Whose Sustainability Is It Anyway?

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ABSTRACT: Over the last few years, there has been a growing interest shown in "green building" in some key developing countries that are growing at almost an alarming pace. There has also been a growing interest in developing Building Energy Codes and Building Environmental Rating Systems – much on the lines of models in developed countries. However, the vastly different contexts suggest that there might be a need for a more context-sensitive approach to sustainable building design. The authors highlight some pertinent disparities that come into play; such as codes and standards (or the need thereof in the developing context), construction technology and materials, thermal comfort expectations, air-conditioning and electricity availability and expectations, size, water use and availability, per capita energy use and energy use intensity, population and economic growth rates; and primary energy sources and emissions-related concerns thereof. When adapting from a foreign model; addressing these disparities is critical to achieving true sustainability.

Keywords: sustainability, standards, rating systems

1. INTRODUCTION

The LEED™ (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. The LEED™ system has been developed for the US Market by the US Green Building Council, a non-profit organization, based in Washington DC, USA.

LEED™ provides a holistic framework for assessing building performance and meeting sustainability goals. Based in most part, on scientific standards, LEED™ emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. LEED™ recognizes achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources.

The following are the different levels of LEED rating awarded to projects (total number of available points is 69):

- Certified 26-32 Points
- Silver 33-38 Points
- Gold 39-51 Points
- Platinum 52-69 Points

In November 2003, the US Green Buildings Council (USGBC) awarded the first building with its highest possible Platinum certification level under its Leadership in Environment and Energy Design (LEED™) Rating System (version 2.0). This first "greenest of green" building - the CII Sohrabji Godrej Green Business Centre, located in Hyderabad, India – was conceived by its owner, The Confederation of Indian Industry (CII) along with the United States Agency for International Development (USAID) as a model clean energy / environmental center [1].

In February 2005, seven additional projects in India were registered for LEED™ Certification. Other developing countries with LEED™ registered projects are China (5), Mexico (2), Brazil (1) and Guatemala (1). A total of 13 countries across the world, apart from the US, have LEED™ registered projects [2].

The following is the list of LEED™ certifications awarded to date, to projects in developing countries [3]:

- India – 3 Platinum, 1 Gold
- China – 1 Gold, 1 Silver
- Mexico – 1 Certified
- Sri Lanka – 1 Bronze (version 1.0)

While this does speak, to a large extent, for the popularity that the LEED™ Rating System has been able to bring to "green" building worldwide – the authors hold the opinion that the LEED™ Rating System, in its conception (and existing format), was not meant to be a "universal" rating system for sustainable building design. Towards that end, the authors will attempt to highlight some of the pertinent dissimilarities that merit attention, in order to facilitate the use of a tool such as LEED™ for worldwide applicability. For the sake of this discussion, these comparisons and contrasts will be made specifically with regards to the applicability of LEED™ to the Indian context – *only* as points in case to demonstrate shortcomings in the framework for the larger picture of global sustainability and concerns thereof.

To make a simple point - there is a good level awareness of the vast discrepancies in per-capita and per-household energy consumption across countries. To illustrate this point, in the context of the recent Indian "accomplishment" – India's per capita energy consumption is about 4-5% of the per-capita energy consumption of the US. Given this great disparity, one must ponder the true "sustainability" of facilities and measures that are rated according to imported

standards. What does it mean to have a LEED™ Platinum rated building in India? Just how sustainable is it – in *its own* context? Or – if a building is performing even 60% better than the ASHRAE 90.1 Standard for minimum energy performance – what does it mean, if it is located in Mumbai or Delhi?

2. COMPARISONS AND CONTRASTS

2.1 Standards and Codes

Each and every one of the referenced Standards and Codes in the LEED™ Rating System are US-based. Where credits do not reference external standards or codes, requirements are in tune with sensibilities and perceptions as they pertain to the US context. Obviously, for a Rating System originating from and intended for use in the US, this makes perfectly good sense. However, for use of the same tool in a totally different context, one needs to be extremely sensitive to the changed situation and the needs, sensibilities, perceptions and expectations thereof.

A point in case here, one of the Pre-requisites and 10 out of the 69 points of the LEED™ (version 2.1) Rating System are based on ASHRAE Standard 90.1-1999 (Energy Performance). Climatic data necessary to determine building envelope and mechanical requirements is available for over 400 US cities and only 6 Indian cities. For any cities other than these 6, one would, at best, make an informed assumption – or such data will need to be collected. Furthermore, amongst the cities that are there, Bangalore (moderate climate zone) finds itself in the same category as Delhi (composite) for Building Envelope Requirements, while Ahmedabad and Nagpur (both in the hot-dry climate zone) find themselves in the same category as Mumbai, Chennai and Kolkata (all in the warm-humid climate zone) [4]. This, apart from the fact that construction technologies and practices themselves, in the two countries, are notably different – as discussed below.

2.2 Construction Technology and Materials

In the US, light-frame construction is the most-widely practiced method, followed by steel; it would be unheard of, to consider building in today's day and age, without at least a minimum level of envelope insulation. The most widely practiced method of construction in India is reinforced concrete frame structure with brick or concrete block infill walls – for residential as well as commercial buildings – and the use of envelope insulation in conventional construction is almost unheard of.

However, this does not by any way mean that these buildings are inherently inefficient when it comes to energy use, on account of a number of factors, some of which are listed below.

2.3 Thermal Comfort Expectations

In India, it would not be uncommon at all for a majority of the population to be satisfied at temperatures that are way outside the accepted band of temperatures, as defined by ASHRAE Standard 55 – to quote one documented study that was carried out over a period of more than one year, with outside air temperatures of up to 45°C (113°F), laboratory employees have recorded no complaints of discomfort in internal temperatures of up to 30°C (85°F) in a passive and evaporatively cooled space with adequate air movement [5].

2.4 Air-Conditioning and Electricity Availability

In India, air-conditioning is not something that is either freely available or taken for granted. This relates as much to the buying capacity as much as it does to different thermal comfort expectations of the masses. It is not uncommon at all for offices that don't involve computerized work (including government and municipal offices), to not have air-conditioning. Most residences across the country are built without air-conditioning.

A major factor in these different expectations also has to do with electricity or energy availability in general. Regular, scheduled power cuts (also known as load shedding), are common in a lot of states and cities, on account of power shortage. In such situations, buildings need to be designed for passive survivability with neither air-conditioning nor electricity being taken for granted – unless on-site generators are part of the design brief, which is being seen increasingly in newer facilities nowadays. These, however come with their own concerns of emissions and the like.

2.5 Size

Comparatively, India is slightly larger than 1/3rd of the US in area [6]. Effectively, the intent of the credits for materials manufactured and extracted locally (within 500 miles), stands to be diminished greatly – almost the entire country would be covered with this radius. It might be in place to consider the 500 mile radius to be reduced appropriately – to 150 or 200 miles. It might even be in place to consider ecological regions for the criteria of this credit, instead of using arbitrary distances and radii.

2.6 Water Availability

While there have been great strides in the supply of safe drinking water in India, gross disparities of coverage continue to exist. An estimated 21% of communicable diseases in India are water-related. Of these, diarrhoea alone killed over 700,000 people in 1999 (estimated) – over 1600 deaths every day [7]. Given the gravity of the situation, the use of potable water for any means other than providing safe drinking water is questionable. There needs to be an acute sense of awareness of this fact – especially when proposing the use of a voluntary sustainable design building rating system.

LEED™ (USA) has 5 Credits for Water Efficiency with 1 point each for water use reduction in buildings by 20% and 30%; 1 point each for reduction of potable water use for landscaping up to 50% and 100% and 1 point for innovative wastewater techniques. In the Indian context, it would make perfectly good sense to make eliminating use of potable water for air-conditioning a pre-requisite, as well as raising the threshold of points for existing credits and increasing the water use reduction

targets. It also might be in place to make the elimination of potable water use in landscaping a prerequisite.

To put these arguments in perspective, the per capita availability of water reduced from 5300 cu.m. in 1955 to 2500 cu.m. in 1990, in India and from 14990 cu.m. to 9900 cu.m. in USA. By 2025, India's per-capita water availability is expected to be 1500 cu.m. [8] – a country is said to experience water stress when the per capita availability drops to below 1700 cu.m. [9]

2.7 Per-Capita Energy Use

The total per capita primary energy consumption per person in India, in 2004, is just below 4% of that for the US [10]. As of 1995, the per capita electricity consumption in India was at 3% of the US level [11]. As of 1995, the per capita commercial energy consumption in India was 6% of the US level [11].

Given these figures, it is really difficult to say what is achieved by a building that saves even up to 60% energy over ASHRAE 90.1-1999 (for a maximum of 10 points for optimized energy performance under LEED™ version 2.1) – in its own context, in Mumbai or Bangalore.

2.8 Population and Economic Growth

Perhaps, the two most striking factors that might magnify and distort the effect of all of the above-mentioned factors and disparities, far beyond the best-thought-out predictions; are India's population and economic growth.

India's population currently is at 1.07 billion, with a growth rate of 1.44%; with the median age of the population being 24 years. The US population is at 293 million, with a growth rate of 0.92% and a median age of 36 years [6].

Over the last 10 years, India's economy has posted growth rates around the 6% mark, and is currently at 8% and rising [12]. Over the same period, the American economy has been growing at around the 3% mark and is currently at around 4% or so.

The effect of over 3 times the population, growing 1.5 times faster, that's 12 years younger, in a country whose economy is growing twice as fast – which means ever more buying power – just in terms of energy efficiency; it might just be disastrous to set the bar based on an imported baseline that's from a country that consumes about 25 times as much energy per capita, of the current consumption levels in India.

2.9 Primary Energy Sources

India has the fourth largest coal reserves in the world [6] – 54% of India's energy consumption comes from coal, 33% from petroleum and 8% from natural gas [13]; as compared to the US, with 40% of its energy consumption from petroleum, 25% from natural gas and 25% from coal.

From the point of view of carbon emissions, this assumes significant importance as well, as coal contains the highest amount of carbon per unit of energy, while petroleum has about 20 percent less carbon than coal, and natural gas has about 45 percent less. The vast difference between the energy consumption profiles by fuel types and the impact it has on the environment, probably suggests the use of a metric other than site energy – perhaps, source energy tied with equivalent carbon emissions would be a more complete metric that would go a long way towards global sustainability

3. CURRENT ADAPTATION EFFORTS

3.1 LEED™ India

Following the successes with the US-based LEED™ Rating System, the Indian Green Building Council (IGBC) has proposed to launch LEED India Green Building Rating System, which would be similar to LEED™ (USA) rating system *"with minor modifications so as to suit Indian conditions and priorities"* [14]. Furthermore, they go on to state: *"By and large, LEED™ (US) is applicable to India, to a great extent"* [15].

3.2 Proposed Modifications in LEED India [15]

The LEED India committee has proposed some changes including two new pre-requisites and a few additional credits. The changes proposed are the following (in *italics* below, followed by the authors' comments without italics):

3.2.1 *New Pre-requisites:*

- *Emissions from Captive Power Generators*

In general, all buildings in India have captive power generation facility. The emissions from these captive power plants can have a direct impact on the building occupants and the community. To facilitate strict adherence to CPCB (Central Pollution Control Board, India) *specified emission levels, LEED India proposes to introduce this requirement as a prerequisite.*

This is a good proposed addition.

- *Safety*

LEED™ US does not address safety as an issue since other building construction codes would cover this aspect to a large extent. LEED India proposes to incorporate safety as a prerequisite, both during construction and post occupancy to ensure that a Green Building is also a safe building.

This is a good proposed addition.

3.2.2 *New Credits:*

- *Potable Water Use Reduction*

In the existing US based LEED™ rating, potable water use reduction by 20% would qualify for 1 point and 30% would qualify for 2 points. LEED India would award one more additional point if the project demonstrates a saving of 40% and more.

This is a good proposed addition. There is no doubt that there needs to be more emphasis on water efficiency in the Indian context. However, in view of the fact that India is perilously close to the water-stress threshold, it might make sense to consider making 30% water-use reduction a pre-requisite and to award additional points for 40% and 50% reduction each.

- *Potable Water Use Reduction for Air-Conditioning Applications*

Air–conditioning being a major use of water for cooling tower make-up, LEED India proposes to recognise projects which would use recycled waste water for cooling tower make-up applications. Hence, it is suggested as follows:

- *1 point for up to 75% reduction in potable water use for air-conditioning.*
- *Additional 1 point for up to 100% reduction in potable water use for air-conditioning.*

This is a good proposed change. It is strongly recommended, once again, in view of water availability in India, that as pre-requisites, no potable water be used for either landscape irrigation or air-conditioning, i.e. necessitate the use of harvested rainwater and / or recycled site water for these uses.

- *Green Power*

LEED – India Steering Committee proposes that the quantum of investment on renewable energy made by the building owners, anywhere in the country should be recognised and awarded a point.

The original intent of this credit is to encourage the purchase of green power for the specific site / building and thereby play a role in increasing the demand for green power. While investment would play an important role as well, it is foreseeable that an increase in demand will automatically be accompanied by an increase in investment. It is suggested that the credit for purchase of renewable energy for the particular building be maintained, and the investment on renewable energy may perhaps be added as an additional credit.

- *Cooling Towers*

ASHRAE 90.1 stipulates that cooling towers in buildings be CTI (Cooling Tower Institute, USA) Certified.

Cooling tower testing facility is not available in India. Hence LEED India Steering Committee proposed that USGBC should accept cooling towers manufactured in India which have been type tested as per CTI.

This is a reasonable proposed change. However, it is recommended that an appropriate certification that is rooted in the Indian context, be sought out in the long run. If such a certification is not currently available, efforts should be made to encourage the development of an appropriate local certification standard.

- *Low VOC Paints*

As per the existing LEED requirements, low VOC paints are required to be used inside the building. LEED India proposes to stipulate use of low VOC paints for the exterior surfaces also.

This is a good proposed addition.

- *Development Density*

Under LEED™ USA, this credit intends to channelize development to areas where the infrastructure is already in place.

In the Indian scenario, the national priority is to move developments away from the existing infrastructural areas, since they are already over-burdened and saturated. Hence it is proposed to exclude this credit in the LEED India rating system.

This seems to be a reasonable case for deletion. However, the intent of the original credit is to protect greenfields and preserve habitat and natural resources – as well as to avoid the additional embodied energy in building new infrastructure. It might be worthwhile to consider maintaining this credit, but with different criteria so that the intent of the credit is met without placing additional stress on existing urban areas.

- *Alternative transportation, Parking Capacity*

LEED India proposes to introduce preferential parking space to eco-friendly two wheelers also in addition to cars, which have not been addressed in LEED™ US along with environment friendly four wheelers.

This seems to be a reasonable proposed modification. It is recommended that the criteria for fuel-efficiency and emissions for eco-friendly vehicles be clearly specified.

- *Alternative transportation, Alternative Fuel Vehicles*

It is proposed that 2-stroke engine operated two wheelers be included in the criteria for this credit.

The intent of the original credit is to reduce pollution and land development impacts from automobile use and specifically intended to reward vehicles that use cleaner and greener fuels – which isn't the case with 2-stroke engine operated two wheelers. Besides, it is still contentious as to whether 2-stroke engines bring about enhanced fuel-efficiency and / or reduced pollution because of emissions [16] [17]. In view of this, it is proposed that this modification be dropped.

- *Alternative Transportation, Bicycle Storage and Changing Rooms*

It is proposed that this credit be deleted as it is "not applicable" in the Indian context.

The original intent of this credit is to reduce pollution and land-development impacts of automobile use and specifically intended to encourage emissions-free transportation choices as well as "live-work-play" mixed-use neighbourhood developments whereby the distances between the employees' residences and the workplace is reduced, so as to facilitate means of alternative transportation such as bicycles. It is therefore recommended to maintain this credit point – so as to not preclude this possibility altogether.

3.3 LEED™ India Summary of Changes

LEED™ (USA) has 69 points and 7 pre-requisites distributed amongst five categories. LEED™ India has proposed 2 additional pre-requisites, 3 additional credit points, and 2 credit point deletions. Changes have been proposed for 9 credits altogether (less than 15% of the total number of credits).

Apart from these modifications, none of the underlying criteria for the credits or pre-requisites, i.e. the underlying codes, standards and sensibilities that determine the awarding of the credit points in question – are proposed to be substantially changed, replaced or adapted to the context.

It is the opinion of the authors, that unless each and every one these underlying criteria are reviewed thoroughly and replaced by standards, codes and sensibilities that are inherently rooted and developed in the context in which they are applied, any adaptation, will, at best, be superficial. In the absence

of existing local standards, codes and sensibilities that may be appropriate to the respective credits; it is suggested that the development of these be undertaken as a top priority. Such a thorough review and overhaul of the underlying criteria will then result in the successful adaptation of a strong and successful theoretical framework such as the LEED™ (USA) Rating System, for a vastly different context, such as India.

4. CONCLUSION

The authors have sought to make the case for a more place-sensitive, context-driven approach to sustainability in developing countries – by illustrating these key disparities and differences that come into play when applying a tool, albeit very successful in and of itself, in a setting other than the one it was intended for – without any prejudice towards the tool itself, or the intended setting.

It must be stated here, too, that it is not the intention of the authors to suggest that LEED™ is being *forced* on any one country in particular or on the developing world in general. It is also true that, in principle, creating guidelines specific to local conditions has always been a stated objective of the World Green Building Council, as well as being the guiding force for national Green Building Councils. This is adequately illustrated in the ongoing efforts by the Indian Green Building Council to adapt LEED™ to the Indian context. However, the authors have attempted to demonstrate, in this paper, that while the intention is there, the reality on the ground suggests that there is a long way to go before this is achieved.

It is, also, a fact that, when the combination of the factors mentioned in this paper are considered, for just two of the early adopters – China and India – who are also, incidentally home to over a third of the world's population and the fastest growing economies in the world today – the impact that an inappropriately directed approach can have, is certainly cause for concern. These two countries are already engaged in a race for long-term energy security – and there is a growing populist and consumerist sentiment that achieving parity with regards to energy consumption is a sign of having arrived on the "developed" stage. This sentiment, coupled with the aspirations of the populations, economic growth and the heavy dependence on coal in both these countries – can potentially spell disaster on the twin counts of global energy outlook as well as global sustainability.

Setting the bar appropriately can make all the difference. The answer lies in adopting successful models with a heightened sense of responsibility and sensitivity, with recognition of the key factors at play and modifying these models to the specific context – by adaptation, instead of adoption; which is systemic, instead of superficial – so as to bring about truly path-breaking and much-needed shifts in the sustainability paradigms as we know them today.

REFERENCES

[1] USAID Press Release: "India Green Business Center Receives Platinum Award" - http://www.usaid.gov/our_work/economic_growth_and_trade/energy/urban_energy/pubs/ss/india_greenbizctr.pdf, accessed April 14, 2006.

[2] USGBC Website: Registered Projects - https://www.usgbc.org/LEED/Project/project_list_registered.asp , accessed February 14, 2005.

[3] USGBC Website: Certified Projects - https://www.usgbc.org/LEED/Project/project_list.asp?Sort=Country, accessed April 14, 2006.

[4] ASHRAE Standard 90.1-2001.

[5] Cooling without air-conditioning. The Torrent Research Centre, Ahmedabad, India. Ford B, Patel N, Zaveri P, Hewitt M; Pergamon, Elsevier Science Ltd, 1998, Proceedings of "Renewable Energy: Energy Efficiency, Policy and the Environment", World Renewable Energy Congress V, 20-25 September 1998, Florence, Italy, edited by A A M Sayigh, Volume 1, pp 177-182, 4 figs.

[6] CIA – The World Factbook http://www.cia.gov/cia/publications/factbook/index.html, accessed February 14, 2005.

[7] "Combating diarrhoeal disease in India through safe drinking water" – Justin DeNormandie and Janette Sunita, Population Services International, Delhi - http://www.who.int/mediacentre/multimedia/2002/ind_sanitation/en/, accessed April 14, 2006.

[8] Approach to Natural Resource Economics - http://www.toenre.ac.in/approach%20.htm, accessed April 14, 2006.

[9] Population Growth, Water Shortages - http://www.infoforhealth.org/pr/m14/m14chap3_1.shtml, accessed April 14, 2006

[10] International Total Primary Energy Consumption and Energy Intensity - http://www.eia.doe.gov/emeu/international/energyconsumption.html, accessed April 14, 2006.

[11] Indian infrastructure – the pace of modernization; S Mitra and V Handa - http://www.ncaer.org/Upload/others/100/I_Brief.PDF, accessed February 14, 2005.

[12] India: Rise of a Mighty Market – White Paper, In-Stat / MDR, May 2004, Scottsdale, AZ.

[13] Energy: Consumption by type and country, 2003 - http://www.geohive.com/charts/charts.php?xml=en_cons&xsl=en_cons, accessed April 14, 2006.

[14] Invitations for Suggestions on LEED India, Green Business Center. http://greenbusinesscentre.com/leedindia.asp, accessed April 14, 2006.

[15] LEED India Rating System, Green Business Center. http://greenbusinesscentre.com/leedindiarating1.asp, accessed April 14, 2006.

[16] Mechanical Engineering Power & Energy, March 2004. *"Two Strokes Against It"*. http://www.memagazine.org/pemar04/2strokes/2strokes.html, accessed April 14, 2006.

[17] India Infoline Sector Reports: Automobile – Two Wheelers; Technology and Usage of Vehicles. http://www.indiainfoline.com/sect/attw/ch05.html, accessed April 14, 2006.