery provision
GPR Green plot ratio	GWP Global warming potential	HDB Housing Development Board (Singapore)	HVAC Heating, Ventalilation and Air-Conditioning	IAQ Indoor air quality
IDP Integrated design process	IEQ Indoor environmental quality	IMCSD Inter-Ministerial Committee for Sustainable Development (Singapore)	IPCC Intergovernmental Panel on Climate Change	LAI Leaf area index
LCA Life cycle assessment	LULCC Land use and land cover change	MEP Mechanical, electrical and plumbing	NEA National Environment Agency (Singapore)	NParks National Parks Board (Singapore)
ODP Ozone depletion potential	PM Particulate matter	PMV Predicted mean vote	PPD Percentage of persons dissatisfied	PUB PUB, The Water Agency (Singapore)
RE Renewable Energy	ROI Return on investment	SO_2 Sulphur dioxide	UNFCCC United Nations Framework Convention on Climate Change	VKT Vehicle kilometres travelled
VOC Volatile Organic Compounds				

Units of Measure

°C Degree Celsius	gha Global hectare[2]	ha Hectare	kg Kilogram	km Kilometre	kWh Kilowatt hour	
m^2 Square metre	m^3 Cubic metre	MJ Megajoule	t Metric ton	W Watt		

[2] A global hectare is a hectare with world-average biological productivity.

Preamble

This policy paper, developed by the Singapore Institute of Architects, describes a sustainable built environment, framed as a set of attributes relating to the design, construction, operation and disassembly of buildings, neighbourhoods and cities.

Implicit in these attributes is a multi-disciplinary, multi-stakeholder, whole-life perspective, reflecting the complexities of how the built environment is managed from concept to end-of-life.

This paper is presented in two parts.

PART I

Definitions and Descriptors

Part 1, **Definitions and Descriptors**, is premised on scientific findings that make the case that buildings and settlements – directly or indirectly – impact our planet by consuming resources, emitting waste and displacing natural habitats. Evidence of this has been documented by the United Nations Intergovernmental Panel on Climate Change (IPCC) and referred to by governments, notably the Singapore Inter-Ministerial Committee for Sustainable Development (IMCSD). The attributes listed in this part are drawn from numerous expert opinions; they describe, in effect, a global consensus on how a sustainable built environment should behave in a world of limited resources.

PART II

Process Considerations

Part 2, **Process Considerations**, describes potential actions by a project team that support the attributes described in Part 1. This list of prompts is organised around the stages of a typical design-construction process. This part of the policy paper has been crafted by experienced practitioners in the Singapore building industry; it represents a real world outlook of what should be considered by a project team, and how it might be positioned within process framework that the industry is familiar with.

1 Metrics are a means of quantifying performance

There are several qualifiers to the list of attributes in its present form:

1. The role of the architect, and the importance of design as an integrating framework, is implicit in all attributes even if, in some instances, the architect may not drive the process.

2. Some attributes speak of impacts that are quantifiable for which there are known metrics[1] (for instance, carbon footprint); others do not offer ease-of-quantification yet. Both are, in our view, equally important. We maintain that for an environment to be valued, it must engage emotions and senses in addition to managing resources, waste and emissions.

3. Many developments will not address all attributes equally. This paper offers a framework for what to consider at the drawing board, offering us a means of comparing one development with another.

4. The Institute acknowledges that in time, as our knowledge deepens and perceptions evolve, the list of attributes will change.

It is our desire that this paper contribute to the dialogue on sustainability already taking place in Singapore. This dialogue, thus far, has evolved rapidly in recent years, led by policy and marketplace, driven by successive Building and Construction Authority Green Building Master Plans and the Inter-Ministerial Sustainability Blueprint of 2009. In returning to the question, 'what is a sustainable built environment?' we seek to further articulate the desired future state, one that is consistent with what we know today of how the built environment impacts the well-being of our nation and planet.

The aim of this paper is to state what we – the Institute – know at present and, in that context, argue for what we believe to be important. Looking ahead it will offer the Institute a framework for collaboration with policymakers, experts and other stakeholders of the built environment in addressing future design and implementation.

PART I

Definitions and Descriptors

Conservation of Natural Capital
Resilient to Climate Change
Reliance on Renewable Resources
Mindful of Resource Management
Designed for Longevity,
Adaptability and Reuse
Adopts 'Sustainable Urbanism'
Harmonisation with Place
Wellness of Inhabitants
'Integrated Landscape'
'Integrated Design Process'
Ecological Literacy

Conservation of Natural Capital

A sustainable built environment seeks to conserve its natural capital which encompasses natural resources and ecosystem services that sustain life.

1.1 OVERVIEW

Natural capital is the **biosphere's** capacity to maintain the **ecosystem services**. These services encompass "all the familiar resources used by humankind: water, minerals, oil, trees, fish, soil, air" and "living systems, which include grasslands, savannas, wetlands, estuaries, oceans, coral reefs, riparian corridors, tundras, and rainforests"[1]. Degradation of natural capital threatens an irreversible damage to the ecosystem services and a permanent loss of biodiversity. **Biodiversity** is defined as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems."[2]

The last five decades have seen an exponential rate of loss of planetary biodiversity. The Convention on Biological Diversity is a key international treaty that seeks to halt this trend. It argues the case for developing strategies for conserving biodiversity, sustaining its use, and ensuring the fair sharing of benefits from its use.[3]

1.2 IMPLICATIONS ON BUILT ENVIRONMENT

Development of the built environment at the expense of natural capital has both short term and long term consequences. To ensure that a development stays within resource constraints, the following options should be considered:

1.2.1 Impact avoidance

Impact avoidance might, for instance, oblige a team to seek out **greyfield** or **brownfield** sites as opposed to **greenfield** sites. Land that is ecologically sensitive, for instance, wetlands or mangroves, is avoided.

1.2.2 Judicious intervention

At the drawing board, ecological impact can be minimised through site selection, site planning, the careful procurement of raw building materials and products that do not compromise natural environments elsewhere. Where a building is sited close to ecologically sensitive land, a pre-design **environmental impact assessment (EIA)** helps assess risks and suggest ways of mitigating negative consequences resulting from the construction and/or operation of the development.

1.2.3 Strategic regeneration

On sites where an ecosystem has been damaged by prior activity, a development can restore the health of natural systems, adopting a **regenerative** approach. Sites that are, for instance, contaminated by landfills or industrial waste, can be cleansed and restored. Damaged habitats, such as mangrove colonies, can be regenerated and revitalised.

1.2.4 Injection of biodiversity

The introduction of **biodiversity** – the symbiotic relationships between plants and animals – into human settlements should be considered. The selection and placement of flora and fauna, for instance, into urban parks and green spaces can attract colonies of butterflies and birds, creating a viable, self-sustaining ecosystem.

1.3 SINGAPORE CONTEXT

Within Singapore's highly urbanised context there is conscious effort in policy and planning to retain and/or introduce biodiversity. Adding up all nature reserves and green spaces, for instance, inclusive of roadside greenery and park connectors, it appears that about half of the island is covered with greenery.[4] As the authority responsible for greenery and natural habitats, National Parks Board (NParks) has explicitly articulated the following actions[5] –

- → Implement species conservation and recovery programmes
- → Rehabilitate areas that have previously been degraded
- → Extend green corridors to counter fragmentation
- → Utilise parks for ex-situ conservation and to house or re-create ecosystems that have been lost

Singapore's ecological footprint – based on its demand on planetary ecosystems – was estimated at 4.51gha per person[6] in 2009, more than four times the world average[7]. Singapore's biocapacity, on the other hand, stands at 0.04gha, resulting in a self sufficiency rating of only 0.9%. Self-sufficiency rating is a measure of what percentage of footprint is supported by the biocapacity. Lacking a hinterland, Singapore's population consumes resources far greater than its land mass can support.

1.4 METRICS

1.4.1 Biocapacity[8]

Biocapacity refers to the capacity of the ecosystem to supply biological materials to support life and its potential to absorb waste, and the potential of terrestrial and aquatic areas to provide these services. Biocapacity is measured as global hectares (gha) per person.

1.4.2 Ecological footprint[9]

Ecological footprint is a measure of the earth's biocapacity in productive land area – for example, cropland, pastures, forest and fisheries – to meet human needs.[10] Ecological footprint is measured as global hectares (gha) per person.

1.4.3 Green Area Index (GAI)[11]

Green Area Index (GAI) is the ratio of the area on plan of green canopy to the area of ground on which the crop is growing.

1.4.4 Greenery Provision (GnP)[12]

Greenery provision (GnP) refers to the ratio of total green area to total site area. It is calculated by considering the three-dimensional volume filled by plants using GAI.

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12. Ibid.

Resilient to Climate Change

A sustainable built environment seeks to minimise its contribution to the underlying causes of climate change. In addition, it is designed to adapt to the predicted local consequences of this global phenomenon.

2.1 OVERVIEW

The United Nations Framework Convention on Climate Change (UNFCCC)[13] defines climate change as being directly or indirectly attributable to human activities that alter "the composition of the global atmosphere"[14] to levels beyond naturally occurring fluctuations. Two anthropogenic contributors to climate change are related to human activity: greenhouse gas (GHG) emissions, and land use and land cover change (LULCC)

GHG emissions result from the burning of fossil fuels, decomposing organic waste (typically in landfills), and food industries such as cattle-farming. Incremental increase in atmospheric GHGs (CO_2, methane, nitrous oxide and ozone) can raise global temperatures; seemingly small changes in global temperature average can significantly alter climates and stress the 'health' of ecosystems.[15]

Land cover is "the observed (bio)physical cover on the earth's surface"[16] encompassing "soil material, vegetation, and water status"[17]. Historically, Man has modified the earth's terrestrial surface to obtain food and to create environments conducive for habitation; processes leading to **land cover change**. The planet's vegetative cover, such as rainforests, is a **carbon sink**[18], a natural buffer that regulates carbon levels in the atmosphere. Loss of carbon sinks – for instance, logging or forest clearing for agriculture – limits Nature's options for future carbon sequestration.

Compounding the problem of **land cover change**, forests are often cleared with slash-and-burn techniques; the release of CO_2 from this further contributes to GHG build-up[19]. Where vegetative cover is replaced with hard urban landscapes, this also results in increased surface absorption of solar radiation leading to local hotspots in a phenomenon known as **urban heat island**.

Climate change is deemed inevitable by the global scientific community; its effects, in the coming years, will be evident and, in some places, severe. These effects include sea level rise, erratic weather and flooding, food and water shortages; these will place stress on, resulting in the displacement of, entire communities.

The Intergovernmental Panel on Climate Change (IPCC) summarises climate change impacts under several criteria. 'Freshwater resources and their management' refers to the question of **water availability**, incidences of drought alternating with flood. 'Ecosystems' speaks of the diminished capacity of natural resources to support life resulting in the **extinction of species**. 'Food, Fiber and Forest Products' is concerned with **crop productivity** which will be severely hit by sea level rise and extreme weather. It is predicted that changes to temperature and weather systems will generally affect **human health and mortality**.

Poorer communities are especially vulnerable as they are more dependent on local food and water sources that require replenishment[20]. Developing countries in Asia will bear much of the brunt of climate change as they seek to become more urbanised and industrialised. Asia will substantially add to the underlying causes of climate change as its share of GHG emissions increases and it continues to deplete its carbon sinks.

2.2 IMPLICATIONS ON BUILT ENVIRONMENT

Mitigation and Adaptation are two important and complementary strategies that make up resilience to climate change. **Mitigation** tackles the cause of climate change, seeking to reduce a development's contribution to GHG emissions; **Adaptation** addresses the consequences of climate change, through design and/or human behaviour.

A sustainable development actively seeks to reduce its GHG emissions. Buildings, for instance, must be designed for reduced dependence on the power from the grid in particular where the centralised production of electrical power is via burning of fossil fuels. These developments seek out primary energy sources that are low-carbon or carbon-neutral such as certain biofuels and photovoltaic (see also Attribute 3: Reliance on Renewable Resources).

At the urban scale, cities will seek to increase reliance on public transport, cycling and walking (see also Attribute 6: Adopts 'Sustainable Urbanism'). Precinct level technologies, such on-site combined heat and power systems, will be sought out as these offers higher yields of energy per unit of GHG emission.

In seeking adaptation, a sustainable built environment will anticipate conditions that it will face over its lifetime, for instance, extreme weather or floods. This will vary with location; some parts of Asia, such as Vietnam, are particularly vulnerable to sea level rise, others, like the Philippines, are already seeing signs of extreme weather.

2.3 SINGAPORE CONTEXT

Singapore has a coastline that is 193 kilometres in length[21]. A rising sea level (ranging from 18cm to 59cm by the year 2100) combined with heavy rainfall, would result in substantial flooding and saltwater intrusion. Singapore is also vulnerable to many of the health-related problems resulting from water intrusion such as dengue fever. Food, energy and water security would emerge as top priorities if there are regional disturbances in crop productivity, resource availability and surge of climate refugees.

Singapore was responsible for 0.2% of global CO_2 emissions in 2005; buildings accounted for 16% of its CO_2 emissions.[22] In the same year, Singapore's population was 0.0006% of the total world population.[23]

2.4 METRICS

2.4.1 Greenhouse Gas Emissions/ Equivalent Carbon Footprint

Major greenhouse gases are CO_2, methane and nitrous oxide. Equivalent Carbon Footprint is a means of gauging the impact of all GHG gases weighted to carbon equivalents. Equivalent Carbon Footprint is measured as 'metric tons CO_2 equivalent' ($MTCO_2e$).

2.4.2 Ozone Depletion Potential (ODP)

ODP is the ratio of the impact of a chemical on ozone (total amount of ozone destroyed) relative to an equivalent mass of CFC-11(ODP of 1.0).

2.4.3 Global Warming Potential (GWP)

GWP is the ratio of the heat absorbing capacity of each gas per unit of weight relative to CO_2 (GWP of 1). It also accounts for the decay rate relative to CO_2. One area of application in the built environment is the ODP and GWP of refrigerants.

2.4.4 Life Cycle Assessment

Life cycle assessment (LCA) is applied to gain a whole-life perspective. LCA is a more effective evaluation of the impact or potential impact of a development beyond short-term concerns. It comprises four stages: goal and scope (methods applied and impact categories), life cycle inventory (modelling of product systems, collection and verification of data), life cycle impact assessment (evaluating performance based on each impact category) and interpretation (conclusions). Each material and product selection is analysed in terms of its impact on the environment across its life cycle. Examples of impact categories include "*global climate change, stratospheric ozone depletion, acidification, photochemical smog, eutrophication, human toxicity, ecological toxicity, and resource depletion*".[24] LCA is a component in various rating tools, including LEED, BREEAM, Green Star and CASBEE.

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Reliance on Renewable Resources

A sustainable built environment opts for renewable resources over non-renewable ones. This operating principle extends to its demand for energy, water and materials.

3.1 OVERVIEW

We consume resources at a rate faster than the planet can replace them. Our dependence on non-renewable resources, such as fossil fuels, is problematic for two reasons. First, the resource will eventually run out, in the process precipitating economic and social crises. Energy prices, for instance, escalate sharply each time oil production is curtailed. Second, consumption itself can have devastating effects. Oil and coal are Nature's way of storing carbon; burning these to power homes and vehicles releases CO_2 and other **GHGs** into the atmosphere (see also Attribute 2: Resilient to Climate Change).

Renewable resources are natural resources, such as "trees, water, sun and wind that can be replenished at about the same rate at which they are used."[25]

3.2 IMPLICATIONS ON BUILT ENVIRONMENT

3.2.1 Energy

A sustainable built environment sources its energy from renewable repositories that never run out or can be naturally replenished. There are two sources of renewable energy (RE): generative technology and passive design.

3.2.1.1 **Generative technology** refers to systems that can tap into natural flows of energy – solar, wind, water, geothermal – converting them to electrical power, or direct cooling and/or heating. These include photovoltaic cells, solar hot water systems, wind turbines, geothermal pumps, hydropower turbines, etc.

3.2.1.2 **Passive design** is the adoption climate-responsive strategies for the making of indoor comfort without assistance from electro-mechanical devices. This depends on the attributes of local and site climate and includes daylight access and natural ventilation, managing solar exposure for heating or shading, the integration of plants and water elements.

3.2.2 Materials

Many natural materials, such as mud, clay (for bricks) and bamboo, offer alternatives to commonly used nonrenewable building products. Bamboo, for example, is a fast-growing plant that can be replenished faster than tropical hardwoods, which are commonly used for building fit-outs. Rammed earth construction, reliant on locally sourced, compressed mud, consumes less energy to make than say concrete or bricks, and can be easily returned to the ground or reused when the building is demolished.

3.2.3 Water

Onsite capture and use of **rainwater** is a key renewable strategy. Rainwater collection is advantageous in that it requires little treatment before it can be deployed for non-potable use. Another renewable source of water is seawater. **Desalination** of seawater is a purification process which removes salt to produce freshwater. This option does however consume energy which – depending on the source of energy – should be factored as a trade off.

3.3 SINGAPORE CONTEXT

Through its various test-bed projects, Singapore is preparing for implementation of solar technology on a large scale at the point when the cost of this technology drops closer to conventional energy.[26] There is however no target for when or how much national demand will be met with RE. To encourage the uptake of RE in new buildings, BCA's Green Mark[27] accords points for "% replacement of electricity by RE source."[28]

Rainwater catchment and storage area by 2011 will cover two-thirds of the island's surface area. Due to its finite land mass limiting Singapore's catchment potential, future emphasis on water sourcing will focus on recycling.[29]

3.4 METRICS

3.4.1 Carbon Credits

Carbon credits can be purchased by a development to offset its non-renewable energy usage by investing in a carbon sink elsewhere as a means of establishing carbon-neutrality. This in effect means there is removal of an equivalent amount of CO_2 from the atmosphere as is emitted by the development. 1 carbon credit is the equivalent of 1 metric ton of CO_2.

3.4.2 Rainwater Harvesting Potential

Calculating rainwater harvesting potential [area of catchment x amount of rainfall runoff coefficient = rainwater volume (m^3)], is a tool for assessing feasibility at the drawing board. It is dependent on rainfall quantity, patterns and the catchment surface properties.

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Mindful of Resource Management

A sustainable built environment optimises the use of non-renewable resources by managing demand, minimising waste and optimising resource efficiency. This operating principle extends to energy, water and materials, and describes efficient use and reuse.

4.1 OVERVIEW

Mindful resource management is the optimisation of resource use through **demand reduction**, **waste minimisation** and **maximisation of systemic efficiency**. In other words, use less, and where consumption is inevitable, use wisely. This principle applies to both construction and building in-use.

The key to this is, first, framing a **whole-life perspective** of building components and systems from fabrication to operations and disassembly. Questions asked would be how much materials and energy are consumed by a component or system, how efficient is this when compared to another equivalent component or system. What is its estimated life, i.e. what is the expected maintenance and replacement regime?

Second, resource flow should be viewed as **cycles** or **closed loops**[30] within larger systems, both man-made and natural. This means that materials discarded by one development can become the resource of another.

4.2 IMPLICATIONS ON BUILT ENVIRONMENT

4.2.1 Energy

Energy management begins with decisions made at the drawing board on the basis of a whole-life perspective of building or its system, i.e. a mapping of predicted energy use based on programme, climate and lifestyle. The project team seeks an optimal fit between system selection and occupant needs for comfort and control, balancing various modes such as passive strategies and active, electro-mechanical systems. Within each system, resource efficacy is maximised and waste minimised.

4.2.2 Materials

Material management is the act of reducing embodied energy, extending the useful life of materials and eliminating waste.

Embodied energy of a building material or product is the quantum of the energy consumed in raw material extraction, transportation, processing, assembly through to end-of-life. Where such data is available, selection should favour use of materials with lower embodied energy.

Extending the life of materials or raw materials through **reuse** and **recycling** reduces the embodied energy of a building component or system. Selection of materials with recycled content or opting for reconditioned materials are two ways of achieving this. At the drawing board this obliges the project team to consider **Design for Disassembly**, i.e. the use of a material or product in a manner that permits it to be later reused elsewhere.

Waste elimination at its simplest begins with a strategic view of **construction and demolition**. **Modularisation** and **prefabrication** for instance can reduce construction waste; the careful removal and sorting of materials from a building to be demolished increases the potential for reuse which in turn reduces the demand for landfills and incineration.

4.2.3 Water

Mindful water management starts with a respect for natural **hydrological systems** of a site, i.e. flows and cycles linking rain, surface and ground water. The built environment should plug into these flows, without interrupting or contaminating surface water discharge.

The quantity of greywater and blackwater produced by a development should be firstly reduced through reliance on water-efficient fitments, such low-capacity tanks in toilets with dual-flush option. What waste water emerges from these systems should be treated and redeployed, for instance for non-potable uses such as irrigation and toilet flushing.

4.3 SINGAPORE CONTEXT

The Singapore Sustainable Blueprint 2009[31] outlines specific targets for resource management at both consumer and national levels by the year 2030. Energy efficiency of buildings is targeted to improve by 35% over 2005 levels. This is elaborated as a 30% improvement in mature HDB estates and 20% in newer residential developments. The recycling rate is expected to rise to 70%. Per capita water consumption in that same period should have dropped by more than 10%.

Version 4 of the Green Mark for 'New Non-Residential' projects shows an emphasis on energy efficiency in buildings, accounting for 60% of credit points available. Water and material-related categories account for 9 and 0.03 percent respectively.

4.4 METRICS

4.4.1 Energy

Energy Usage per capita (kg/capita): Energy usage per person is expressed as an equivalent of kilograms of oil consumed.

Energy Intensity (kWh/m²/year): This accounts for energy consumption during the end use of the building. A subset of this is incorporating the occupant into the equation to be **kWh/o/year**.[32] The energy intensity value is used in GHG emission calculations where it is multiplied by the GHG emission coefficients for each fuel source.

Envelope Thermal Transfer Value (W/m²): Amount of thermal energy transmitted through a building envelope.

Lighting power (W/m²): A measure of the energy demand for lighting design.

4.4.2 Water

Water Index (m³/person/year): The volume of water consumed per capita per year.

4.4.3 Materials

Concrete Usage Index (m³/m²): Volume of concrete in cubic meters needed to cast one square meter of the constructed floor area. It includes structural and non-structural elements but excludes external and sub-structural works. [33]

Recycled content can be expressed as a percentage (%) of total material content by weight or volume.

30. Yeang, K. 2006. Ecodesign: A Manual for Ecological Design. London. Wiley-Academy.
31. MEWR and MND. "Sustainable Development Blueprint." Sustainable Singapore. 2009. http://app.mewr.gov.sg/data/ImgCont/1292/sustainblueprint_forweb.pdf (accessed October 6, 2010).
32. UNEP. "Common Carbon Metric. ." Sustainable Buildings and Climate Initiative. 2009. www.unep.org/sbci/pdfs/UNEPSBCICarbonMetric.pdf (accessed October 6, 2010).
33. Building and Construction Authority. " Code for Environmental Sustainability of Buildings." April 2008. http://www.bca.gov.sg/EnvSusLegislation/others/Env_Sus_Code.pdf (accessed October 6, 2010).

Designed for Longevity, Adaptability and Reuse

A sustainable built environment is designed for adaptability and reuse, with a view to extending the life of whole buildings and their components. It seeks to reduce the risk of obsolescence by anticipating changes in programme, technology and land use.

5.1 OVERVIEW

Designing for longevity begins with intent, at the drawing board, to extend the building's life beyond the industry average, anticipating changes and pressures that a building is likely to face. Where these are not self-evident the strategy then is to create flexibility for growth through easy reconfiguration of space and replacement of systems and fitments. **Preservation**, **rehabilitation** and **adaptive reuse** are approaches that extend the life of the building and its components, thereby lowering their embodied energy cost. A building that endures longer is also more likely to muster **emotional affinity** from its occupants and the community at large.

5.2 IMPLICATIONS ON BUILT ENVIRONMENT

5.2.1 Precinct

The **longevity** of a building, as affected by its economic value, often depends on **land use** controls which are typically decided by planning authorities. Where changes to land use, density and height limits, occur frequently, there is pressure to tear down and build again to exploit the new value of the land on which a building sits. **Planning guidelines**, conceived as long-term propositions, can alleviate this pressure of obsolescence.

5.2.2 Building

Longevity, in part, results from the selection of building materials and systems that are durable, resource efficient, and low-maintenance. A building that is inefficient and prone to repair is likely to be valued less over time.

It is important to consider that elements within a building will have their own **lifespans**. The building envelope which is exposed to the elements, and key mechanical systems can have a life expectancy of 20 years; structural systems, made from concrete and/or steel can last 100 years or more. Interior elements, such as furniture and finishes, may need more frequent replacement and/or repair, say once every 10-20 years. A critical understanding of these differences is important in determining ease of replacement and reuse.

The risk of **functional obsolescence** must be dealt with through spatial design; spaces should be planned for flexibility and changeable use. With rapid technological change, many older buildings will suffer **technical obsolescence**. This can be countered by providing flexible building infrastructure such as raised floors, accessible or oversized ducts. Change can enforced with minimal disruption to operations.

5.2.3 Component

The lifespan of building components depend on several factors, including the ease of disassembly and durability of materials. Dimensions should be standardized to facilitate ease of replacement; materials selected should be slow to deteriorate (dependent on use and exposure to climate) for instance, emergence of rot or rust.

5.3 SINGAPORE CONTEXT

There is a tendency to tear down and rebuild in Singapore, in particular with private residential developments. Building longevity is compromised by changes to land use which create economic pressure for developments that sit on 'undervalued' land. In the 80s and 90s, the move to save historically significant buildings and precincts resulted in conservation of many old structures. This however affects only a small percentage of the building stock.

5.4 METRICS

5.4.1 Embodied Energy/lifespan

Embodied Energy (MJ/kg or MJ/m²) refers to the total primary energy consumed over a building's life cycle (amount of carbon released) in extraction, manufacturing, transportation, installation, waste, use, reuse etc. It is typically expressed as a quantity of non-renewable energy per weight or area of the product. There are two types of embodied energy: initial embodied energy (non-renewable energy used in raw material extraction, processing, manufacturing, transportation and construction) and recurring embodied energy(non-renewable energy used to maintain, repair, restore, refurbish or replace components, systems and materials over the course of a building's lifespan. The ratio of embodied energy to lifespan measures the value of a building's longevity in increasing/ reducing its embodied energy/year and is an indication of its energy efficiency.[34]

5.4.2 Existing Structure Percentage

The Singapore Green Mark rating tool awards points for the percentage of area of existing structural elements and building envelope preserved. In the case of 'Residential' buildings, 2 points are awarded if a minimum of 50% of existing structural elements or building envelope is conserved.[35]

34. 'Measures of Sustainability' http://www.canadianarchitect.com/asf/perspectives_sustainibility/measures_of_sustainablity/measures_of_sustainablity_embodied.htm (accessed August 30th, 2010)

35. BCA. "BCA Green Mark for New Residential Building Version RB/4.0." Building Construction Authority. December 2010. www.bca.gov.sg/GreenMark/others/gm_resiv3.pdf (accessed October 6, 2010).

Adopts 'Sustainable Urbanism'

A sustainable built environment is one that has in place principles and infrastructure that support an efficient use of resources and a low-carbon lifestyle.

6.1 OVERVIEW

Sustainable urbanism describes an approach to urban design and planning with several key outcomes. **Larger precinct level systems** can be built into urban infrastructure – as opposed to smaller scale building systems – permitting more efficient management of space, resources and waste. **Integrated landscaping** can improve ambient conditions for well-being and comfort, reducing the need for building level cooling and lighting. Low-carbon choices can reduce carbon footprint of a community, for instance, by offering residents the option to switch from private cars to **public transport** access, purchase of **locally sourced food** and goods, switching to **Green energy** sources.

6.2 IMPLICATIONS ON BUILT ENVIRONMENT

Sustainable **urban planning** principles can create conditions enabling its inhabitants to live "ecologically aware, low carbon lifestyles".[36]

A main characteristic of a low-carbon city lifestyle is its **connectivity**. Transportation has become a global issue in relation to sustainability as the global vehicular transport sector accounts for 23% of global **carbon emissions**[37]. Of the various modes of transport including air, maritime, rail and road, road transport accounts for 73% of the global carbon emissions[38]. Studies have also shown that as the urban density increases, the private transport **energy use per capita** decreases[39]. In a high density **mixed-use development** where transportation networks are well-designed such that occupants have high accessibility to facilities by walking, cycling and public transport, carbon emissions and traffic congestion can be substantially reduced. This also leads to **wellness** of the inhabitant, lower social security costs and a more liveable city.

The inclusion of precinct level networks for energy, water and waste also affect the carbon footprint of a city. There is an economy of scale, for instance, in district cooling systems that could potentially reduce energy waste. Precinct level systems are critical because they are potentially more cost effective and efficient than decentralised systems at the building scale.

A sustainable community reduces its **carbon footprint** through local sourcing. Locating food production, for instance, within city boundaries is gaining credence as emissions due to shipping and food security are seen to be increasingly important. The presence of **urban agriculture**, plus other forms of urban landscaping such as parks, gardens and green connectors, contributes to carbon sequestration, reduced urban heat island effect and qualitative aspects of a liveable city.

6.3 SINGAPORE CONTEXT

The combination of high density housing, constraints on private car usage and the extensive and reliable public transportation system has had a measurable impact. In 2005, Singapore's transport accounted for 19% of the **overall carbon emissions**[40] and 52.4% of Singapore residents commuted to work by public transport[41]. By 2030 the government has targeted 75% public transport use out of all motorized trips[42]. To encourage the use of green transportation such as the use of bicycles, there are increasing provisions for designated cyclists' paths; there are also plans to heighten **connectivity** for pedestrians and cyclists through the increase of **park connectors** from 100km in 2007 to 360km by 2020[43].

The handling of energy, water and waste in Singapore is centralised. In the context of water and waste recycling, centralisation offers building owners convenient options for a Greener lifestyle. In the context of energy however there will be inefficiencies due to transmission losses. The move towards decentralised, onsite energy production is slow; and even though it is now possible to return energy to the grid.

6.4 METRICS

6.4.1 Vehicle Kilometres Travelled (VKT)

Vehicle Kilometres Travelled (VKT) is measured in kilometres. It gives a measure of the pressure that transport puts on the environment. For example, by measuring the total vehicle kilometres travelled by all types of vehicles, the carbon emissions associated with transportation can be estimated.

6.4.2 Carbon Footprint

Carbon footprint refers to the total set of greenhouse gases (GHG) emissions caused by an entity. It helps to provide a reference for the **ecological footprint** and is measured as metric tons (t) of CO_2.

6.4.3 Floor area per person

Floor area ratio is measured as ratio of total living space to the number of inhabitants (m^2/inhabitants). It provides a reference for urban density.

36. The Prince's Foundation for the Built Environment. "Valuing sustainable urbanism." The Prince's Foundation for the Built Environment. 2007. http://www.princes-foundation.org/files/0707vsuoverview.pdf (accessed July 30, 2010).
37. International Energy Agency (IEA), CO_1 Emissions from Fuel Combustion 1971-2005, (IEA, 2007).
38. Ibid.
39. Peter Newman and Jeffrey Kenworthy, Urban Design to Reduce Automobile Dependence, Opolis: An International Journal of Suburban and Metropolitan Studies; Vol.2: No.1, Article 3, 2006. http://repositories.cdlib.org/cssd/opolis/vol2/iss1/art3 (accessed July 30th, 2010).
40. MEWR, Singapore's National Climate Change Strategy, (Singapore: Ministry of the Environment and Water Resources, 2008), available online at: http://app.mewr.gov.sg/data/ImgUpd/NCCS_Full_Version.pdf (accessed July 30th, 2010).
41. Singapore Department of Statistics, General Household Survey 2005, Statiscal Release 2: Transport, Overseas travel, households and housing characteristics, (Singapore: Department of Statistics, Ministry of Trade and Industry, Republic of Singapore, 2005), available online at http://www.singstat.gov.sg/pubn/popn/ghsr2/chap1.pdf
42. Lim Swee Say, "Commuting Sustainably (Singapore)," Transport and Communications, UNEP, 2001, available online at http://www.unep.org/ourplanet/imgversn/121/say.html2001(accessed July 30th, 2010).
43. MEWR and MND. "Sustainable Development Blueprint." Sustainable Singapore. 2009. http://app.mewr.gov.sg/data/ImgCont/1292/sustainbleblueprint_forweb.pdf (accessed October 6, 2010).

Harmonisation with Place

DEFINITIONS AND DESCRIPTORS 7

A sustainable built environment is in harmony with its setting; acknowledging and responding to the pre-existing conditions that physically define a site or describe its social and cultural context.

7.1 OVERVIEW

A sustainable built environment is in harmony with its setting. In seeking to insert a new development into a site or context, it seeks to be sensitive to pre-existing conditions such as history and culture, local craft and knowledge, ecology and terrain, climate and microclimate, urban spaces and connectivity, all of which collectively define **Place**. Harmonisation is therefore the act of integration and assimilation, of actively reducing the ecological and social burden that a new development will place on existing natural and man-made environments.

7.2 IMPLICATIONS ON BUILT ENVIRONMENT

'**Place**' refers in part to the natural attributes of a location – its terrain, ecology and climate – and in part to man-made conditions, such as history, culture and local wisdom, urban and community networks. Even though these two descriptors – natural and man-made – rely on separate knowledge domains, they are equally important. There are three aspects of place that a sustainable built environment must address:

History, culture and local wisdom[3]. Developments that ignore these contextual factors have limited local acceptance; there is therefore value to be had in adopting principles and practises that have strong local precedence. Vernacular buildings and associated crafts, for instance, are a means through which to understand what works best in a particular context.

Terrain, ecology and climate. Each site has its own flows and cycles. These can be, for instance, hydrological, the movement of water resulting from a combination of terrain and climate. These can be seasonal, patterns of annual/diurnal air and sun path movement. They can be ecological, for instance, the exchange of resources and waste between plant and animal life. Sites can be ecologically mature or immature[44], a hybrid of natural and man-made or wholly man-made. In all cases it is important to understand, via site studies, how a new development can be least disruptive, how it can utilise onsite resources in a sustainable manner.

Urban and community networks. Where a development seeks to integrate within pre-existing community settings, it must respect the connections and ties that exist. Respecting existing community spaces and pathways, for instance, can become a way of integrating old with new.

7.3 SINGAPORE CONTEXT

Over 80% of Singaporeans reside in public housing[45] which over the years has become the defining element in urban and community networks. Public housing offers a broad-based shared experience of what it means to be in Singapore; through its design and administration, it channels public behaviour and expectations on quality of life and social cohesion.

The integration of Singapore's built environment with extensive landscaping and historical conservation precints is an act of harmonisation, each augmenting local identity and place-making

3. Buchanan, P, 2000, Ten Shades of Green, Architecture League of New York

Wellness of Inhabitants

DEFINITIONS AND DESCRIPTORS 8

A sustainable built environment ensures the **wellness** of its inhabitants, taking into account the physiological and psychological needs of its users, addressing their expectations and preferences relating to comfort and health.

8.1 OVERVIEW

Health and comfort are central to the notion of a sustainable environment. Where the design or operation of an environment fails to deliver these outcomes, this may result in misuse, premature obsolescence or repeat retrofits.

Wellness may be understood through two broad descriptors – **avoidance** and **affordance**.

Avoidance describes the act of designing within prescribed bandwidth of conditions. Where these boundaries are overstepped, there are known consequences to physiological health and/or comfort, for instance, excessive solar gains leading to thermal stress or exposure to harmful substances such as volatile organic compounds (VOCs). **Affordance** describes the pursuit of environmental qualities that are emotionally and psychologically satisfying, for instance, access to daylight or exterior views.

Avoidance delineates limits in design while **affordance** describes design potential.

8.2 IMPLICATIONS ON BUILT ENVIRONMENT

There are several aspects of wellness that must be addressed:

a. **Physiological Wellness** – Pertaining to quantitative ambient conditions such as temperature and air quality. Through design one seeks to avoid stressors such as excessive air movement or presence of harmful substances or chemicals in the indoor air.

b. **Psychological Wellness** – Pertaining to qualitative attributes of the environment, such as daylight and views. Act of design seeks to avail these to as many occupants as possible.

c. **Emotional Satisfaction** – Pertaining to calming and/or arousing attributes of the environment which appeal to an occupant's need for order and cohesion.

Examples of conditions affecting physiological wellness include air movement, thermal and visual conditions, air quality, noise and light pollution. These are collectively described as **indoor environmental quality (IEQ)**; they have been known to affect workplace productivity and absenteeism. **Indoor air quality (IAQ)**, as a subset of IEQ, goes on to describe the level of microbes, pollutants such as VOCs and particulates. Exposure to these can affect the health of occupants, sometimes resulting in sick building syndrome. There are many design factors affecting IEQ and IAQ, for instance, material selection, lighting distribution. There are also many operational factors affecting a space, for instance, maintenance of its air supply ducts.

Examples of conditions affecting psychological wellness include visual and physical access to nature, access to natural light, etc. Studies have shown that these have beneficial effects on the building's occupant, both in the short and long term. These can translate to higher levels of productivity or a state of satisfaction.

Examples of conditions affecting emotional satisfaction are colour, pattern and artefact. The ease with which a building is understood is described as its level of legibility; which in turn depends on the cohesion of its constituent parts. Cohesion and legibility are critical to the way in which we make sense of an environment.

8.3 SINGAPORE CONTEXT

Guidelines by authorities in Singapore, such as National Environment Agency (NEA and BCA generally delineate limits of avoidance, stipulating for instance what is the acceptable bandwidth of conditions for IEQ[4].

At the national level, Singapore has consistently managed air quality by regulating and monitoring pollution at source. According to the Sustainable Development Blueprint (2009)46, Singapore has targeted by 2020 reductions in fine particles levels in the air to (PM2.5) to 12µg/m3, capping Sulphur Dioxide (SO_2) levels at 15µg/m3.

8.4 METRICS

8.4.1 Operative Temperature

Operative temperature describes the combined effect of air and radiant temperature as sensed by the human body. It is measured in degree Celsius (°C).

8.4.2 Predicted Mean Vote (PMV) Percentage of Persons Dissatisfied (PPD)

PMV is the 'predicted mean vote' (on the thermal sensation scale) of a large population of people exposed to a certain environment. PMV is derived from the physics of heat transfer combined with an empirical fit to sensation. PMV establishes a thermal strain based on steady-state heat transfer between the body and the environment and assigns a comfort vote to that amount of strain. PPD is the predicted percent of dissatisfied people at each PMV. As PMV deviates from zero in either the positive or negative direction, PPD increases.

8.4.3 Level of fine particulate matter (PM2.5) in the air

Particulate matter 2.5 (PM2.5) are fine particles in the air that are 2.5 microns or less in width. The level of fine particles in the air can cause health concerns when it is high. As the particles are small enough to travel deep into the respiratory tract of human lungs, exposure to them can cause serious health issues. Sources of fine particles include vehicular exhausts, chemical reactions such as burning of fuels, volcanic eruptions, and even tobacco smoke. PM 2.5 is measured in micrograms per cubic meter of air (µg/m³).

4. Singapore Standard SS 554: 2009 | Code of practice for indoor air quality for air-conditioned buildings: The Singapore Standard document entitled "Code of practice for indoor air quality for air-conditioned buildings" addresses protection from harmful substances in the indoor environment, which if present in excessive concentrations, can adversely affect the health and comfort of occupants. The document outlines an audit methodology which includes recommendations for acceptable limits and measurement or analytical methods for the following IAQ parameters - thermal comfort, chemical and biological.

44. Ken Yeang, Ecodesign: A Manual for Ecological Design, (London: Wiley-Academy, 2006)

45. HDB. "HDB Annual Report 2008/2009: Key Statistics ." Housing Development Board. 2009. http://www.hdb.gov.sg/fi10/fi10221p.nsf/0/d4a0f107613b79944825766200236310/$FILE/Key%20Statistics.pdf (accessed October 6, 2010).

46. MEWR and MND. "Sustainable Development Blueprint." Sustainable Singapore. 2009. http://app.mewr.gov.sg/data/ImgCont/1292/sustainbleblueprint_forweb.pdf (accessed October 6, 2010).

Integrated Landscape

A sustainable built environment integrates greenery and other landscape elements into urban masterplans, site design and building envelope.

9.1 OVERVIEW

At the urban scale, integrated landscape refers to the early consideration and inclusion of features such as water bodies, gardens, parks and green connectors into the urban fabric. At project level, this refers to the integration of water features and plants into site layout, plus the use of horizontal and vertical surfaces of the building, such as roof and façade, to grow vegetation.

9.2 IMPLICATIONS ON BUILT ENVIRONMENT

An integrated approach to landscaping is one in which these elements are considered early in the design process with the objective that building and landscaping are better synergised. There are several other important outcomes to this:

- → Landscaping systems and elements can contribute to **microclimate**, for instance lowering ambient temperatures. Building integrated plants are also known to improve the thermal insulation of facades and roofs, reducing thermal transmission into the building interior. In warm climates these can reduce demand for mechanical cooling within buildings, lowering energy demand.
- → There can be symbiosis between natural and man-made **flows and cycles**. The channelling and retention of rainwater, for instance, has potential for on-site sourcing and recycling, plus stormwater management. Natural elements, such as bioswales and phytoremediation ponds, augment mechanical systems such as swimming pools and irrigation systems.
- → Plants are a form of **carbon sequestration**; they absorb CO_2 from the atmosphere and store it.
- → Plants can be a source of **food**. Where onsite food production is substantial, it can lower the carbon footprint of the population by reducing its food miles, i.e. emissions resulting from transportation of food items from farms and production centres situated beyond the city limits.

The net effect of integrated landscaping is that it reduces the environmental burden that a development has on its immediate environment. It can also have a direct bearing on the well-being of the population, adding delight, relieving stress and offering nutrition.

9.3 SINGAPORE CONTEXT

Singapore is extensively landscaped which contributes to lower **heat island effect**. The policy of urban landscaping, which has been in place for several decades, is ramping up with strategies for green park provision of 0.8ha per 1,000 populations by 2030, and the introduction of 50ha of skyrise greenery by 2030[47]. The qualitative aspects of sustainable urbanism are pursued through strategies of integrating landscape within the built environment, providing equitable access to public infrastructure. Singapore aims to have 900ha of reservoirs and 100km of waterways open for recreational activities by 2030.[48]

At the building level, the Green Plot Ratio requirement earns credits under the Green Mark rating scheme, promoting the drive towards site and building integrated greenery.

9.4 METRICS

9.4.1 Green Plot Ratio (GPR)

The Green plot ratio (GPR) is measure of the amount of greenery found within a development's site boundaries. The computation of GPR begins with leaf area index (LAI) of different types of plantings – stipulated within Green Mark – which are added and weighted against site area. A GPR of 1, for instance, implies that the development has greenery equivalent to that of the site surface area covered with grass. GPR allows for the regulation of greenery on site, providing flexibility to the designer while simultaneously encouraging a higher green component to the design.[49]

Leaf Area Index (LAI) is defined as the single-side leaf area per unit ground area and is a dimensionless number. More information on LAI values and its application in Singapore can be sought via NParks' 'Floraweb'[50] (an online plant-reference database) or '*Leaf Area Index of Tropical Plants*'[51].

47. Ibid.
48. MEWR and MND. "Sustainable Development Blueprint." Sustainable Singapore. 2009. http://app.mewr.gov.sg/data/ImgCont/1292/sustainblueprint_forweb.pdf (accessed October 6, 2010).
49. Ong Boon Lay, Green plot ratio: an ecological measure for architecture and urban planning, Landscape and Urban Planning, Volume 63, Issue 4, Pages 197-211, 15 May 2003.
50. National Parks Board . NParks FloraWeb. 2010. http://floraweb.nparks.gov.sg/ (accessed October 6, 2010).
51. Tan, Puay Yok, and Angelia Sia. Leaf area index of tropical plants: a guidebook on its use in the calculation of green plot ratio. Singapore: Centre of Urban Greenery and Ecology, 2009.

Integrated Design Process

A sustainable built environment is a product of a collaborative framework known as the integrated design process (IDP). The IDP seeks to bridge the gap between the various stakeholders across all phases of the design-construction process, driven by a singular focus on targets and performance.

10.1 OVERVIEW

The IDP starts with the project team setting benchmarks and targets at the drawing board; it obliges them to address the needs of all stakeholder including the building occupants and operators, over the life of the building. In a sense, the IDP is a reversal of the fragmented, partisan and capital-expenditure driven approach that the industry adopts today, pushing process towards a symbiosis of systems and strategies towards long-term outcomes.

There are several key conditions of an IDP:

a. Appointment of all project consultants early in the design process

b. Collaborative and consultative approach to decision-making in which each person's contribution is valued. The project timeline is typically punctuated by periodic charrettes or workshops at which the team collectively reviews progress and outcomes. Through this act of collaboration & peer review, tradeoffs and conflicts between goals are managed

c. Process is driven by performance targets, many of them quantifiable and verifiable.

d. The needs and expectations of building users and operators are articulated in an IDP ensuring that the development is designed as it will be used by its occupants, and vice versa.

10.2 IMPLICATIONS ON BUILT ENVIRONMENT

Buildings designed with the IDP are more likely to result in an efficient use of resources during their operation. Various outcomes and deliverables, such as accessibility, safety and security, functionality, aesthetics and cost effectiveness52, are optimised and negotiated, in particular where the needs of one conflicts with another. This optimisation process results in a holistic outcome, where one feature or strategy reinforces the other.

The IDP also obliges the project team to adopt a whole-life view of building performance, from concept to disassembly. This perspective shifts the question of cost from upfront budgeting to a life-cycle analyses through which long term operations expenditure and environmental costs can be factored in.

10.3 SINGAPORE CONTEXT

The design-construction process in Singapore is driven by pressures of capital expenditure and construction schedule. Mindsets and disciplinary boundaries between architects and engineers often limit drawing-board communication that is necessary for design of high performance buildings. User feedback of a completed project is rarely solicited. Many projects are subject to iterative re-design when conflicts of cost and schedule become apparent; these short-term exigencies can compromise long term performance.

52. WBDG Sustainable Committee. "Sustainable | Whole Building Design Guide." WBDG - The Whole Building Design Guide. 2010. http://www.wbdg.org/design/sustainable.php (accessed October 6, 2010).

Ecological Literacy

11 DEFINITIONS AND DESCRIPTORS

Ecological literacy is the awareness in a population of the consequences of its behaviour and/or inaction towards its environment at large. A built environment, seeking to be sustainable, must factor in the degree of this awareness. It can conversely, through its design and interfaces, seek to promote it.

11.1 OVERVIEW

The built environment and its users are in continuous interaction. Buildings affect behaviour; occupants, through behaviour, shape their environments. Where a population is ecologically literate and committed to action, this conversation between occupant and building results in sustainable outcomes. Where a building is designed to promote ecological literacy, it heightens this awareness and helps align occupant behaviour.

11.2 IMPLICATIONS ON BUILT ENVIRONMENT

Ecological literacy is a prerequisite for a sustainable built environment. There are three ways in which buildings become educators[53]: demonstration, experience and involvement. 'Demonstration' is a formal channel of education, for instance through smart meters. 'Experience' connotes learning acquired via a passive form of interaction and observation. 'Involvement' implies active interaction with the building.

In other words, ecological literacy can be promoted by the built environment in several ways:

a. Formal and informal learning. Buildings can be commissioned with explicit instructions on appropriate use, with operational manuals on the features and systems that are in place. There are also formal industry-wide training programmes for building operators that equip them with the skills necessary for managing building performance.

b. Building-occupant interface. How an occupant should behave can also be inferred from the way a building's elements and controls are designed. The clarity of how certain elements are to be operated, such as windows and shading devices, is important. Decentralisation of controls, for instance, desktop task lighting or personalised ventilation systems, allows occupants to regulate their own comfort conditions without having to light or cool the entire space, all the time.

c. Awareness raising. A building can communicate the essence of ecological design[54]. This can be inferred from the degree to which it engages and respects the natural environment on site, for instance its relationship with nearby ecosystems. It can be perceived in the way it engages with the climate, for instance, the extent of daylight reliance and solar shading. This can also be inferred from the selection of some materials and avoidance of others. The combined effect of these ideas is that it will alter the feel and appearance of a sustainable building, setting it apart from one that is not.

11.3 SINGAPORE CONTEXT

Formal channels of learning are available to the Singapore building sector. Green education, by way of seminars, conferences and workshops, is targeted at the industry players, such as architects, engineers and builders. Informal channels of learning, affecting building users, are less common. There appears to be limited awareness in the public domain on the importance of the occupant's behaviour and lifestyle in the context of a Green building. This results in disjuncture between design and behaviour, bringing into question if a building designed to be Green at the drawing board is also Green in its operations.

53. Bonnett, E., & V. W. Olgyay 2009. Crytallised Pedagogy: Architecture as a Medium for Sustainability Education. Plea 2009: 2. 26th Conference on Passive and Low Energy Architecture. Quebec City: Rocky Mountain Institute.

54. The AIA Sustainability Discussion Group 2007. "AIA 50 to 50 Version 1." The American Institute of Architects . 2007. http://www.aia.org/groups/aia/documents/pdf/aiab051123.pdf (accessed October 6, 2010).

PART II

Process Considerations

Team Building — STAGE 1
Information Gathering and Goal Setting — STAGE 2
Design Brief — STAGE 3
Schematic Design — STAGE 4
Design Development — STAGE 5
Tender Documentation — STAGE 6
Tender and Award — STAGE 7
Mobilisation — STAGE 8
Construction — STAGE 9
Testing, Commissioning and Documentation — STAGE 10
Operations — STAGE 11
Demolition and Disassembly — STAGE 12

Team Building

STAGE 1

INTEGRATED DESIGN: organise a team (involve the client) for integrated project design and delivery.

ARCHITECT'S ROLE: leverage on the expertise within the firm among the consultants and client group.

SEARCH for a core team of specialised consultants (urban planners, architects, landscape architects and engineers) who have prior experience with projects that demonstrate sustainable community, urban and site planning as well as landscape design, such as (but not limited to):

- → Code reviewers
- → Ecologically Sustainable Development (ESD) designers or consultants
- → Biodiversity consultants
- → LCA consultants
- → Carbon consultants
- → Grey water consultants
- → Energy consultants
- → Geothermal engineers
- → Sustainable timber consultants
- → Computational Fluid Dynamic (CFD) analysis consultants
- → Facilities management
- → Engineers
- → Acoustics consultants.

INCLUDE people who are familiar with the codes (to have a balance between innovative design and meeting agency requirements).

BALANCE innovative design with cost (specialised consultants).

ORGANISE the client, from infrastructure/ masterplanning (campus situation) and user groups to facility managers and maintenance/final demolition team if available.

ORGANISE a consultant and future construction team that mirror the client's team or vice versa.

Information Gathering and Goal Setting

STAGE 2

EIA

DEVELOP ESD strategy during design charettes with all stakeholders to identify and endorse targets and goals.

CHECK AND CONFIRM government regulations on ESD aspects and applicable rating systems. Local rating systems should prevail over international systems.

ESTABLISH specific aims such as low carbon/low energy to establish better understanding and focus of ESD measures.

RAISE ESD ASPECTS with clients that are not typically associated with the classic construction process such as post-occupancy evaluation and LCAs.

ESTABLISH ESD ASPECTS to form part of project deliverables and create a responsibility matrix among the client/consultant team so that additional costs and fees can be established early on.

Design Brief

STAGE 3

REVIEW ESD GOALS from the project brief and develop cost estimates and Return on Investments.

CONDUCT INFORMATION GATHERING to obtain existing site information such as:

- → Climatic conditions (wind, rain, temperatures, humidity, sun path/radiation)
- → Traffic conditions
- → Site preservation and conservation assessment including flora, fauna and geographic, cultural and historical resources
- → Natural resource availability including hydrology reports
- → RE opportunities on and around the site.

INTEGRATE FINDINGS into the concept design in regards to building forms, massing orientation and location on site.

CONSIDER using local and natural materials in the design.

CONSIDER the use and rehabilitation of existing buildings on the site.

MAXIMISE the utility of open spaces for natural ventilation that can be used as common/public spaces.

DEVELOP AN ESD ACTION PLANS based on a responsibility matrix and concept design.

Schematic Design

STAGE 4

EIA

REVIEW ESD goals through regular design meeting and charettes.

IDENTIFY ownerships based on ESD action plans and rating system requirements.

DEVELOP a transport plan to minimise vehicular traffic and advocate public/pedestrian and bicycle network solutions.

CONDUCT studies on microclimate, solar heat impact and daylight based on software analysis and integrate findings into the design to avoid heat islands and solar heat impact on occupied spaces.

DESIGN for flexibility and future adaptation.

IDENTIFY areas for natural ventilation or mixed-mode air treatment.

EXPLORE recycling possibilities for on-site building components and materials.

DEVELOP stormwater management strategies to encourage and promote water recycling and conservation. Use government or local programmes where applicable [PUB, the Water Agency (PUB) Active, Beautiful and Clean (ABC) water programmes etc.].

EXPLORE embodied carbon for structural options and consider cement replacement options.

DEVELOP shading and glazing strategies for façades.

DEVELOP rain and shading strategies for natural ventilated spaces.

CARRY OUT initial energy modelling based on the above strategies.

Design Development

STAGE 5

REVIEW
ESD strategies and action plans including regular reports and monitoring of targets.

SELECT
materials with low (VOC) emissions and other harmful chemicals.

PROVIDE
acoustic separation between sources of noise in adjacent areas.

DEVELOP
detailed plans to conserve, reinstate or create habitats on site.

CARRY OUT
detailed energy modelling.

CHECK
if government incentives or funding programmes are available for specific goals.

PROVIDE
operable windows and shading, and Heating, Ventilation and Air-Conditioning (HVAC) systems where possible/ practical for end user control.

SIZE
structural members efficiently.

DEVELOP
detailed waste management systems including recycling stations and explore the use of waste for energy use (co-gen plants etc.).

SELECT
environmentally friendly and recycled materials.

DEVELOP
a detailed façade system to address solar heat gain, glare, natural lighting, air tightness and moisture control.

SIZE
and locate Mechanical, Electrical and Plumbing (MEP) equipment efficiently, including metering and monitoring systems.

DEVELOP
a detailed strategy for integrated greening.

EXPLORE
innovations and identify synergies to enhance building performance and environment.

Tender Documentation

STAGE 6

CLEARLY DOCUMENT
ESD goals, strategies and mandatory requirements in the contract drawings and specifications.

DEVELOP
material specification with particular reference to green products.

DOCUMENT
ESD aspects to minimise erosion or habitat destruction during construction.

STIPULATE
how a contractor should run the site.

Tender and Award

STAGE 7

CONVEY
ESD strategy and goals to the tenderers.

ESTABLISH
pre-qualification based on suitable experience.

ESTABLISH
assessment evaluation methods to evaluate contractor experience and conformance to tender documents.

REVIEW
tenderers' sustainable proposals and submissions including:

- Experience and capability
- Conformance and understanding
- Overall achievement of ESD and certification goals
- Maximising opportunities to explore sustainable strategies.

Mobilisation

STAGE 8

ENSURE conscientious planning for the entire construction process.

ENSURE adequate and safe working space around areas that require conservation.

ENSURE conserved areas are not isolated during construction.

ENFORCE sustainable practices in the contractor's setting-up of temporary buildings and in the demolition of existing structures, disposal and handling of demolished (salvaged) material.

EMPLOY just-in-time delivery and proper and safe storage to reduce wastage of storage space and damage to materials/equipment.

LOCATE the site office with due consideration for existing structures, storage, plant and manoeuvrability of heavy equipment required for construction.

CONSIDER the effects of vibration, dust and noise pollution generated by construction equipment, especially where existing structures are deemed 'fragile'.

ENSURE safety recommendations are enforced.

ENDEAVOUR to protect and maintain the existing landscape where possible.

USE sustainable construction methods including silt fences or bioswales to prevent soil erosion and sedimentation.

PROTECT existing landscape features such as trees, turfing or water bodies to avoid damage during construction.

Construction

STAGE 9

INTEGRATE
ESD strategies and goals into the agenda for site meetings.

DEVELOP
a monitoring plan to monitor the contractor's performance against tender/contract requirements.

ENSURE
the proper protection of on-site vegetation, habitats or cultural/ historic installations.

ENSURE
all HVAC and façade systems are installed properly with full documentation and manuals.

ENSURE
HVAC systems are protected from dust/ microbes during construction.

ENSURE
materials and finishes are protected from moisture and heat impact.

Testing, Commissioning and Documentation

STAGE 10

DOCUMENTATION (include brochures)

ENSURE green features are implemented and working effectively.

ENSURE complete documentation for certification requirements.

ENSURE user guidelines and training plans are in place.

REVIEW design documentation, and complete thorough testing to key specifications.

REVIEW key documents for completion such as logging, plant efficiency, performance and equipment.

Operations

STAGE 11

RECOMMEND
and fine-tune the integrated system.

CHECK
operation manuals for HVAC, façade and waste systems and ensure that maintenance staff is properly trained.

MONITOR
and check building performance against goals established during DD through full post-occupancy evaluation.

ADVISE
the client to carry out occupant surveys to confirm IEQ standards and address any comments or concerns.

PROMOTE
the sharing of building data with occupants and the public to create better benchmarks.

INSTALL
'dashboard' monitors to educate building users on the impact of their actions.

ENSURE
recycling points are properly located and maintained, and that users are educated on their use.

Demolitions and Disassembly

STAGE 12

ASSESS
the building for adaptive reuse.

UPDATE/EVALUATE
and re-establish the demolition protocol.

MAKE PROVISIONS
for proper disassembly and safe disposal or recycling.

DEMOLITION AND DISASSEMBLY
of the building should not affect the Natural Capital.

Credits

Authors

Cheong Yew Kee, Clifford Chua, Vivien Heng, Nigel Greenhill, Nirmal Kishnani,
Kuan Chee Yung, Li Sau Kei, Amit Pathak, Bhavna Singhal, Peter Stueck,
Gieto Sugianto, Jaye Tan, Mark Teo, Yang Li

Contributors

Idris bin Bidin, Cheah Kok Ming, Bhatt Vikas Kailankaje, Leong Tatt Man,
Ng Kim Hoon, Leonard Ng, Benjamin Towel

Council Members

PRESIDENT: Theodore Chan

1ST VICE PRESIDENT: William Lau

2ND VICE PRESIDENT: Chan Kok Way

HONOURABLE SECRETARY: Seah Chee Huang

HONOURABLE TREASURER: Laurence Liew

IMMEDIATE PAST PRESIDENT: Ashvinkumar

COUNCIL MEMBERS:
Darren Peter Benger, Angelene Chan, Chan Seng Kee, Changaroth N Suneeth,
Cheong Yew Kee, David Chung Kah Keat, Kuan Chee Yung, Richard Lai Teck Chuan,
Law Yoke Foong, Patrick Lee, Lim Choon Keang, Loh Ju-Hon, Catherine Loke,
Ong Eng Liang, Ong Tze Boon, Song Yew Kee, Richard Soon Yu Kong,
Christina Thean, Mark Wee, Wo Mei Lan

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Sn	Country	Question 1 What is the current situation in your country regarding the level of awareness in the community and in the architectural profession of Sustainability/Responsibility ?	Question 2 What word(s) do you use in your country to describe Sustainability/Responsibility ?	Question 3 What aspects of Sustainable/Responsible architecture are recongnised in your country?	Question 4 What national plan do you have for Sustainability/Responsibility?	Question 5 What are the key aspects of your plan?	Question 6 What practical methods do you have to implement this plan?	Question 7 How do you work with your government/s to implement this plan?	Question 8 How is this changing your country, socially, economically for the betterment of people?	Question 9 If you do not have a plan, are you working on one, when will it be finished and how do you think you can have it implemented with the help of your government?	Question 10 If you do not have a plan will you start to investigate having one or not, do you need help to start a plan?	Comments
1	Bangladesh	Architects are day by day becoming conscious about the sustainability issues & long term environmental impact related to building projects	"Paribesh Bandhab Unnayan" or environment friendly developments	Climatic issues such as natural ventilation, use of solar energy etc	There are laws for environment protection, pollution control & protection of wetlands etc.	The key aspects are reducing the heat island effect, ground water recharge, road widening to ease transportation, increase green area, use of renewable energy, better use of daylight etc.	IAB has been relentless in motivating the development control authorities in incorporating incentives for rain water harvesting, ground water recharging, use of renewable energy in buildings for getting building permits in the major cities.	IAB keeps close contacts with the building approval authorities, department of environment of the government related sustainability and environmental issues.	Use of renewable energy, efficient stove for cooking, rain water harvesting has become an integral part of a large segment of the rural households. Government, Financial institutions and the NGO's are very active in promoting & implementing these programs.	We are hopeful that by the end of the year, Dhaka city development authority will incorporate the incentives for rainwater harvesting, ground water recharge & solar power installation in buildings as per recommendations of IAB.	IAB is planning to initiate formulation of a green building index for the architects. IAB will welcome any such support from UIA, ARCASIA and CAA.	
2	China P.R.	China government has realized the essentiality of sustainable development, especially in the building, community and urban development. So far, the national and local governments have formulated and issued some standards and policies to promote the sustainable design and construction in building, community and urban scales. And the researches on sustainable urban / rural planning are also incepted. However, not all the common people have the awareness of sustainability.	Green, Low-carbon, Energy efficiency, resource-conserving, environment-friendly	The following 6 components of green building are recognized in China, including: (i) land saving and outdoor environment, (ii) energy saving and efficiency, (iii) water saving and efficiency, (iv) building materials saving and efficiency, (v) healthy indoor environment, and (vi) efficient O&M	There is five-year plan in China. The 11th National Economic and Social Development Five-Year Plan was issued in 2006, which makes plan of sustainable development for the whole country, especially defines the goals on sustainable use of energy and on pollutants emission. According to the national plan, the State Council and the local governments had made further detailed plans. The next five-year plan will start in 2011, which will keep on stressing sustainable development. The legislation on building energy efficiency has been promulgated in China; and the legislation on green building is also under consideration. Several cities has promulgated the compulsory implementing rules of green buildings. Several standards related to building energy efficiency and green building have been also promulgated in China. The standard of green building in the future will cover all the types of buildings.	In the construction sector, we mainly concern on two aspects: one is to promote the implementation of sustainable architectural design and construction standards; the other is to carry out the demonstration projects in building, community and city scales. Currently, the building energy efficiency is under compulsory implementation. Chinese Premier Wen Jiabao has required the full coverage of implementation of green buildings. And in the future, the green building will be compulsory requirements step by step. Till now, there are over 100 cities in China have confirmed the "ecological or sustainable city" as their goals of development, and several demonstration districts show the systematical implementation and demonstration of green buildings.	In recent years, the Chinese government actively formulated related regulations and policies to improve the sustainable development of building industry. Firstly, it is required realizing the sustainable design and construction at least for all government invested projects as pilot ones. For example, the central government invests special funds on real-time monitoring systems for governmental buildings and large-scale public buildings; till now, more than 800 such buildings are in the monitoring system. Secondly, the government is keeping researching on economic incentive policies to promote the R&D, demonstration and industrialization of key technologies of renewable energies. For example, the Golden Solar Engineering is implemented and is estimated of near 10 billion RMB in 2-3 years with hundreds of demonstration projects, which is emphasizing on support the demand side adopting the solar energy into the grid. The installation capacity is estimated as over 500MW; for single project, it will subsidize 50%-70% of the total investment. All such measures really promote the low-carbon and sustaina in the future, such policies will be expanded to the urb	ASC (Architectural Society of China) has good cooperation with the national and local governments in China. Firstly, many members of ASC have been researching and practicing on sustainable building, community and urban development, and providing technical support on the standards and policy formulation. Secondly, ASC is in the leadership of implementing and disseminating the standards and policies. Thirdly, ASC actively includes the green building related contents into the vocational education and award evaluation of architects, which elevates the knowledge in an optimal extent of the sustainable development for architects.	For common people, it is improving their living conditions and reducing energy fee as well as improving the quality of inhabitant's environment. For the society, it is mitigating the increase of energy consumption and greenhouse green house gas emission as well as helpful to the environment. For the government, it is effectively promoting the upgrading and transforming of building sector, and stimulating the emerge of new industries to increase employment, which improve the competitiveness and attractiveness of the whole country.	N.A.	N.A.	
3	Korea	Most people in Korea today have an immediate and intuitive sense of the urgent need to build a sustainable future. They may not be able to provide a precise definition of "sustainability/responsibility", but they clearly sense the need for action. The awareness level in the professional community differs depending on the trades in the industry. While some of them tends to cling to the status quo rather than to challenge or change, very few architects can survive in the market these days without dealing with the issues of energy conservation, utilization of alternative (or renewable) energy resources, ecology and "green environment".	The government frequently uses the words "Green Growth". However, "sustainability" is a common word.	The government and the society urge architectural communities to implement immediate actions to mitigate climate change. Yet, the profession seems to recognize "ecology and indoor environmental quality(EEQ)" as the most important aspects. It is also true that many architects understand sustainability is synonymous with energy conservation.	FIKA(Federation of Institutes of Korean Architects) in 2009 adopted "Declaration of Environmental Sustainability", in which the federation declared to place environmental sustainability at the core of professional practices and responsibilities. The federation also pledged to promote utilization of natural and renewable energy resources in building design. Although conceptual in nature, the declaration is a symbolic movement to signpost for the profession the need and necessity of promoting sustainable architecture.	FIKA is scheming to implement action plans as follow-up measures of "the Declaration of Environmental Sustainability". The key aspect is to establish the goal of Energy/CO2 reduction target which can be achieved through building design. Presently, the target has not been set yet. However, thirty percent(30%) reduction of CO2 emission by 2030 on BAU basis is considered most viable.	Education and training: FIKA has very limited means of implementing the plan except for education and training of students and member architects. FIKA has been running "Sustainable Architecture Academy" for 2 years. The academy educates the concept/principles/methods/details of sustainable architecture to the recent graduates of architectural schools. Practice: Most public sector projects and large scale projects in the private sector already mandate variety of compulsory measures to conserve energy and to reduce CO2 as basic requirement that architects have to comply with. These measures include energy conservation, passive solar principles, use of alternative (renewable) energy source, collection of rain water and use of grey water and aggressive use of green to sustain ecology system.	The concrete action plans have not been set, yet. FIKA is willing to work with the government when the plan has finalized. In the meantime, the government has financially supported the Sustainable Architecture Academy, providing about a half of its budget.	Government to influence national policy. In tandem with this policy level work, the Institute has a large number of initiatives in place to promote the role of design in contributing to the growth of Sustainability	Not applicable	Not Applicable	
4	Hong Kong	**See Also full text attached below** • The professional group has high level of awareness on sustainable design and its responsibility therein. • The Hong Kong Institute of Architects (HKIA) has established Environment and Sustainable Development Committee since last decade to enhance the sustainable development among members through seminars, forums, visits, CPDs and government liaison. Committee is well-established and sustainable-related events are well-supported by our fellow professionals. HKIA has organized Green Tours in 2000, 2002, 2004, 2005, 2008, 2010 to pay visit to leading countries and cities with green design policy and participated in the international Green Building Challenge Conference 2000, 2002, 2005, 2008 to enhance the knowledge and know-how exchange at professional level. • Professional Green Building Council (PGBC) was established in 2002 by the Founding Members including The Hong Kong Institute of Architects (HKIA), The Hong Kong Institution of Engineers (HKIE), The Hong Kong Institute of Landscape Architects (HKILA) and The Ho • The Hong Kong Green Building Council (HKGBC) was established in	• For PBGC, "A sustainable building provides a quality living amenity for its users and neighbours in terms of social, environmental and economic aspects while minimizing environmental impact at the local, regional and global levels throughout its full life cycle." • Green Building Award (GBA) was established by PGBC in 2006 with the motto "Conserving for Livable Environment - Building toward Sustainable Development". • For HKGBC, "Green buildings are occupied structures that are environmental and sustainable throughout their life cycle. Green buildings are: 1. Good neighbours, with healthy and productive indoor and outdoor environments 2. Low polluters, that minimize waste 3. Energy efficient, with low carbon footprints and greenhouse gas emissions 4. Sustainable, re-using and recycling materials, and conserving water"	• For HKIA, HKIA Annual Award has adopted sustainable design as one of the key criteria for award assessment including the HKIA Medal of the Year, Merit Award and other categories. A special-dedicated category namely "Special Architectural Award – Sustainable Design" is established to highlight the significance of sustainable design in Hong Kong. Other Special Architectural Award winning entries such as Heritage, Architectural Research, Urban Design and others may be awarded to sustainable design projects and proposal as well. • For PBGC, Green Building Award (GBA) was established in 2006 to promote the recognition of sustainability among professionals, and this award is organized on a bi-yearly base as a collective effort among the professional institutes to enforce sustainable design development in Hong Kong. In 2010, HKGBC and PBGC jointly organize this award with an extension to 6 categories namely 1. RP: Research & Planning 2. BNB: New Buildings 3. BEB: Existing Buildings 4. BAR: Adaptive Reuse & Revitalisation 5. BIN: Interiors 6. AP: Projects in Asia Pacific Region	1. In terms of professional's sustainability force towards the National Plan in China, China Green Building (HK) Council is established in 2010 to address the national development of China Green Building Council. CGBJHKJC will arrange 1-star and 2-star certification of China Green Building Labelling in Hong Kong, while certification of 3-star project to be controlled in Beijing. 2. In terms of professional's sustainability force towards the Local Plan in Hong Kong, HKIA / PGBC / HKGBC always in response to the HKSAR government's Policy Address and direction of Council for Sustainable Development established as per Chief Executive's Policy Address in 1999.	7. In the Local Plan in Hong Kong, HKGBC becomes the leading organization with input from the government, professionals and sustainable building assessment units. The first year plan for 2010 includes the following aspects: a. Green Building Certification and Promulgation b. Influencing and Advising the Government on the Drive for Green Building Growth c. Leading the Community to Adopt Green Building Practices d. Protecting the Environment in an Urban Context e. Reducing Carbon Emissions	1. HKGBC will be the organization responsible for the certification of local green building assessment tool BEAM-PRO. This assessment tool is an upgraded version incorporated with the government's green building initiative CEPAS so that BEAM-PLUS is geared towards more scientific assessment studies. • HKGBC engages the community, industry, and government to create practical solutions for Hong Kong's unique subtropical, built environment. Through partnership and engagement, Hong Kong's green building practices will gain momentum, providing better choices, creating a more competitive market internationally, and making good community and business sense. 1. HKGBC reaches out to the public and industry on how their actions can contribute to positive change in the built environment 2. By engaging a strong body of members, HKGBC brings together industry leaders and passionate supporters in a united council 3. We promote performance rating standards, such as BEAM, the Building Environment Assessment Method, to benchmark and enhance the performance of Hong Kong's built environment	• The HKSAR Government has joint-force with HKGBC to offer a direct collaboration opportunity among government and professionals. • HKGBC establishes HKGBC Green Guide in collaboration with the professional groups addressing the government's launch of new measures to accelerate the revitalisation of industrial buildings for redevelopment, conversion and change of use of industrial buildings starting from the April 2010. In line with the policy launch, HKGBC has issued its Green Guide on Revitalising Industrial Building, aiming at providing the preliminary introduction on how BEAM Plus (2009 Edition) green building label, Hong Kong's comprehensive and voluntary environmental assessment scheme, helps owners to understand and capture these opportunities. • HKGBC Green Labelling Development Steering Committee is formed with representatives from HKSAR government, HKGBC, universities and expert term consultant to form the Green Labelling System for Hong Kong.	Sustainable development is required to make Hong Kong a clean, comfortable and pleasant home, and also to maintain our competitive advantage and our position as a world class city. In Hong Kong, it means: • finding ways to increase prosperity and improve the quality of life while reducing overall pollution and waste; • meeting our own needs and aspirations without doing damage to the prospects of future generations; and • reducing the environmental burden we put on our neighbours and helping to preserve common resources. ("1999 Policy Address").	Not applicable	Not Applicable	See also full report covering government and community involvement.
5	India	Not only the profession or community but even at the Government level the awareness and acceptability of sustainability / responsibility is the current concern and there is on over all agreement on three foundational aspirations. First that human beings should be able to enjoy a decent quality of life; second, that humanity should become capable of respecting the finiteness of the biosphere; and third, that neither the aspiration for the good life, nor the recognition of biophysical limits should preclude the search for greater justice in the world.	We use the word "Green Architecture / Sustainable Architecture in India to describe sustainability / Responsibility, for general public, the common popular theme is "Go Green"	The architects engineers and builders with full support and cooperation from the Government are engaged in perusing and implementation of the following aspect of sustainability / responsibility. Sound urban planning practices leading to long term sustainability. Implementation of Green code / practices for buildings and promoting GRIHA rating system suitably designed for Indian climates conditions. Energy conservation and use of Alternate and Renewable Energy and architectural design optimized as per climate and sun path analysis alongwith implementation of passive strategies for example earth air tunnels etc. Recognising the advantages and use of Bio fuels, wind farming, solar farming and wind turbines in addition to solar heaters and use of solar energy in various aspects of habitat.	It is relevant to mention that under the National Action Plan on climate change the Government of India recognizes that the country economy is closely tied to its natural resource base and climate-sensitive sectors such as agriculture, water and forestry. Hence it is envisioned to create a prosperous, but not wasteful society, an economy that is self-sustaining in terms of its ability to unleash the creative energies of our people and is mindful of our responsibilities to both present and future generation. For effective implementation of the action plan eight national mission forming core of National action plan are:- National Solar Mission National Mission for Enhanced Energy Efficiency National Mission on Sustainable Habitat National water Mission National Mission for Sustaining the Himalayan Ecosystem National Mission for a Green India National Mission for Sustainable Agriculture National Mission on Strategic Knowledge for Climate Change.	Briefly the key aspects of Mission of Sustainable Habitat is to make habitat sustainable through improvements in energy efficiency in buildings, management of solid waste and modal shift to public transport. The Mission will promote energy efficiency as an integral component of urban planning and urban renewal through three initiatives. The Energy Conservation Building Code, which addresses the design of new and large commercial buildings to optimize their energy demand, will be extended in its application and incentives provided for retooling existing building stock. Recycling of material and Urban Waste Management will be a major component of ecologically sustainable economic development. India already has a significantly higher rate of recycling of waste compared to developed countries. A special area of focus will be the development of technology for producing power from waste. The National Mission will include a major R & D programme, focusing on bio chemical conversion, waste water use, sewage utilization and recycling	There are incentives to Builders, Architects and also end users for the project if constructed as per the GRIHA RATING SYSTEM. The Institute / profession's representatives at various implementation monitoring groups are teamed to work towards:- Capacity Building & Qutreach Research & Development Formulation of City Development Plans incorporating Principle of Sustainable Habitat. Supplementary Measures. Development and Adoption of Sustainable Habitat Standards into a Legal Framework. The Indian Institute of Architects (IIA) has been organising Seminars on Green Architecture throughout the country for the benefit of Architects, Engineers, Consultants, Students of Architecture and also for the public at large. Besides through our Chapters and Centres we are encouraging Architects to construct buildings on Green principles and passive strategies including utilising natural light and ventilation to avoid excessive use of electricity.	Use of Green & Sustainable Architecture wherever implemented has shown results in improving quality of life and for rural areas wind farming, solar farming, project has helped as a substitute alternative energy source being used thus helping increasing yields in agriculture for farmers with lassoer means. It has resulted in path towards optimizing use of energy, environmental friendly built from habitats, thus aiming towards achieving a balance between the economic and social development of human habitats together with the protection of the environment, equity in employment, shelter, basic services, social infrastructure etc.	In view of all above, the answers to the next two questions are not applicable, however UIA's support and help is welcome and always sought for.	In view of all above, the answers to the next two questions are not applicable, however UIA's support and help is welcome and always sought for.	
6	Indonesia	The Sustainability issues have been on the table for 4-5 years and just began to be seriously discussed in the architectural profession a couple of year ago. Green Building Council Indonesia (GBCI) was established in 2009, and at this moment already signed an MoU with Indonesian Institute of Architects to develop Green Rating and to campaign on the sustainability issues nation-wide.	A (design) work that giving full respect to the environment. More people also add local culture as part of sustainability/responsibility approach. Sustainable word in our own language is keberlanjutan, literary means going on and on while ideally maintaining quality.	Saving energy, saving water, environmentally friendly design, recycle-reduce-reuse, passive design, active design, local material, mechanical equipment efficiency, architecture design that is treasuring heritage and local wisdom.	To raise architects' awareness on sustainability issues Establish collaboration with green community To support government program on national sustainable development programs Endorse members of IAI to attend GreenAssociate and GreenProfessional programs	Members' attention to join the program Support from green community Partnership with the government Level of people awareness toward sustainability issues	Put the sustainability programs into our 4-monthly professional courses Get hand-in-hand with GBCI to setup working programs Being active in Sustainable Urban Development forum in Indonesia as it is the place where seminars, discussions and workshops are being handled by concerned parties and individuals.	Set up a public private partnership program with Ministry of Public Works as the responsible Ministry for sustainability issues. We had signed a declaration concerning this matter. Running several design competitions each year to promote sustainable design Support local government to develop programs to assess key government buildings with regard to sustainability and green rating.	Unknown yet, we have just begun. Good thing is that more people are significantly now giving good attention to the environment. Bad thing is that local investors think that to design a green architecture is more expensive. But in general the tendencies are positive and people accept the ideas quite well.	We are thinking that the sustainable architecture is a long term program, and will get the first milestone when it is put as an important consideration in the national building codes.	Yes we will appreciate any help to start a plan. We like to learn from the other countries on how to have a good sustainability/responsibility based on own culture and local wisdom.	

		What is the current situation in your country regarding the level of awareness in the community and in the architectural profession of Sustainability/Responsibility ?	What word(s) do you use in your country to describe Sustainability/Responsibility ?	What aspects of Sustainable/Responsible architecture are recognised in your country?	What national plan do you have for Sustainability/Responsibility?	What are the key aspects of your plan?	What practical methods do you have to implement this plan?	How do you work with your government/s to implement this plan?	How is this changing your country, socially, economically for the betterment of people?	If you do not have a plan, are you working on one, when will it be finished and how do you think you can have it implemented with the help of your government?	If you do not have a plan will you start to investigate having one or not, do you need help to start a plan?	
7	Japan	Since COP10 was convened by Japanese Government in 1997, awareness of sustainability in terms of the reduction of GHG emissions (actually CO2e) is very high throughout the related sectors including building and construction industry.	According to the time and the Zeitgeist, this has been differently expressed such as; 1) Environmentally Symbiotic Housing, Building and City (since 1990) 2) Carbon Neutralization (since 2008)	Since 1990, the reference year of Kyoto Protocol, only business and household sectors have been constantly increasing their CO2e, while industry and transport sectors showed relatively efficient outcomes. Architectural sustainability has been therefore recognized very responsible for contributing to the creation of low carbon society. Key issues are: 1) Energy efficiency 2) Resource and material efficiency 3) Indoor environment 4) Quality of services 5) On-site outdoor environment 6) Off-site environment	Japanese Government has announced the following basic goals of policy; 1) 6% reduction of GHG emission during 2008-2012 (Kyoto target) 2) 25% reduction of GHG emission by 2020 (by the Prime Minister) 3) 80% reduction of GHG emission by 2050 (by the Ministry of Environment) Accordingly, Government provides us with a variety of legal and financial incentives.	1) Awarding the annual best practice of sustainable building 2) Promoting model eco-houses throughout the country 3) Promoting the design methods of sustainable building 4) Development of assessment system	1) Since 2001, JIA has been selecting and awarding the annual best practices of sustainable building in two categories; Housing and Non-housing. 2) In addition, JIA has recently promoted building model eco-houses throughout the country, representing and being customized by the region-specific conditions from north to south, being financially supported by the Ministry of Environment. 3) In collaboration with other 16 building related associations, JIA released the "Vision 2050: Building-related Measures to Counteract the Global Warming" for COP15. 4) JIA has been offered related seminars and workshops with CPD points.	JIA, as a member of governmental-industrial-academic consortium, works directly and/or indirectly to implement the above plans. However, such collaboration is based upon rather personal than organizational efforts.	Above all, all these initiatives are expected to promote market transformation towards green and sustainable society. This requires people's behaviours from "brown" to "green" driven by both ethical and beneficial motives. The integral change by the triple bottom line is now becoming tangible through the recent real estate industry's interests in green property.	Not applicable	Not applicable	
8	Lao	The notion of "awareness" was only recently introduced in society in our country. You could say that the level of understanding of this notion remains very low. Over the past few years, the government has included the obligation to involve society in all stages of project realisation in the terms of reference for consultants charged with installing infrastructure projects financed by donations or by loans from international financial institutions (ADB-WB-AFD-JICA-etc.). However, in reality, the community's participation or awareness remains extremely limited. Concerning "sustainability" within the architectural profession, architects' level of understanding is not so different from that of the public. The word appears in all the speeches and seminars, etc. (because it is in fashion), but without anyone really knowing what it means and is all about. Our association is making every effort to explain to our young architects the meaning of the word and what our profession needs to do to give meaning to it through more concrete actions in the architectural design of future w	In our country we use both words 'sustainability' and 'responsibility' according to the context. But the word 'responsibility' is used more frequently because it is better understood.	To tell the truth, our association and the Department of Housing and Urban Planning (Ministry of Public Words) are currently conducting an evaluation of architecture's impacts on the physiognomy of the city, starting with the capital 'Vientiane'. From 1954 until 1975, we can say that major architectural works were rare, because of political events and the state of economic development. From 1975 to 1988 the country was going through a change of political regime (abolition of the monarchy and establishment of a popular republic), during which the government put more effort into consolidating power and researching a "new economic policy" than into architecture and building architectural masterworks. Beginning in 1988, with the launch of the new economic policy (at the same time as Vietnam), and with political stability, the country really began to give importance to urban development, infrastructure projects and architecture. This is when the city of Luang-Prabang was listed as a World Heritage site. In Vientiane new buildings were built (administrative buildin In 2005, we needed to set up our association (A	If such a plan exists on the national level, we have no knowledge of it. There are of course two ministries that are more or less responsible for questions related to architecture. They are the Ministry of Culture, Information and Tourism, and the Ministry of Public Works. Within the first ministry, the Heritage Department is charged with managing and protecting heritage in the largest sense, and in particular safeguarding "built heritage". The second ministry is charged with urban development and building in general. In addition to these ministries there is a Luang-Prabang Department of World Heritage (DPL) with which we signed a renewable, three-year assistance contract that allows us to help the DPL train its technical staff. But we, as an association, will continue to work with the relevant ministries and departments in the areas of training personnel and distributing know-how.	The 'key aspects' are and will remain reinforcing human resources, architectural education at the university level, monitoring the profession and capacity building. We feel that "architectural sustainability will be attained in our country only after professionals have been trained in the notion of sustainability"	As our plan focuses on education and raising awareness, it targets three levels: (1) the university level: help architectural faculties to revise-improve their curriculum, offer conferences (courses) to 5th year students, participate in diploma evaluation juries, etc. (2) the professional association level: suggest revisions to certain laws to officialise the profession of 'architect'; revise the method for registering architects; train architects in the notion of sustainability (3) the government level: help to implement ministerial decisions and decrees and the existing laws on architecture, continue participating in various inter-ministerial commissions or juries to examine architectural projects on the national level and attribute prizes, etc.	As an association of architects, we are not certain how and in what ways we should work with the government to realise a plan. However, what we can do is continue our present actions to evaluate the 'architectural damage', the errors made by young architects, monitor architectural practice by upholding national laws, ministerial decrees, etc., with the goal of registering architects, applying ethical codes and sanctioning violations, training architects through all the communication means available, etc., this is what we are doing at the moment with the department of habitat and urban planning.	Certainly if we had a more concrete and easily understandable plan, it would make a positive impact on social life and the well-being of our citizens, as well as the country's economic development. We are a very small country, with a population of 7 million people for a territory half the size of France. The country has enjoyed political stability for 30 years and there is no reason for that to change. The country is certainly under-developed, if we judge using the various development ratios put out by the United Nations, but our country is rich in natural resources that are currently being exploited with great care. Despite the relative lack of development, we have a good quality of life. On the cultural level, our country has a very old civilisation with its own art and architecture. For the moment, we can still preserve our art and architecture from the ravages of modern or avant-garde architecture. The time has come for us to develop a plan or appropriate measures to ensure the sustainability of our architectural heritage and for our country to continue its development in a	We do not have a concrete plan at the moment.	We would like to start development on a plan, and would be very happy and grateful for all assistance and support from the UIA in this work.	
9	Macau	More and more concerns in the community. There are more and more sustainable concepts applied in different kinds of projects, and certain guidelines have already circulated among the government departments for environmental protection. However, in the architectural profession, it's still at the initial stage in Macau. Government is now instituting the guideline for green buildings in order to encourage sustainability building design.	Environmental friendly, green, low-carbonized.	Energy saving.	No plan yet, but hope to develop the knowledge and skills of this scope and try to apply those into practical projects.	Sustainable and environmental friendly adapted to Macau's conditions	Apply the concepts and skills in practical projects.	Introduce the ideas when designing a project.	The citizens would be able to live in a more comfortable environment. Increase people's consciousness of environmental protection and help to reduce the hazard to the environment. Introduce more new sustainable technologies to Macau and may develop a new market for the district.	No idea yet.	Yes	
10	Malaysia	Awareness of Sustainability and the Green movement is just beginning in the community. However the architectural profession has taken a strong lead in this area through the development of the Green Building Index (GBI). GBI was launched in May 2009 and is today recognised as Malaysia's green building rating tool. It was developed by a team headed by professional architects with the assistance of professional engineers. GBI is specifically customised for the local tropical climate, culture and state of development in Malaysia.	Green, Hijau (malay for green), Mampan (malay for sustainability	The Green Building Index provides certified, silver, gold or platinum ratings for buildings (soon also for townships). It gives points for sustainable aspects in 6 criteria - namely Energy Efficiency, Water Efficiency, Site Planning and Management, Materials and Resources, Indoor Environmental Quality and Innovation. The architectural profession in conjunction with the print media also gives out annual excellence awards for Green Homes and Green Developments	We will continue to develop and maintain the GBI rating tool for Malaysia and also promote Sustainability/Responsibility through the schools, professional programs, community outreaches, CPDs and also the Malaysian Green Building Confederation (MGBC - affiliated with the WGBC)	The GBI is the key tool in the overall plan	The take-up rate has been very promising with more than 90 projects registered for GBI certification in the first year. We will continue to train all professional architects and engineers to work with the tool and eventually to become part of the normal professional services. Also working on standards and legislation to raise the benchmark in Malaysia.	We have applied for and received incentives from the Government in the form of tax credits, stamp duty exemptions and also increased plot ratios etc. We are also working with government to develop laws, regulations and standards to eventually implement mandatory green standards.	This has brought a greater awareness of the principles of sustainability that are helping the people to plug the leaks in their homes, offices and buildings. This helps create a better living environment for all and also improves the economic well being of the people.	Not Applicable	Not Applicable	
11	Mongolia	The community awareness level is not bad basically, because seasonal nomadic lifestyle itself were sustainable/responsibility, only if we understand the meaning in correct terms. Then architectural profession these words are almost new, and looking at dictionary. Recently we had a questioner witin a young generation by msnger, the few replays understand only Sustainable means - energy saving.	We understand meaning -Sustainable development- its translated already as –Stable-. But Sustainable/responsible related with architecture still complicating to describe here. Do you think –Stable- is good for it?. If you have a complete explanation of these words please send us.	Reduction of energy consumption and pollution of construction, using grey water and eco-friendly construction materials. If possible, we would like to know more variety aspects in architecture	We do not have plan	We do not have plan	We do not have plan	We do not have plan	We do not have plan	We do not have plan	We do not have plan, but we will start to investigate to have it, we need help to start a plan.	
12	Pakistan	The current level of conscious awareness of 'sustainability' and what the term implies is at a minimum among professional architects in Pakistan at present. Although this is a general condition it is important to note the following highlights. Young professionals who have graduated in the last ten years are more abreast with theoretical and practical examples of sustainability available through web browsing. In the past few years interest in this aspect has risen substantially and architects are now exploring design strategies that would promote resource efficiency, reduce energy costs and promote inhabitant comfort. Some projects have already been designed keeping these in view and noteworthy among these are the ones that use historical, traditional and vernacular architecture in the country as a point of reference. In addition, as majority of the population in Pakistan is still 'rural' that is where vernacular architecture is still 'sustainable' by default and it is in the urban areas where most of the problem lies. For internationally 'certified' green buildings, as of 2010 ther Of the Government of Pakistan (GOP)-sponsored activities su There is no private sector initiative of note, especially at the	'Sustainability' as a buzz word is gaining awareness among the community and NGO's and the term used more generally among the architectural community is 'Green buildings'. In addition, we have often discussed the need to look for appropriate words in Urdu (our national language) that encompass both the global meaning and our particular local orientation.	As outlined in the answer to Q.1, technical knowledge about aspects like carbon footprint, life cycle analysis etc. is few and far in between among Pakistani architects, however some general aspects are widely accepted as responsible actions for sustainability. These include; designing for climatic responsiveness, appropriate orientation, using passive heating and cooling techniques, deriving reference from vernacular traditions, reducing energy costs through design, minimizing building cost, using local materials, recycling water, building for user comfort and wellbeing etc. etc.	A formal agreed upon national plan for Sustainability/Responsibility does not exist in Pakistan however the Institute of Architects Pakistan has initiated a Green Sustainable Committee which after doing ground work since the beginning of 2010 has been vibrantly active since the month of May. Several milestones have already been achieved. These include; increasing awareness among architects through seminars, lectures, presentations and brainstorming sessions, developing active teams and committees to work on several plan directions, surveying existing practices of sustainability and green architecture in the country, bringing key players together, providing a platform for knowledge sharing among architects, allied professionals and other stakeholders, organizing efforts towards the establishment of PGBC (Pakistan Green Building Council), researching on tangible attributes of Green Buildings, developing curriculum for sustainability in existing schools of architecture. All of these activities and works are documented and have been shared widely with members.	We believe that it will take a long time before we see green building principles widely adopted in the building industry for reasons explained above. However, we also believe that both short-term and long-term benefits can be achieved from a well-conceived program, if based on the following principles: 1) A sustainable plan. Any plan of sustainability for Pakistan has to be sustainable in its own right by being based on realistic targets that can be worked at in a sustained fashion over a long period of time. Small steps taken surely will lead to tangible results rather than grand plans that do not stand the test of time and limitations of resources. 2) A contextual and regional orientation. The solutions, plans and needs are ascertained through localized contextual analysis, let alone led by global trends. 3) An all inclusive and participatory attitude and method. Diversity and all inclusiveness of stakeholders into this process will ensure that the frameworks developed are appropriate for the entire country, which includes a wide range of varying geographical and sociological c 4) A two-pronged approach. A long-term progra 5) A clear demonstration of the economic and s	Several techniques are being employed and adjusted for successful implementation of the plan. Meeting regularly every week, having awareness sessions every month and maintaining list serves are few of the practical methods employed.	Refer to answer of Q.9. for this.	Not applicable at present.	As outlined, we have just begun working on a plan and a year at a minimum is estimated to complete the consultative process required for the development of objectives and strategies for sustainability which are contextually appropriate and agreed upon as priority by majority of the stakeholders. After the initial work with architects and professional community, we intend to establish liaison with the Ministry of Environment and Ministry of Housing and Works at the Government level. Other key organizations and NGOs like ENERCON, ABAD, PEC (Pakistan Engineering Council), ISOP (Illumination society of Pakistan), AEDB (Alternative Energy Development Board) etc. will also be important stakeholders and partners in the implementation process.	Yes we do need help from the international community in this regard. As outlined above, we have recently started to work towards the sustainability agenda and our small team of motivated architects has already initiated correspondence with counterparts in other Institutes with the request to share information on national policies, green building codes and other official documents. This is being encouraged so as to not to reinvent the wheel and to take existing knowledge forward through contextual relevance. The response has been slow so far and UIAs assistance in this regard may facilitate and speed-up this process.	

		What is the current situation in your country regarding the level of awareness in the community and in the architectural profession of Sustainability/Responsibility ?	What word(s) do you use in your country to describe Sustainability/Responsibility ?	What aspects of Sustainable/Responsible architecture are recognised in your country?	What national plan do you have for Sustainability/Responsibility?	What are the key aspects of your plan?	What practical methods do you have to implement this plan?	How do you work with your government/s to implement this plan?	How is this changing your country, socially, economically for the betterment of people?	If you do not have a plan, are you working on one, when will it be finished and how do you think you can have it implemented with the help of your government?	If you do not have a plan will you start to investigate having one or not, do you need help to start a plan?	
13	Philippines	The Philippines is very much involved in Sustainability advocacy program. Among the various programs that the government has already started are the following: a. Creation of the Commission on Climate Change b. Passage of the Clear Air Act and Clear Water Act c. Propose Green Building Code Commission d. Rating System being developed by GAM 3EAB by PhilGBI	Responsibility – pananagutan (in Filipino/Tagalog language) Sustainability – pagpapanatili (in Filipino/Tagalog language)	Green Architecture and Green Building concepts are what is very popular at the moment.	EUAP is one of the prime mover of the crafting of the Professional Group Initiated Green Building Rating System GAM 3EAB - UAP signed a declaration of support to sustainability during the Natcon36 (2010) - UAP is a signatory to the ASIAN ACCORD on Sustainability - UAP has included in all its Continuing Professional Education program the aspect of Sustainable Design and Green Architecture - UAP has an advocacy arm called the Green Architecture Movement	Key aspects of the Plan is to instill in all its members the social Responsibility of architects in the sustainability of the built environment.	Thus, competitions and advocacy program encourage government incentive program.	a. Lobby for the adoption of the UAP GAM 3EAB as the nationally recognized Building Rating System b. Partner with the DOE, DENR, DILG, other government agencies and local government units in Sustainability projects.	Effects are not yet manifested although public awareness has increased tremendously	No response	No response	
14	Singapore	Level of awareness is high and getting stronger by the day. the close rapport and co-operation between the Government and private sector has helped to catalyse awareness Within the profession, SIA has organized various events/seminars as part of the CPD Programme to elevate the Level of understanding on Sustainability/Responsibility.	Sustainable Approach 12 Attributes for a Sustainable Built Environment	Land conservation with particular emphasis on increasing the area of nature reserves, parks, wetlands, wildlife/bird sanctuaries The increasing importance of passive design is natural ventilation, daylighting, sunshading, indoor environment Water harvesting / purification Waste management	In Singapore, there is already a national plan in place. It is captioned "Inter-Ministerial Committee on Sustainable Development" and it represents Singapore's roadmap towards addressing the wave of Sustainability In response to the above, SIA had used a working document captioned "12 Attributes For A Sustainable Built Environment"	Awareness – to increase awareness of Green Architecture amongst the members Engagement – to engage the authorities and NGOs by constructive input to refine existing rating tools and renew policy guidelines for increased stakeholders's buy-in Leadership – to establish a green region in Southeast Asia and promote research in green initiatives and formation of a green alliance	Seminars Movie Screenings Exhibitions at national and regional level Awards Feedback on Government Policies Dissemination of policy paper Singapore Roundtable	Being pro-active to win over confidence of Government officers so that we can be consulted/involved in renew and formation of new guidelines Meetings Involve in each other's initiatives -hrough publications in the media	Increased publicity at grassroots level has resulted in the people "demanding" an increased responsibility for a green or sustainable end product. This has resulted in developers requiring the consultants to design green.	Not applicable to Singapore context	Not applicable to Singapore context	
15	Sri Lanka	Good awareness among architects and students on sustainability. There is an improvement during the last few years on awareness by the public	Sustainability.	Usage of energy. Usage and recycle materials. Reduction on CO2 emissions and saving the forest coverage and increase the treas. Usage of water.	Government is in the process of working out a national plan.	Yet to comment	Awareness programmes. Inculcate sustainable attitudes to the public.	SLIA- Sri Lanka Institute of Architects is closely working with the Government, Universities and other professional bodies. SLIA initiated setting up of GBC (Green Building Council) Sri Lanka.	It will help to create better environment where people will be healthy : less cost (running cost).	We are working on a plan as part of the GBC (Green Building Council) and SLIA has a key role.	Not right now. However we may need assistance in the future.	
16	Thailand	Thailand has many different schemes on promotion of green buildings. Firstly the Ministry of Energy developed the first energy rating tool called 'TEEAM' or Thailand Energy and Environmental Assessment Method in 2005. More than 100 buildings have been certified under TEEAM. The program is organized by the Ministry until the establishment of TGBI (Thailand Green Building Institute) in 2010. In addition, LEED is becoming more well-known for Thai architects and engineers as new commercial buildings are applying for LEED certification.	Green, Environmentally Friendly, Self-Sufficiency, Low-Carbon.	Energy conservation together with the utilization of renewable energy is the term the public has perceived mainly about what the green building should be for the country. Some corporations use the term 'CSR' for what they need to do for the environment. Green CSR is the norm that corporate must do and show to the public as the example.	The Association of Siamese Architects (ASA) has established a working group call 'ASA Green Committee' to take responsibility about promoting green building design and construction. Programs like publications, seminar, lectures, and green building awards have been initiated by the association for many years. Moreover, the association; in corporation with the Engineer Institute of Thailand has established the first 'Thailand Green Building Institute' which will be the certifying body of green buildings in the country.	At the association level, ASA will continue to provide continuing professional development programs or 'CPD' concerning with new technology and regulation of green buildings. In the national level, the Thai Green Building Institute will be responsible for certifying green buildings based on national and international good practice and standards.	The TGBI will launch the formal certification for green commercial buildings within the first quarter of 2011. Along the way is the bi annual green building award organized by ASA. After everything is in place, TGBI will take part in the World Green Building Council (WGBC).	TGBI adopts standard and regulation developed by the Ministry of Energy and the Department of Pollution Control. TGBI also invites government officials to take part in its advisory board.	Public are more aware of increasing oil prices and climate changes. Most Thai perceive Global Warming and Climate Changes as a real threat to a country as Thailand because it is agriculture based society and very dependent on imported oil. For buildings, green building is viewed as standards of practice that every new building must abide by—whatever it is international or local standards.	TGBI will be the key coordinator between private and public agencies in the near future. By the end of 2011, all the mechanism will be in place.	Help from other parties in terms of 'Lesson Learnt' or sharing of experience will be highly welcome.	
17	Vietnam	In Vietnam recently, the concept "green building" is mentioned more and more, the government also issued a resolution on "Use energy saving and efficiency", but in fact only few sustainable projects are designed and realized.	The Vietnamese words "Bền vững" and "Xanh" are used to describe Sustainability.	Use energy saving and efficiency; Applying the building materials that are friendly with environment.	No response	No response	No response	No response	No response	No response	VAA need help start to study an action plan on Green Architecture, that includes: * Organizing training courses on Green Architecture for young architects. * Propaganda on Green Architecture, encourage architects and their clients to design and using green materials and buildings. * Launch a Green Architecture Award in the program of National Architecture Awards. * Establish the lists of energy saving equipments and building materials that are friendly with environment... * Petition to Ministry of Construction (MOC) for establish Vietnam Green Architecture Council that includes the representatives of MOC, VAA, Construction Association and Association of Planning and Urban Development.	
18	Nepal											