

Building Design and Construction: Forging Resource Efficiency and Sustainable Development



**Sustainable Buildings
and Climate Initiative**

Promoting Policies and Practices for Sustainability

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This report was produced under the coordination and supervision of Arab Hoballah, Chief, Sustainable Consumption and Production, UNEP-DTIE.

Lead Authors

Maggie Comstock, U.S. Green Building Council

Curt Garrigan, United Nations Environment Programme – Sustainable Buildings and Climate Initiative

Stéphane Pouffary, ENERGIES 2050

Additional Authors

Tatiana de Feraudy, UNEP SUSHI

Jacob Halcomb, UNEP-SBCI

Jason Hartke, U.S. Green Building Council

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Executive Summary

In June 2012, thousands of delegates will assemble in Rio de Janeiro, Brazil for the 20th anniversary of the Earth Summit, at which the world convened to promote sustainability for decades to come. The 1992 Earth Summit yielded several outcomes, including Agenda 21, the United Nations Convention on Biological Diversity and the United Nations Framework Convention on Climate Change.

Considering the need for housing and infrastructure expected over the coming decades, the building sector is critical to achieving long-term sustainability objectives. Buildings represent a significant opportunity for sustainable development. As part of a broader and more complex system linking transport, energy generation and urban planning, building sector strategies have an impact on the economic, social and environmental development of the society as a whole. For example, the construction sector employs 111 million people globally (ILO, 2010). The design, construction, operation and maintenance of sustainable buildings support additional high-quality, long-term jobs to ensure the proper performance of these buildings. In addition to delivering considerable gains in resource efficiency

and a reduction in the life cycle costs of buildings, sustainability in this sector has several health and social benefits that promote the well-being of local communities. With urbanisation increasing rapidly, and with it the growing demand for resources, building sustainably and promoting resource efficiency in general and energy efficiency in particular is essential to achieving sustainable development.

At the Rio+20 summit, decision-makers will create the roadmap for a green economy in the context of sustainable development and poverty eradication, supporting consumption and production patterns that respect environmental and social priorities worldwide. To achieve this objective, the unique and significant potential of the building sector should be recognized and brought forward in the strategies developed as outcomes of the negotiations. The United Nations Environment Programme – Sustainable Buildings and Climate Initiative expects that the outcome of the summit promote sustainable buildings and cities as a conduit for resource efficiency, greening of economic growth and sustainable development.

Introduction

Buildings are an inextricable part of society; they harbour the places where we live, play, learn and work. Though the percentage of time spent indoors varies widely worldwide, citizens in developed countries, such as the United States, spend nearly 90 per cent of their time indoors (American Physical Society, 2008). As centres of our social and economic lives, buildings are also the source of a great share of our environmental impact. The International Energy Agency (IEA) (2009) estimates that nearly 60 per cent of the world's electricity is consumed in residential and commercial buildings. This usage does, however, vary widely according to geographical location, climate, and consumption patterns. This consumption can explain why the

Intergovernmental Panel on Climate Change (IPCC) estimates that by 2030, greenhouse gas (GHG) emissions from buildings will account for over one-third of total emissions (Levine, et al., 2007).

Although it already is the largest single contributor to GHG emissions, the buildings sector represents a huge but untapped potential for emissions reductions at the least cost (Levine, et al., 2007). With proven and commercially available technologies, energy consumption in both new and existing buildings can be cut by an estimated 30 to 50 per cent with potential net profit during the life-span of the building (UNEP-SBCI, 2009).

The IPCC Fourth Assessment Report also shows that the potential for GHG reductions from buildings is common to both developed and developing countries, as well as to countries with economies in transition. The United Nations Environment Programme (UNEP) has stated that 'no other sector has such a high potential for drastic emission reductions' and that the built environment offers some of the most cost effective and expedient ways to contribute to climate change mitigation.

In addition to its carbon footprint, the buildings sector is responsible for more than one-third of resource consumption globally, which equates to approximately three billion tons of raw materials annually (UNEP-SBCI, 2010; Roodman and Lenssen, 1995). Buildings consume 12 per cent of the world's potable water. The construction, renovation and demolition of buildings constitute about 40 per cent of solid waste streams in developed countries (UNEP-SBCI, 2010).

Buildings account for:

40 per cent of global energy use

38 per cent of global GHG emissions

12 per cent of global potable water use

40 per cent of solid waste streams in developed countries

+

But can achieve:

30-50 per cent reduction in energy use

35 per cent reduction in GHG emissions

40 per cent reduction in water use

70 per cent reduction in waste outputs

=

Greatest potential for resource and emissions reductions at the least cost

According to a global analysis of the buildings sector, McGraw-Hill Construction concludes that green buildings have the potential to reduce energy use by 30-50 per cent, CO₂ emissions by 35 per cent, waste outputs by 70 per cent and water usage by 40 per cent (McGraw-Hill Construction, 2008).

As the IPCC estimates, energy consumption can be reduced by 29 per cent by 2020 at zero net cost (UNEP, 2011). The buildings sector holds the greatest potential for low-cost, high-return investments toward climate change mitigation and adaptation.

Background on Green and Sustainable Building

The definition of a green building can vary; however, for the purposes of this report, a green building is initially defined as a structure which employs multiple strategies, such as energy efficiency, water conservation, responsible use of materials and resources, and indoor air quality, in order to alleviate the negative environmental impacts of the built environment. Green buildings are at the core of decisions made by public authorities, companies, educational institutions, and individuals. Improving the sustainability of the built environment requires careful consideration of stakeholders' needs and objectives in both the construction of new buildings and the retrofitting of existing buildings. Understanding priorities and potential gains, and pursuing both building types will maximize the sustainability benefits achieved in the buildings sector. Though 'green buildings' reap economic, environmental and social benefits through thoughtful and innovative design practices, 'sustainable buildings' have a subtly different connotation, focused on greater resource efficiency,

limited or no global impact on the environment, and broader consideration of social and economic objectives.

Integrating sustainability in the design and construction of new and existing buildings results in more efficient use of natural and financial resources, and buildings that more thoroughly address the social dimension, rather than constructing buildings to conventional standards and then later retrofitting for sustainability. Green building design and construction can take many forms. Environmental design strategies usually fall within one of two paradigms: passive or active building design. Through passive design, buildings employ design strategies that take advantage of the characteristics of the building site, insolation, microclimate, and other factors to meet lighting, heating and cooling needs. For example, natural ventilation and day lighting improves the building occupants' health and well-being without the use of active technology. The second approach includes active systems, for instance technologies that reduce the impacts of energy production or consumption, such as photovoltaic or thermal solar panels or energy efficient appliances, to achieve greater overall operational efficiency (UNEP, 2011). Green building rating systems consider actions and results related to both passive and active strategies to provide additional benchmarks for green building markets.

Passive:

55-60 per cent - The reduction in energy consumption in office buildings in the UK after introducing natural ventilation (UNEP, 2011).

Active:

64 per cent - The reduction in energy use in new commercial buildings in the U.S. by employing energy-efficient lighting, heating, ventilation, air conditioning and shading (UNEP, 2011).

Green building rating systems with third-party verification, such as the British Research Establishment's Environmental Assessment Method (BREEAM), the Building and Construction Authority of Singapore's Green Mark, the Comprehensive Assessment System for Built Environment Efficiency (CASBEE), the Green Rating for Integrated Habitat Assessment (GRIHA), Green Star, the High Quality Environmental Standard (HQE), the Leadership in Energy and Environmental Design (LEED) system, and others, are rapidly growing in prominence and implementation around the world. Pike Research estimates that by 2020 green building certification programmes will certify 4.9 billion square metres, cumulatively (Bloom and Wheelock, 2010). Each rating system encourages green building through a suite of sustainability strategies which promote energy efficiency, water conservation, indoor air quality, and more. The combination of prerequisite construction practices and voluntary credits, in aggregate, determine the assessment of a green building and its rating. For example, the LEED Green Building Rating System, like GRIHA, Green Mark, HQE and others, recognises performance in key environmental areas. LEED, specifically, promotes sustainability in the areas of Sustainable

Sites Selection, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Locations and Linkages, Awareness and Education, Innovation in Design, and Regional Priorities based on climatic conditions and environmental pressures (as depicted below). See the subsequent case studies to learn more about select rating systems.



The Economics of Sustainability in Buildings

The global construction industry represents US\$4.7 trillion, or 8-10 per cent of the global gross domestic product (GDP). While the United States supports the largest domestic construction market at US\$1.2 trillion annually, Asia and Europe have the strongest regional markets each at US\$1.4 trillion annually. The construction sector already accounts for 5-10 per cent of employment globally (UNEP, 2011), and the construction industry is rapidly expanding, namely in developing economies (the strongest growth is witnessed in

Asia, particularly in Vietnam and India (McGraw-Hill Construction, 2008). Though the recent recession slowed growth in the construction sector, green building construction maintained its pre-recession market level in the United States (McGraw-Hill Construction, 2012).

In order to alleviate the effects of the 2008 economic crisis, countries throughout the globe implemented recovery plans, many of which

Rating System Spotlight: Leadership in Energy and Environmental Design (LEED) Green Building Rating System



Leadership in Energy and Environmental Design, or LEED, awards green buildings an internationally recognised mark of excellence. The assessment framework provides building owners and operators with a system for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

With over 836 million square metres of building space participating in the suite of rating systems and 148,000 square metres certified per day around the world, LEED is transforming the way built environments are designed, constructed, and operated—from individual buildings and homes, to entire neighborhoods and communities. LEED accommodates many building

types throughout the life cycle of a building, as depicted below.

LEED certification provides independent, third-party verification that a building, home or community was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

Developed by the U.S. Green Building Council (USGBC) in 2000, the LEED rating system is developed through an open, consensus-based process led by LEED committees. The upcoming update of the LEED rating system, LEED v.4, is the next step in the continuous improvement process and on-going development cycle of LEED.



Certification occurs through the Green Building Certification Institute (GBCI), an independent non-profit that was established in 2008 with the support of USGBC. GBCI includes a network of ISO-compliant international certifying bodies, ensuring the consistency, capacity and integrity of the LEED certification process.



LEED-certified buildings are designed to:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions

Learn more at: www.usgbc.org.

Photo: The U.S. Treasury Building, the third oldest federal building in Washington, D.C., USA, achieved LEED Gold Certification for Existing Buildings in 2011. Photo Credit: U.S. Department of Treasury

included strategies focused on greening sectors of their economies. In its analysis of national recovery acts, HSBC's Global Research acknowledges that '[t]he low-carbon economy can also be a job-rich economy at a time of soaring unemployment, particularly through enhancing building efficiency, either via retrofit or new construction, and improving mass transit' (Robins, 2009, p. 6). Additionally, HSBC rated the effectiveness of building efficiency investments 'top in terms of [effectiveness on] "green stimulus"' (Robins, 2009, p. 41).

**Every dollar spent on building
efficiency yields three dollars in
savings in the United States
(Robins, 2009).**

Greg Kats (2010) suggests that additional investment costs for green building are considerably lower than generally perceived. Data from 170 green buildings in the U.S. showed that green building construction costs on average only 1.5 per cent more than conventional buildings, while public perception was that going green required an additional investment of approximately 17 per cent. In addition, these premium costs are quickly recouped as sustainability actions result in lower energy bills and increased employee productivity.

The benefits of sustainable buildings in avoiding climate change impacts and improving public health are recognized. However, green buildings have been especially embraced by both the environmental and business communities for their potential to mitigate environmental impacts while saving money. Green and sustainable buildings are recognised as a fiscally responsible solution for government building operations that also support

the bottom line for building owners. In a McGraw-Hill Construction survey, U.S. corporations revealed that green building strategies decrease operating costs by 8-9 per cent, increase building value 7.5 per cent, achieve a 6.6 per cent return on investment, increase occupancy ratio 3.5 per cent and increase rent ratios 3 per cent. Sixty-one per cent of corporate leaders surveyed also indicated that sustainability and a commitment to green building can lead to improved financial performance, competitive positioning and market differentiation (McGraw-Hill Construction, 2008). Many businesses and individuals can additionally take advantage of tax benefits and policy incentives available for green buildings and green building strategies.

Governments are also embracing sustainable building as a means to save operating costs and demonstrate public leadership in achieving environmental and social objectives. Facing increasing costs and social demands, and with limited options for additional revenue, governments must maximize efficiency in their operations to avoid workforce reduction and service cutbacks. As owners of important building portfolios—offices, public housing, schools, hospitals, and service or operation centres—and as consistent procurers of building sector services, governments are well-positioned to take advantage of energy and resource efficiency options that reduce operating costs and result in important financial savings. A natural co-benefit of these initiatives is the ability to re-allocate resources currently expended on energy to other services. Broader efficiency applied to public infrastructure and integrated planning for resource efficient cities can further multiply the benefits to residents and governments and lead to greater sustainability in the buildings sector.

Rating System Spotlight: The Energy and Resources Institute's Green Rating for Integrated Habitat Assessment (GRIHA)



India is facing increasing energy-related challenges as a result of the rapid urbanisation and growing urban–rural divide. Energy access and security are two critical issues that define the policy landscape in the power sector, while the environmental sustainability agenda remains crucial in the urban development process. Realizing the need to address the environmental impacts of the construction sector, in 2005, TERI (The Energy and Resources Institute) launched GRIHA (Green Rating for Integrated Habitat Assessment), a green building rating system specifically designed for the Indian construction sector. It was further modified and adopted by the

Ministry of New and Renewable Energy (MNRE) in 2007 as the national rating system for green buildings in India. TERI, along with MNRE and other sectoral experts, jointly established the Association for Development and Research of Sustainable Habitats (ADaRSH), which has the mandate to promote green buildings and habitats in India.

GRIHA is an evaluation tool to help design, build, operate, and maintain a resource-efficient built environment. It emphasises end use energy optimization (within specified comfort levels) and integration of renewable energy, thereby providing a framework which looks at long-term policy options both on the supply and demand sides, and is consistent with aspirations of economic growth. MNRE has adopted GRIHA as the national rating system for green buildings, making compliance with this system mandatory for buildings belonging to the Government of India and public sector undertakings. The Central Public Works Department has also adopted and integrated GRIHA into their standard operating procedures.

GRIHA is a rating system for green buildings which evaluates a buildings' performance on over 34 criteria, and delivers a rating of one to five stars (five stars being the highest rating). GRIHA encourages the use of passive solar techniques for optimizing indoor visual and thermal comfort. Developed for commercial and residential buildings, the rating system sets benchmarks for air-conditioned and non-air-conditioned buildings in five climatic zones.

Projects that comply with GRIHA guidelines and benchmarks have registered the following improvements in performance:

- 35 per cent reduction in quantity of potable water required
- 35 per cent reduction in amount of waste water generated
- 15 per cent of treated waste water used for various applications (in new buildings)

Learn more at www.grihaindia.org.



*Photo from Suzlon One Earth project in Pune, Maharashtra which received a 5 Star GRIHA Rating and LEED Platinum Certification.
Photo credit: The Energy and Resources Institute*

Beyond energy and financial savings, building sustainability can result in far reaching benefits. Green and sustainable buildings can reduce health care costs and increase productivity by improving the indoor air quality for employees and providing a more pleasant work environment. Incorporating sustainable building practices in schools will likewise reduce operational costs, potentially allowing the savings to be reallocated for teachers salaries, supplies and other critical needs. The ILO notes in its report, *Green Jobs Creation Through Sustainable Refurbishment in the Developing Countries*, the unique role that construction has for governments, and more broadly for public policy: ‘...the [construction] sector is responsible for creating the foundations for sustainable development by delivering a built environment that provides the context for social interactions as well as economic development’ (ILO, 2010, p. 22). In all of these areas, there are considerable opportunities for greater resource efficiency and sustainability, but in buildings and in construction, the broad impacts provide the rationale to prioritise this sector to advance social and economic objectives, such as creating jobs and strengthening local economies.

Greening the global building stock and constructing new buildings according to sustainability strategies requires concerted investment in new technologies, materials and training. The IEA and Organisation for Economic Co-Operation and Development (OECD) (2010) estimate that a 12.6 gigatonne reduction in CO₂ by 2050 could be achieved with an average investment of US\$308 billion per year from 2010 to 2050. Investments in sustainable buildings also have positive implications for the long-term, including job creation and sustained employment.

Job Benefits of Investments in Green Buildings

Every US\$1 million invested in building energy efficiency retrofits would create **10-14 direct jobs** and **3-4 indirect jobs** (UNEP, 2011).

If 40 per cent of the U.S. building stock were renovated by 2020, it would create **6,250,000 jobs** over ten years (Hendricks, et al, 2009).

An investment of US\$1 million in energy and resource efficiency would generate a net gain of **16.4 job-years** over 20 years (UNEP, 2011).

Rating System Spotlight: Building and Construction Authority's (BCA) Green Mark



The BCA Green Mark (GM) Scheme was launched in January 2005 as an initiative to drive Singapore's construction industry towards more environmentally-friendly buildings. It aims to promote sustainability in the built environment and raise environmental awareness among developers, designers and builders when they start project conceptualisation and design, as well as during construction. BCA GM provides a meaningful differentiation of buildings in the real estate market. It is a benchmarking scheme which incorporates internationally recognised best practices in environmental design and performance.

The Inter-Ministerial Committee on Sustainable Development (IMCSD) of Singapore has set targets whereby at least 80 per cent of the buildings in Singapore must achieve the BCA GM Certified rating by 2030. In support of this vision and BCA's mission, BCA has gone 'beyond buildings' to inspire and promote environmental sustainability in parks, districts, rapid transit systems while also supporting infrastructure through the GM scheme. Additionally, BCA's efforts 'within buildings' have been focused on encouraging end-users to play their part in greening their premises.

The implementation of the GM Scheme has been responsible for a number of transformations in the building sector in Singapore. Reported as of May 2012, the number of GM building projects has grown significantly from 17 (total floor area of 1.1 million square metres) in 2005 to 1182 (total floor area of 3.4 million square metres), with 16 per cent of Singapore's total building stock recorded as green. In an effort to train green specialists, a comprehensive world-class training framework for professionals, managers, executives and technicians has been put in place with 2,600 green specialists trained to-date.

Additionally, the scheme has also had climate and environmental benefits. It has been estimated that buildings consume 25 per cent of all energy use in Singapore. With 80 per cent of buildings in Singapore achieving GM Certified standards by 2030, the country can expect energy efficiency gains of at least 25 per cent against the 2005 building codes. The GM Scheme has led to a reduction in energy and water bills for buildings, with energy savings of at least 10-15 per cent for a GM certified building and at least 30 per cent for a GM Platinum building. It has also led to an improvement in indoor environmental quality for healthy living and a reduction in potential negative impacts on the environment.



Learn more at http://www.bca.gov.sg/GreenMark/green_mark_buildings.html.

Photo from the Mapletree Business City project in Singapore which received a Platinum Green Mark certification. Photo credit: Mapletree Business City.

Sustainable Buildings Support Job Creation and Resource Efficiency

‘Energy- and resource-efficient buildings have the largest potential to reduce greenhouse gas emissions and resource use. There are also significant opportunities for employment creation in new, green buildings, and even more opportunities in retrofitting the large estate of older buildings’ (ILO, 2012).

Green jobs are a pillar of the transition to a more sustainable economy by preserving the environment and promoting social equity for future generations. Green jobs can protect ecosystems directly—through employment opportunities that preserve biodiversity, reduce energy use and increase resource efficiency—or indirectly—including conventional jobs that improve manufacturing or supply processes to reduce negative environmental impacts (ILO, 2010).

The definition of a green job can vary and will continue to evolve over time. In their Foreign Policy in Focus article, *Global Green Jobs*, Sarah White and Jason Walsh (2008), describe green jobs as ‘family-supporting, middle-skill jobs, most of them in the primary sector of a clean energy economy—efficiency, renewable, and alternative transportation and fuels.’ The systematic upgrading of residential and commercial buildings offers many opportunities to create decent, local new jobs. One of the unique aspects of the building and construction sectors is the broad participation across all socio-economic and skill levels, from owners and developers to architects and contractors to labourers, as well as enterprises of all sizes. Large multi-national corporations, small-medium enterprises (SMEs) and individual contractors are all represented in the diverse construction market.

McGraw-Hill Construction (2012) estimates that in the United States, green building construction accounts for one-third of the design and construction workforce. Booz Allen Hamilton (2009) estimates that the entire green building supply chain will support nearly eight million new and sustained jobs in the United States by 2013 in a range of occupations, including construction managers, carpenters, electricians, architects, truck drivers and cost estimators, among many others. An OECD (2011) study finds that retrofits create demand for low and semi-skilled labour as well as professional energy services while new construction creates demand for medium to high-skill labour. Thus, implementing a green growth strategy with a focus on the buildings sector would create jobs across all skill levels, provide benefits for workers and create a foundation for a more sustainable local economy. As employment is the fundamental means to alleviate poverty and provide economic opportunity, the building and construction sector is critical for meeting such goals. To do so while increasing resource efficiency and sustainability in the sectors enhances the prospects further.

Opportunities for job growth related to sustainable

Green Jobs Spotlight: United States

The U.S. Department of Labour estimates that new standards for water heating and fluorescent lamps (among other products), could generate 120,000 jobs through 2020 (UNEP et al. 2008). Green construction also has the potential to transform buildings from being exclusively consumers of resources to become partial producers of resources like water, energy, food and materials, or even green space.

Rating System Spotlight: La Haute Qualité Environnementale French Benchmarking Programme (HQE®)



La Haute Qualité Environnementale (HQE®), or High Environmental Quality Association was founded in 1996 and classified as being of public interest in January 2004. HQE® operates in pursuit of two vital missions: providing stakeholders with benchmarks and operational methods; and overseeing the promotion of the HQE® approach through training, certification and resource centres.

The HQE® sustainable construction benchmark is based on a set of qualitative and quantitative indicators through a global conceptual matrix supporting a holistic approach in order to achieve a series of 14 targets (on a number of specific topics such as eco-construction, eco-management, comfort and health). These targets were recently expanded to include components of sustainable development, different categories of infrastructure and urban-scale development. This approach is intended to produce healthy and comfortable buildings whose environmental impacts are measureable and verifiable over the life cycle of the building. It features two distinct reference frames that are available free of charge on the Association's Website:

- 'Explicit definition of Environmental Quality' (EDEQ), which serves to generate, improve or maintain the environmental quality of buildings, as influenced by construction designs, adaptations or management.
- 'Environmental Management System' (EMS), which serves to coordinate building operations so as to optimize the quality of the environmental effort among all actors concerned. The EMS reference frame is closely tied to the format of standard ISO 14001.

During the last decades, the gradual introduction of a certification process has been championed by a number of actors in collaboration with the HQE association as an expression of encouragement for a scale change along with official recognition of construction projects that meet high quality environmental criteria. This certification also offers project owners the opportunity to have the environmental quality of their development acknowledged by an independent external body.

Over time, the exemplary projects ascribed pilot status grew in number and became more widespread thanks to an expanded level of awareness on the part of local actors, as well as to the introduction of support measures within the framework of energy or environmental policies focusing on high-efficiency techniques/facilities or on innovative design. Today the HQE® is expanding internationally with a set of appropriate indicators.

Learn more at <http://assohqe.org/hqe/>.

*Photo from the Premium Building project in Nice, France.
Photo credit: Stéphane Pouffary – ENERGIES 2050*



buildings exist in both developed and developing countries. Research by the Millennium Institute on behalf of the International Trade Union Confederation (ITUC) finds that green job growth in the construction sector could help alleviate poverty and improve social well-being. Analysing a prospective investment of two per cent of GDP in green economy strategies by 12 countries (representing developed, developing and emerging countries), the research determined that 48 million jobs could be created over a five year period, with 17.5 million of those in the construction sector, second in number only to the transport sector (ITUC, 2012).

The great potential for green job growth in the building sector is supported not only at the national level, but also at regional and city levels. A recent

study by the OECD (2011), *Cities and Green Growth: The case of the Chicago Tri-State metro-region* identified the built environment as a ‘top priority for a green growth strategy’ in the Chicago region. At 36 per cent, the study indicated that building-related activities accounted for the largest share of all green jobs in the region, and that building retrofits would add the highest number of green jobs from 2009 to 2020. The report also highlighted the potential market expansion in specialized areas related to green building, including the manufacturing of energy saving building materials and green building materials, linking this growth to the number of projects pursuing LEED certification and demonstrating the potential for market transformation through sustainable building practices.

UNEP Initiative Spotlight: Green Jobs Initiative

The Green Jobs Initiative is a partnership established in 2007 between the United Nations Environment Programme (UNEP), the International Labour Organisation (ILO), and the International Trade Union Confederation (ITUC). The International Employers Organisation (IEO) joined the Initiative in 2008.

The Initiative was launched to assess, analyse and promote the creation of decent jobs in combination with environmental policies that address the global environmental challenges, including, among others, climate change. It supports a concerted effort to promote coherent policies and effective programmes leading to a green economy with green jobs and decent work for all, in a climate-challenged world.

Its objectives are:

- To promote awareness and dialogue of the linkages between development, environmental challenges, and employment;
- To facilitate a ‘fair transition’ that reflects the environmental, economic and social pillars of sustainable development;
- To identify and respond to knowledge and data gaps on the opportunities presented by a low-carbon emissions economy;
- To promote policies and measures to achieve green jobs and green workplace;
- To catalyse employment and poverty alleviation within climate mitigation and adaptation programmes; and
- To strengthen collaboration between UNEP/ILO/ ITUC/IEO, within the UN system and with the international business community.

Learn more at: http://www.unep.org/labour_environment/features/greenjobs-initiative.asp.

The Social Benefits of Sustainable Buildings

Sustainability in the buildings sector is too often perceived only through its environmental aspects, namely energy and water efficiency, or reduction of related GHG emissions. Policy makers, experts and business leaders have started addressing these issues through policy instruments, innovative technologies and demand-management programmes. While the environmental benefits of these initiatives are well-established, the potential for sustainable buildings to contribute to social and economic objectives is still generally overlooked or poorly understood. Although addressing the environmental impact of buildings is crucial to sustainability in the built environment, sustainable building policies and programmes can have an even greater impact on social and economic development. Opportunities exist for governments at all levels to achieve broader economic and social objectives through sustainable building initiatives. These opportunities include: contributing to poverty eradication, creating and maintaining green jobs, increasing urban integration, improving quality of life in urban and rural areas, enhancing economic opportunities, and achieving significant financial savings.

Governments at all levels struggle to cover rising operational costs, as their financing options are becoming increasingly limited. A focus on sustainable buildings presents multiple actions and policy options that can be employed to address escalating social needs from changing demographics, such as the growing demand for housing and public education.

Two crucial trends will impact governments over the coming decades: unprecedented population growth and rapid urbanisation. The world population hit five billion people in 1987. In 1999, it hit six billion. It is projected that by 2030 there will be eight billion people, and more than nine billion by 2050 (UN, 2001). More than half of the global population currently lives in urban areas, and that percentage is expected to increase to 80 per cent by the year 2050.

Governments will face a severely increased demand for housing, schools, hospitals, commercial spaces and associated infrastructure. Most of this population growth and related construction will occur in developing countries, many of which are already facing scarcity in water, energy and other resources. Urban development needs to plan for these upcoming challenges, as a delayed response will further strain governments, resources and may severely challenge their ability to provide access to water, electricity and other necessities.

Providing for social needs will require comprehensive policy action, greater resource efficiency and capitalising on the known technologies and sustainable building practices that will provide cost savings, better shelter, job growth and an improved ability to sustain lives and livelihoods. Sustainable built environments—buildings, infrastructure and cities—not only create the physical foundation for sustainability, but can also be the drivers of greener economies.

Sustainable Social Housing: Meeting Social Needs Responsibly

One of the greatest opportunities governments have is to apply sustainable building policies and practices in social housing. Governments in most nations, but mainly in developing countries, will be faced with challenges to meet the social and economic needs of an increasing urban population. UN-HABITAT has estimated that the number of slum dwellers will double by the year 2030 (UN-HABITAT, 2007). In that year, it is projected that 40 per cent of the population—three billion people worldwide—will need access to housing.

‘Many would say that inadequate housing is at the root of many, perhaps even most, of the social, economic and health problems that plague third-world communities’ (FIDIC, 2009).

Sustainability improvements in social housing units lead to measurable environmental, economic and social benefits. At an environmental level, a more efficient use of resources would see a reduction in the production of solid waste and wastewater and a more controlled impact on the local environment.

At an economic level, significant financial savings can be achieved through sustainability actions—simple improvements in building design, or in water and energy features, have a short investment payback period, and lead to repeated, long-term savings (assuming proper maintenance). In the social housing sector, there is a further advantage, the possibility to control and redistribute savings between developers (social housing is often managed by public authorities) and occupants. Beyond the direct financial savings, other economic benefits include creating and maintaining

jobs in the communities where the housing is being built, supporting local markets (namely for local building materials, which are often preferred in social housing projects) and encouraging the broader local economy. Social housing sustainability improvements will be chosen according to the local needs, with a particular interest in traditional architecture and readily available, local, cost-effective solutions. Sustainability in social housing provides multiple benefits to the private sector, governments and end users, while advancing the practices and technologies needed to support the mainstreaming of sustainable buildings in the broader residential sector. As the construction industry employs workers across all skill levels, such green projects create economic growth and build markets for more sustainable buildings.

At a social level, beyond the usual benefits of sustainable buildings (healthier indoor and outdoor environments, increased quality of life, reduction of costs), financial savings will have a significant impact on the quality of life of residents. Reductions in the cost of tenant-paid utilities provide a boost to social housing residents, who otherwise spend a disproportionate share of their limited resources on utilities. Sustainable social housing also provides new employment and life opportunities for residents, through improved urban integration. Facing the current challenges of urban segregation is crucial to truly contribute to poverty eradication and enhance the quality of life of the most vulnerable populations.

UNEP, through support from the Government of Norway, launched the Sustainable Social Housing Initiative, piloted in São Paulo, Brazil and

Bangkok, Thailand, to embed the tools and strategies developed by UNEP-SBCI in social housing. A second SUSHI pilot will commence this year in Delhi, India and Dhaka, Bangladesh. It will

improve lives and livelihoods in those communities, creating jobs and shelter, while building capacity for greater uptake of sustainability on a community scale.

UNEP Initiative Spotlight: SUSHI – UNEP’s Sustainable Social Housing Initiative



Developing countries, due to rapid population growth and urbanization, have to face a specific challenge in responding to the housing demand. Residential buildings represent a large share of new construction. The housing shortage has led to the launch of large-scale housing programmes, targeting the low-income population, which is often the most affected by increased housing prices and urban segregation. Although these programmes deliver a

high quantity of housing units at a lower price and provide shelter for millions of families, the time and budget constraints often lead to low-quality, unsustainable, and sometimes unhealthy buildings. The high rate of building defects leads to users having to face high operation and maintenance costs, and the constraints in land use often result in units being located in remote areas, where users have little access to urban infrastructure, and even less to the social and economic opportunities of the city.

Two of the main preconceptions which slow down investments in sustainability in affordable housing are that (1) social housing units have low energy consumption, not justifying investments in energy efficiency and (2) sustainable solutions are far too expensive to include in social housing, as they would increase the cost of the unit and make it unaffordable for both users and developers.

UNEP launched the Sustainable Social Housing Initiative (SUSHI) in 2009, with the objective to invalidate these two arguments and present the opportunity for the social housing sector to contribute to sustainable development in the building sector and in the country as a whole. The long-term social, economic and environmental benefits can strongly improve the quality of life of residents, reduce energy and resource consumption at national level, improve the climate responsiveness and adaptation of buildings, and deliver co-benefits in terms of social integration, lower health costs, increased performance and productivity.

The first phase of the SUSHI project, conducted in Brazil and in Thailand, focused on identifying locally-appropriate techniques, solutions and practices to deliver sustainability improvements at low or no-cost. Results of this first phase show that additional initial investments can be offset in less than ten years, and in less than two years for the most efficient solutions.

The SUSHI project is currently in its second development phase. The guidelines derived from the first activities will be tested in India and Bangladesh. Developing a local project agenda, and identifying priorities related to the local context, will lead to the construction of more sustainable housing units without an increased life-cycle cost, and will even reduce the costs of housing for developers and residents in the long-term. In addition, the second phase is increasingly focused on the urban integration of social housing units, and the creation of opportunities (employment, education, health and quality of life) for residents.

Excerpt from SUSHI II Project Document, UNEP 2011

Learn more at: www.unep.org/sustainablesocialhousing.

Schools: Educating Children in Healthy Environments

Pathways to poverty reduction recognise the importance of employment opportunities, shelter and education. Unfortunately, many school facilities are inadequate, inefficient and unhealthy learning environments. Sustainable building practices can greatly enhance school facilities, reducing the financial burden on school systems while improving indoor air quality for students and teachers alike and creating more equitable educational opportunities. Creating more sustainable school buildings should be a priority and a standard for school systems.

The benefits of improving the environmental performance of schools are becoming more widely recognised and support efforts to create more sustainable school facilities. A report developed by Washington, D.C. based research consultant, Capital-E, on schools in the United States, entitled *Greening America's Schools—Costs and Benefits*, highlights the financial potential of green school buildings. The report analysed 30 green schools in the U.S., and concluded that the direct savings to schools resulting from lower costs for water and energy, along with the benefits from improved teacher retention and reduced health costs are four times the additional cost of building green. When indirect financial savings were also factored, the benefits were 20 times the additional cost of building green (Kats, 2006). Such schools use a third less energy, providing significant operational savings that can be reallocated elsewhere such as providing funding for at least one additional full-time teacher, improving teacher-pupil ratios—a key indicator in education systems.

As important as the financial savings to schools, is the health and equity benefits to students and the community at large. Kats' *Greening America's Schools* report cites five studies that indicate a 38.5 per cent reduction in asthma in buildings with improved air quality. In addition to highlighting the substantial health care cost savings associated with asthma in unhealthy buildings, the report supports an associated increase in school attendance and teacher retention, and a potential reduction in risk and liability from mould resulting from poor ventilation. While calling attention to the fact that lower income children have higher rates of respiratory illness due to poor indoor air quality in their schools and homes, resulting in absenteeism and lower test scores, the report makes a clear link to inequity resulting from inadequate school facilities:

Wealthy families can move their children into better designed and healthier private schools. Less affluent families are less likely to have that luxury. Greening public schools creates an opportunity to improve the health and educational settings for all students, regardless of income or background, a process with clear moral benefits. The financial benefits of a less inequitable educational system are difficult to calculate but could be substantial in terms of increased diversity in the work force, community development, increased productivity, etc. (Kats, 2006)

As a means to improve educational opportunities, and thus support pathways to poverty alleviation, sustainable building practices for schools offer demonstrable benefits and a clear, cost-effective approach.

Buildings and Cities as a Vehicle for Resource Efficiency, the Green Economy and Sustainable Development

All countries will be affected by the expansion of urban areas, although developing and geographically vulnerable countries will be particularly affected. In industrialised countries, urban population is expected to increase slightly from currently 75 per cent to about 85 per cent in 2050. In developing countries, this trend will be much faster, from currently two billion people, to four billion by 2030. Such a growth pace has no precedent and will create significant demands on resources (Pouffary, 2011).

To accommodate the expected increase in urban population of 2 billion people before 2030 would require the equivalent of 200 new 10 million people cities.

Cities and the built environment are clearly interconnected. Appropriate building codes, land-use policies and energy efficiency standards will have clear consequences on the ‘morphology’ of the city. Green services will likely be more urban-orientated than green manufacturing or primary industry, although there will be some high-tech green manufacturing clusters in or close to urban cores, drawing on information advancements at universities and research labs. ‘Already, the 100 largest metropolitan regions in the U.S. have far greater shares of low-carbon employment in wind and solar energy (both 67 per cent), energy research (80 per cent) and green buildings (85 per

cent) compared with the 66 per cent share of the national population’ (UNEP, 2011, p. 464).

Environmental improvements in cities can both create jobs and support the local economy through investments in infrastructure, public buildings, public transport, waste management, recycling and environmental education. Additionally, governments can further stimulate job creation through thoughtful policies that promote private sector innovation. Green job creation will enable cities to be greener while addressing urban poverty, particularly in developing countries. Additional reductions to poverty will continue with the increasing recognition of community, consumers, and workers’ rights.

Sustainable cities and sustainable buildings need to be a priority within national and international agendas. Policies and investments in the low-carbon economy without addressing the built environment would waste time, money and lock-in poor results.

‘The building sector should be central to any attempt to use resources more efficiently. Buildings consume a large proportion of the global energy supply but opportunities to improve efficiency are huge and the sector has the greatest potential—more than any other covered in [the Green Economy] report—to reduce global GHG emissions’ (UNEP, 2011).

Resource Efficient Cities: Drivers of Change towards Sustainability

A focus on the buildings sector to promote sustainable development and lead a transition to a greener economic growth will have a considerable

impact on jobs, housing and poverty reduction. To sustain and expand on such gains, action in the buildings sector should be accompanied by

complementary actions at the city level. Integrated urban strategies considering sustainable buildings, transport, waste, water and associated infrastructure, which look holistically at overall resource and energy efficiency, will become considerably more important in achieving sustainable development objectives.

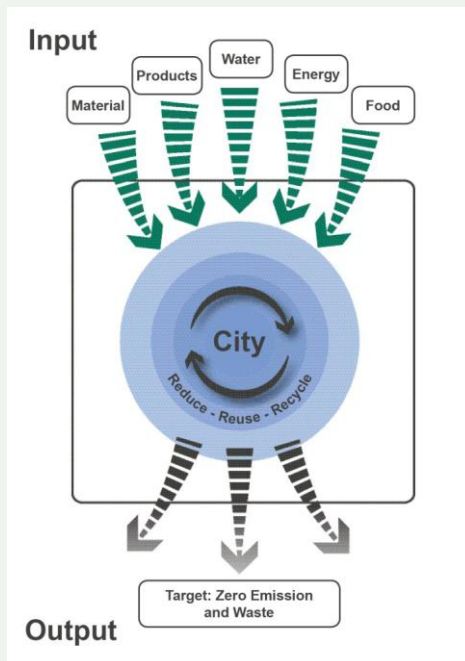
As rapid urbanisation continues to place significant strain on cities, greater attention is needed to assure that the social and economic demands are met in an environmentally-sound and responsible manner. Cities are assuming more accountability for their consumption of resources, and are increasingly recognising the value of sustainability and resource efficiency as a means to meet growing demands. Recognising the critical role that buildings, infrastructure and urban development will play to meet these demands, the buildings sector is well positioned to support cities and national governments in the shift to greater resource efficiency and sustainability. FIDIC, the International Federation of Consulting Engineers recognises the unique function that the building and construction sector has in contributing to sustainable development and to provide the new skills to support a transition to greener economy. In its paper, *Rethink Cities*, FIDIC states, ‘the building and construction sector, as a privileged actor for improving the built environment owing to its deep experience, has already moved in a more holistic direction through knowledge sharing in many countries to develop, for example, new skills, methods and tools for sustainable urban development’ (FIDIC, 2012).

As cities see increasing demands on resources—financial, human and natural—a shift to broader resource efficiency and integrated strategies becomes critical. The quality of life in cities is closely related to the availability and accessibility of resources, but also reliant upon the proper management of those resources. Becoming more resource efficient—reducing negative environmental impact, while continuing to generate economic growth and lifestyle choices for citizens—will stimulate innovation and investment, and contribute to local and global sustainability. The potential to realize multiple benefits through resource efficiency strategies will depend on the awareness by cities of their resource footprint and how they manage consumption and production patterns.

To catalyse such efforts, UNEP has developed the Global Initiative for Resource Efficient Cities, which seeks to connect the many different entities around the world working on resource efficiency, using UNEP’s convening power to mobilise partners and different constituencies from governments at the national and local levels, civil society, business and industry and other major groups. The ultimate goal of the Global Initiative is to mainstream resource efficiency and sustainable consumption and production into policies and tools at the city level and to support change in citizens’ and business’ habits accordingly.

UNEP Initiative Spotlight: Global Initiative for Resource Efficient Cities

The Global Initiative for Resource Efficient Cities will provide a range of support to cities to assist with realizing the economic, social and environmental benefits of resource efficiency and SCP. The core activities include:



Research on Resource Efficiency

Dedicated to further knowledge to facilitate decision making and provide access to information for decision makers in various fields related to resource efficiency and SCP as well as to increase access, processing and use of resources through supply chain and life cycle management.

Enabling Framework

Offer national and city decision makers access to technical expertise in areas such as policy development and proven practical tools, market incentives and public-private partnership options to support resource efficiency.

Network Platform

To provide a mechanism for decision makers to exchange experiences, share best practices and establish a peer-review process across cities for further improving access to resources and their efficient use.

The Global Initiative will focus on the following:

- **Develop a resource footprint of cities** - informed by the above core activities, knowledge on resource flows and resources assessments (inputs/outputs) in cities is improved and common indicators are set up with the overall aim of contributing to the development of a resource footprint of a city. This will provide decision makers with a unique tool to support and follow progress on the efficient use of the resources available to them with adequate policy tools and market instruments.
- **Development of clear goals and targets** - such as reduction in energy consumed in buildings and of water use in urban areas, reduction of waste as well as transforming waste into resources. Assist cities in accessing the resources needed to achieve them. Use ambitious goals to develop and disseminate a set of criteria for a model resource efficient city.
- **Technical expertise** - Facilitate access to public and private sector expertise that cities need to overcome their unique challenges and at the same time further the rapid spread of good practices and new technologies in the energy generation, buildings, transport, water, food and waste sectors. Provide UNEP's advice and technical expertise or support for important dimensions of resource efficiency such as decoupling city development from resource use and its environmental impact, supply chain management, life cycle analysis and a systemic analysis of resource flows in cities.

Learn more at: www.unep.org/resourceefficiency.

Conclusion

Rapid urbanisation and rising population necessitate that the world's leaders address the sustainability of the built environment. As one of the most environmentally burdensome sectors in the world, new building construction and the operation of existing buildings hold significant potential for yielding meaningful energy, emissions and resource reductions at least cost.

In order to realise the full job creation potential and environmental benefits of the buildings sector, the United Nations Environment Programme-Sustainable Buildings and Climate Initiative invites national governments to include green and sustainable buildings as a conduit to increasing resource efficiency and greening their growing economies.

National governments play a role in prioritising the buildings sector in national sustainable development strategies and international negotiations. Appropriate policy frameworks provide investment certainty and drive capital flows and innovation in the sector, supporting and enabling sustainable urban development. Through leadership in the construction and operation of

public buildings, energy efficiency initiatives and financial incentives for resource efficiency improvements, national governments can create jobs and promote green growth.

Business and industry play a crucial role in designing, constructing and managing buildings to maximise resource efficiency and reduce water and energy consumption, as well as waste generation. By adopting operational practices that reduce energy and resource consumption in buildings, business and industry can green the building supply chain through market transformation.

Cities have a role demonstrating positive impacts from sustainable building practices in schools, housing and government buildings. By enacting sustainable building policies and applying integrated urban planning approaches, local governments can reduce infrastructure needs and costs. Finally, cities can foster change in consumption patterns and educate their residents on the benefits of sustainable buildings to ensure the long-term performance and benefits of sustainable buildings.

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