

Analysing Market Feasibility of Residential Green Buildings in Tier-II Cities in India

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Abstract: *Going green is the latest trend among corporate and residential apartments. The Indian Green Building Council (IGBC) estimates the demand for Green building materials and equipment will reach \$ 8 billion per annum by 2015. In tune with the global trend to protect the environment, the number of Green building projects in India went up from 164 in 2009 to over 2000 by 2012. Looking into this scenario, the objective of this paper is to assess and improvise level of knowledge among developers, customers, and local authorities regarding residential green buildings in Tier II cities in India. The study is limited only for Tier-II city of Bhopal, which is an upcoming residential hub situated in the heart of India. A three-tier survey involving three parties, viz. Potential Buyers, Developers and Government Bodies helped in determining the level of awareness regarding green building concepts in the general public and local real estate developers of Bhopal; ascertaining the willingness of the public to pay for energy efficiency; assessment of the customers', developers' and Government's perspective on Green buildings; analysis of the market scope of residential green buildings from the developers' and Government's perspective; identifying the challenges that the developers face in building green; and getting an insight of the current scenario of the residential green building market. The results show that if all the above parties involved in the process of residential green building development work in sync with each other, residential green buildings can be made feasible for Tier-II cities in India.*

Keywords: *IGBC, Residential Green Buildings, Energy Efficiency.*

I. Introduction

Green building is the practice of increasing the efficiency with which buildings use resources – energy, water and materials – while reducing building impacts on human health and the environment, through better site, design, construction, operation, maintenance and removal i.e. the complete building life cycle. Today a variety of Green buildings are coming up in the country – residential complexes exhibition centers, hospitals, educational institutions, laboratories, IT parks, airports, Government buildings and corporate offices. India, which has an estimated 19 years for the domestic oil reserve to last and 86% of its oil consumption being imported, has taken a leading role in promoting Green buildings. Green buildings utilize designs and materials that are environment friendly. They ensure pollution-free environment and reduction in energy bills through application of smart energy management, building management, application of solar photovoltaic system, high performance windows and heat resistant paints among others. Green buildings have provision for solar protection to prevent heat gain in the premises during the day. This helps in putting less of load on air-conditioning system to maintain ambient temperature within the premises. The solar protection mechanism in Green building ensures the usage of natural light to the maximum and that results in the reduction in the consumption of electricity used for lighting. This mechanism also protects the premises from the glare and heat of harsh Sun in the summers and maintains the warmth of Sun during the winter. This helps in the increase in the comfort level of users as it enables natural ventilation, natural light and climate control in a natural way.

Around the World, green building is accelerating as it becomes viewed as a long-term business opportunity. Fifty-one percent of the architects, engineers, contractors, owners & consultants from all over the World anticipate that more than 60% of their work will be green by 2015, up from 28% of firms in 2012 according to a study conducted by McGraw Hill Constructions across 62 countries from all around the World including India. According to McGraw Hill Constructions, the growth of green is not limited to one geographic region or economic state-it is spreading throughout the global construction marketplace. The Indian Green Building Council (IGBC) estimates the demand for Green building materials and equipment will reach \$ 8 billion per annum by 2015. Going green is the latest trend among corporate and residential apartments. Green building, as the concept is called, ensures environment protection, water conservation, energy efficiency, use of recycled products and renewable energy. In tune with the global trend to protect the environment, the number of Green building projects in India went up from 164 in 2009 to over 2000 by 2012.

Statement Of The Problem

The main problem lies in the fact of awareness of Residential Green building design in India. This problem is nationwide, lack of awareness among public and developers has resulted into wide range of disbelief. Every expert depicts the same story to take measure regarding the perception of customer behavior. It may be small start to use the technique of pamphlets reciting the concept of green building design along the project brochure, but this impacts to wide range of customers. The issue of addressing such issues under myth category is a big challenge that its needs to be improvised. Indian real estate market is widely unorganized, wide range of developers from big groups to a local developers impacts the quality of project and the trust of customer. Lack of knowledge, traditional methods are some main factors which contribute in making projects like green building a myth. Developers need to improvise in their level of knowledge, just putting green belt in front of multi-storey residential complex does not account that building as green building. This problem is not limited up to developers but even the local development authorities are not aware with the idea of innovation or any new technique.

The question arises on how this can be achieved in a Tier-II city of population around 34 lakh with India moving towards the stage of global platform. The idea of conducting survey with customers is to ascertain the level of awareness and judging their behavior with respect towards new concept or innovation. The idea of conducting survey with different developers is to ascertain the level of technical expertise and knowledge regarding green building construction in the residential real estate sector. The interview with government officials provided an insight to the policies and regulatory environment of green buildings in the residential real estate sector. The question also revolves around the level of awareness among developers and local government bodies. Is it right to presume that our government bodies lack in the idea of development? The questionnaire will provide data that will ascertain the value of business and its related myths and will ultimately serve as a guide to whether the concept of residential green buildings is feasible for the market of Bhopal or not. The local government bodies will determine the level of influence towards new idea and technology.

Objective Of Study

- To identify the necessity of Green Buildings with respect to the present scenario.
(Source: Consultation from Environmental Planning & Conservation Organisation, EPCO).
- To identify challenges associated with Green Buildings, including entry barriers to Green Building construction.
(Source: Consultation from IGBC & Developers)
- To conduct Market Analysis with respect to green buildings in the Bhopal region.
(Source: Survey at three different levels)

Significance Of The Study

It is must to contribute towards society, this study will not only benefit the customer, developers in terms of money but it will also enhance their knowledge about a new concept or innovation. The study revolves around a basic plan to make people aware of the concept and to determine whether the citizens of Bhopal are open towards a new innovation, whether for them is just a new concept or it something which will provide customer with a sense to acquire for knowledge before investment. Today's customer has become conscious but does this mentality is just in terms of investment or it would provide upper hand to customer with knowledge of the concept. Many experts have argued for the feasibility of green building design, but the truth is seen to be that such concept will be accepted not today but may be after 10 years. It just a matter of time when government will opt for such measures to achieve the dream of sustainable development. Government need to put efforts to promote such concepts in order to make public aware of such new work. Government is often found to be reluctant on such matters, but being reluctant can't make our nation progress. The public should be a part of change until the public still living in the old world it's a duty of government to work on such cases to promote green buildings. Such things can be achieved if government uses the same concept to promote its new era buildings which will be built on the same concept. The idea of creating such an environment is to generalize the public towards the sustainable growth.

Market of developers is poorly organized, big developers have the idea of brand image and customer satisfaction. The basic need is to bring such characters in local developers. The idea of marketing can't be improvise until there is satisfied platform where a customer and developer transaction can take place. The main motive for such enhancement is to provide level of awareness among local developers so that the market can be organized. Developers require to work on concept which is not universally accepted. Also it is the duty of developer to provide every possible details regarding the project to the customer as per the Indian real estate act 2013. Everyone has the tendency to follow which is successful. The project success is not only determined by the market but it is also determined by the level of effort done by the developer to provide customer with an interest of satisfaction.

Limitations Of The Study

This study will show result only for the region of Bhopal. The study will not entertain any public outside Bhopal. Further study will not include any work regarding the pricing, place or further any market mix. Also arriving from developer's point of view suggest following disadvantages which can't be covered in this study:

1. Economies of scale:

While many green developments are enormous, a number of them are small and seem to have a little of everything. As an owner, or as a larger tenant, it may be difficult to get the economies of scale you need in a smaller green building development.

2. Difficulty of management:

For many property managers, managing this kind of development can be a gargantuan task. Most property managers focus on office management or retail space management. Unless the development is enormous and justifies several property managers on one project, this can be a beast to manage. As a tenant, you will have to realize that your property manager may excel at dealing with office tenants, but not understand well how to manage retail tenants. Before leasing in a mixed-use location you may wish to investigate this further with your Landlord.

II. Literature Review

The Concept Of Green Building:

There have been various popular definitions of sustainable buildings or green buildings. USGBC (United States Green Building Council), one of the pioneers in propagating green buildings across the globe states that the term 'green building' is synonymous with 'high performance building', 'sustainable design and construction' as well as other terms that refer to a holistic approach to design and construction. Green building design strives to balance environmental responsibility, resource efficiency, occupant comfort and well-being, and community sensitivity". According to the Indian Green Building Council (IGBC), a building which can function using an optimum amount of energy, consume less water, conserve natural resources, generate less waste and create spaces for healthy and comfortable living, as compared to conventional buildings, is defined as a green building. The Energy and Resources Institute (TERI), a not-for profit organisation working in the field of sustainable development defines it as, "A Green building is designed, constructed and operated to minimize the total environmental impacts while enhancing user comfort and productivity".

Some of the key attributes of Sustainable buildings are as under:

- Consideration of sustainability aspects in all phases of building design and planning
- Consideration of sustainability aspects during construction and production of building materials
- Use of healthy and environmentally friendly building materials and products
- Use of efficient systems
- Use of constructions and systems which are easy to maintain and service
- Safeguarding of high functionality, flexibility and adaptability
- Safeguarding of health and comfort of users, occupiers and visitors
- High aesthetic and urban design quality; high public acceptance
- Appropriate location with good access to public transportation services and networks

Conventional methods of building use tremendous quantities of material, many of them non-renewable and toxic, and pay little attention to the impact the building has on the environment. Green buildings not only reduce these impacts but are also healthier and consume less energy saving money in the long run. Green building design is a practical and climate conscious approach to building design. Various factors, like geographical location, prevailing climatic conditions, use of locally available and low embodied energy materials and design parameters relevant to the type of usage of the building are normally taken into consideration. Such an approach ensures minimum harm to the environment, while constructing and using the building. A green building uses minimum amount of energy, consumes less water, conserves natural resources, generates less waste and creates space for healthy and comfortable living. When a number of green buildings are located in proximity, they would create a green zone, providing much healthier environment and minimise heat-island effect. The ultimate aim will then be to create many such areas, which would help the towns and cities and therefore the nation in reducing total energy requirement and also the overall global carbon footprint. In a nutshell, sustainable buildings use less energy and water, generate less greenhouse gases, use materials more efficiently, and produce less waste than the conventional buildings over their entire life cycle.

Compulsions Of Going Green:

Studies show that the global urban population is expected to grow from 47% of the total in 2000 to 70% in 2050. The urban populations of China and India are continuing to grow rapidly to 2050, reaching more than one billion in both China and India. In India drastic urbanization is mainly due to both socio-political motivation. In line with expanding development and population, India's building sector is expected to grow five-fold till 2050 as two-thirds of the commercial and high-rise residential structures that will exist in 2030 are yet to be built (70%). While India's total energy requirement is projected to grow at 6.5% per year by 2016-17 to support the country's projected growth rate. India is en route to becoming the world's second largest emitter of greenhouse gases. It is a globally excepted fact that green buildings save the resources in the entire lifecycle of the structure and it starts from Green design. Green design has environmental, economic and social elements that benefit all stakeholders, including owners and the occupants. With rapid improvements in construction techniques and ethos, it is visible that many of the contemporary office buildings being built across metropolitan cities in India are already including some of the Green features as part of the buildings being delivered for occupation.

In such a scenario, the residential developments also need to switch to green development in order to address the future issues of energy efficiency, increased pollution, increasing carbon footprint and emissions. Going green will ultimately lead to the sustainable development of the society, the nation and the world on the whole.

Benefits Of Green Building:

Buildings have an enormous impact on the environment, human health, and the economy. The successful adoption of green building strategies can maximize both the economic and environmental performance of buildings. Research continues to identify and clarify all of these benefits and costs of green building, and of how to achieve the greatest benefits at the lowest costs. According to IGBC, green building has the following benefits:

- Environmental Benefit
- Emissions Reduction
- Water Conservation
- Storm water Management
- Temperature Moderation
- Waste Reduction
- Economic Benefits
- Energy and Water Savings
- Increased Property Values
- Decreased Infrastructure Strain
- Improved Employee Attendance
- Increased Employee Productivity
- Sales Improvements
- Development of Local Talent Pool
- Social Benefits
- Improved Health

Green Building Economy And Market

Recent studies predict that energy efficiency in building and appliances can reduce 1.6 Gt CO₂ in 2020 and up to 7Gt CO₂ in 2050. About \$158 billion per annum between 2010 and 2050 are required to diffuse the energy efficiency technologies globally. According to study by McGraw Hill Construction, about half of new global commercial building projects will be planned as green buildings and 45% of retrofitting projects on existing buildings are targeted to improve energy performance. In terms of region, the fastest growing regional green building market is Asia, where the population of firms largely dedicated to green building is expected to jump from 36% today to 73% in 2013. More than half study firms expect to be largely dedicated to green building (on over 60% of projects), up from 30% today. Over 85% firms expect rapid or steady growth in sales and profit levels associated with green building.

Studies show that the Green building movement in India has gained tremendous momentum during the past 3-4 years, since the CII-Godrej GBC embarked on achieving the prestigious LEED rating for its own center at Hyderabad. The Platinum rating awarded for this building sparked off considerable enthusiasm in the country. Today a variety of green building projects are coming up in the country residential complexes, exhibition centers, hospitals, educational institutions, laboratories, IT parks, airports, government buildings and corporate offices.

Green Building Rating Systems

Motivated by a desire to appear environmentally conscious, many commercial facilities have adopted “Green technologies” in order to earn “Green and Sustainable” certifications. According to USGBC, the Green Buildings Ratings and Certification process has gained tremendous momentum over the last few years. Particularly, growth in the number of projects certified by rating systems such as Energy Star and LEED has nearly doubled in size during this period. In India, the Indian Green Building Council (IGBC) provides LEED ratings to structures and aims to make the country one of the leaders in green buildings by the year 2015. The Green rating for Integrated Habitat Assessment (GRIHA) is the National Rating System of India. It has been conceived by The Energy and Resources Institute (TERI) and developed jointly with the Ministry of New and Renewable Energy, India. It is a design evaluation system for green building and is intended for all kinds of buildings across every climatic zone in India. According to a 2008 news report in the Indian Express, Mumbai had registered 30 green building projects, at the time the highest among Indian cities. Thanks to the gradual spread of awareness about eco-friendly constructions, there has been a considerable rise in the number of registered green buildings in India. According to 2008 IGBC data, there are 315 green buildings in India, of which 250 are commercial properties.

IGBC offers specialised rating systems for green residential developments. Some of the rating systems are briefly described below:

- **IGBC Green Homes Rating System:** IGBC Green Homes is the first rating programme developed in India, exclusively for the residential sector. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts. The system is designed to be comprehensive in scope.
- **IGBC Green Townships Rating System:** This rating system is designed to address large developments and it is mandatory to include residential development as part of the township. Some typical examples of large scale developments are integrated townships, satellite cities, gated communities, campuses with multiple buildings etc.

The Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets. Carbon credits and carbon markets are a component of national and international attempts to mitigate the growth in concentrations of greenhouse gases (GHGs). One carbon credit is equal to one metric tonne of carbon dioxide, or in some markets, carbon dioxide equivalent gases. Carbon trading is an application of an emissions trading approach. Greenhouse gas emissions are capped and then markets are used to allocate the emissions among the group of regulated sources. Carbon credit may be prove as a good source of income for rural areas and industrial, factories etc. by minimizing GHG emission or increasing the trees plants and other environment friendly techniques, which is not tough for Indians. Promotion and knowledge of such business opens should be promoted through education system.

Green Buildings In India – The Challenges

Building energy-efficient 'green' homes sounds like a great idea in theory. But in practice, especially in developing countries, it can be extremely expensive. In India, there are no direct incentives for building energy-efficient homes or commercial spaces. The Indian housing industry faces several problems while trying to be eco-friendly, according to international real estate services specialist Jones Lang LaSalle.

A major challenge is that the overall demand for space in Indian cities has been gradually falling. India's top seven cities will see about 25 percent vacancies by 2014, says RajatMalhotra, head of Integrated Facilities Management for West Asia at Jones Lang LaSalle. Finding tenants or buyers willing to pay more for green space, therefore, is a serious challenge for developers. For private homeowners, there is no immediate motivation to take the energy efficient path.

In the absence of mandatory standards for green and energy efficient buildings in India, most municipalities do not have a uniform and practicable energy code especially for passive and solar designs. There are no clear implementation guidelines in place for state and municipal bodies to develop and implement building energy efficiency programmes and policies. There is also no effective local implementation infrastructure for code administration and enforcement including code checking and inspections.

Building owners tend to under invest in green technologies and energy efficiency during building design and construction because of the split incentives. The developers do not gain from the initial investments in building energy efficiency and thus pass on the cost of inefficiency to the tenants and the environment. The current high cost of borrowing can be a strong impediment to incremental funding in efficiency that would be offset by future savings of energy costs.

Bhopal-An Emerging Tier-Ii Residential Hub

Bhopal is the capital of the Indian state of Madhya Pradesh and the administrative headquarters of Bhopal district and Bhopal division. The city was the capital of the former Bhopal State. Bhopal is known as the City of Lakes for its various natural as well as artificial lakes and is also one of the greenest cities in India. Bhopal is the 16th largest city in India and 134th largest city in the world. It is basically divided into two parts - old Bhopal and new Bhopal.

A Tier-II city, Bhopal houses various institutions and installations of national importance. Some of these include ISRO's Master Control Facility, AIIMS Bhopal (Established in 2012), National Institute of Fashion Technology (NIFT) AMPRI, MANIT, IISER, SPA, IIFM, BHEL, School of Planning and Architecture (SPA Bhopal) and NLIU, Gandhi Medical College.

The city attracted international attention after the Bhopal disaster, when a Union Carbide India Limited (UCIL) pesticide manufacturing plant leaked a mixture of deadly gases including methyl isocyanate on the intervening night of 2/3 December 1984, leading to one of the worst industrial disasters in the world's history. Since then, Bhopal has been a center of protests and campaigns which have been joined by people from across the globe. Bhopal is widely known for its silver jewelry, fashioned beadwork, embroidered and sequined velvet fashioned purses and cushions. In recent times, Bhopal has emerged as a potential real estate destination after Indore in Madhya Pradesh. It offers various investment opportunities for both property developers and property investors. The economy of Bhopal mainly comprises of electrical major BHEL, services and administration sectors. The development of property in Bhopal seems to be following a wholesome approach as all the sectors, be it residential, commercial or retail, are growing rapidly.

III. Research Methodology

The study is based on both Primary and Secondary data. The secondary data consists of information collected from journals, magazines, books and internet. The primary data is collected through questionnaires on three separate levels. Three separate questionnaires were prepared for three different parties: Potential Buyers, Developers & Officials from EPCO (Environmental Planning & Conservation Organization). All the questionnaires were of structured non-disguised type.

The sample size for potential buyers was taken as 200 and the sample size for Developers was taken as 10. The sample size of the officials from EPCO was taken as 2 depending upon the availability of the government officials. The sample size is kept small as the study is done only for the Bhopal region.

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Interpretation

Based on the analysis of the three-tier survey, following are the final consolidated key findings:

Buyer's perspective:

- 20% of the potential buyers are completely aware of the green building concept and almost 50% of the potential buyers are somewhat aware of the green building concept.
- Majority of the potential buyers belong to the age group of 18-35 years and 35-49 years. Out of these, the most aware potential buyers belong to the 18-35 years age group.
- Majority of the potential buyers belong to the middle and upper middle class of the society. 47% of the potential buyers belong to the income group of Rs. 2-5.9 LPA and 42% of the potential buyers belong to the income group of Rs. 6-12 LPA.
- The major source of awareness regarding green building concept for the potential buyers has been the print media, accounting for a 42% share. Social media accounts for 10% as a source of awareness.
- Almost all the new developing areas in Bhopal like Hoshangabad Road, Ayodhya Bypass and Arera Colony Extension fetch a good amount of customer interest, i.e. 30%, 22% and 28% respectively.
- Around 40% of the potential buyers have a wrong perception about the green building concept.
- Almost 25% of the potential buyers think that all the features of a green home are equally important to them.
- 60% of the potential buyers are willing to pay more for a green home in the current scenario.

The Developers' Perspective

- 80% of the developers have read information regarding the green building concept, but never used it.

- Majority of the developers (90%) are currently using measures like rainwater harvesting, alternate energy sources, natural lighting and water recycling techniques etc. in one or the other project.
- 30% of the developers are found to be reluctant in using green building technology because of regulatory concerns.
- 40% of the developers do not opt for green building technology because of market concerns.
- 50% of the developers are reluctant in using green building technology because of the complexity of information and the complex set of guidelines they have to follow in order to achieve a green rating certification.
- 40% of the developers do not engage in green development because of the high level of initial investment which is associated with green building construction.
- The major source of awareness regarding green building concept for the potential buyers has been the print media, accounting for a 42% share. Social media accounts for 10% as a source of awareness.
- A whopping 90% of the developers think the Government and City Administration should take steps to facilitate green development in the residential real estate sector.
- 50% of the developers suggest that the Government should engage in promotion of the green building concept among the general public.

The Government's Perspective

- The Government of Madhya Pradesh in collaboration with EPCO, BDA and BMC is currently working on the development of a Clean Development Management (CDM) Agency in Bhopal, which will address the issues associated with sustainable development and will facilitate the development of green homes in the city.
- Officials think that in order to facilitate green building development in the residential real estate sector, the current guidelines and rating systems should be revised and should be made a little bit favorable to the developers.
- There is a definite scope for residential green development in the upcoming future according to the Officials' viewpoint.
- The Government of Madhya Pradesh is on the verge of kick starting promotion of sustainable development and green building technology in order to generate awareness in the general public.

IV. Conclusion

Increasing development across all sectors of realty has resulted in a considerable hike in property rates in Bhopal. Prices in major developmental areas or prime locations have shot up significantly in wake of the growth of real estate in Bhopal. Residential sector has been witnessing developing of both luxury villas as well as low-cost or budget housing, diversifying the housing scenario. Bhopal property market scenario is getting hot like never before as even leading national builders are taking interest in developing property in the city. It is considered a 'virgin land' known for its 'nawabi' culture like Hyderabad and Lucknow and has been going through a dynamic phase of realty development.

In the present scenario, when the level of awareness in the general public is mediocre, a majority of the potential buyers willing to pay more for a green home, the developers ready to invest in green housing projects on the condition that they are provided authentic information on green building technology and full support from the Government and the Government itself engaged currently in developing a promotional strategy and a Clean Development Agency (CDM) in Bhopal, green building development is definitely the need of the hour.

If all the above parties involved in the process of residential green building development work in sync with each other, residential green buildings can be made feasible for a city like Bhopal. If the facts fetched by the analysis in this project report are taken into consideration, the dream of building green homes in a city like Bhopal can definitely be turned into reality.

V. Recommendations

Based on the Analysis and Interpretation, following is a set of recommendations in order to make residential green building development feasible in the Bhopal region:

- In order to generate awareness among the general public regarding green building development, an effective promotion strategy and campaign should be designed which targets the majority of potential buyers, i.e. people belonging to the middle class and upper middle class in the age group of 18-49 years of age
- The promotion strategy should cover all the aspects of green building construction and development so that the customers are fully aware and the developers cannot take illegal advantage of the customers.
- Print media accounts for majority of the source of awareness, followed closely by internet and social media. Keeping in mind the fact that a majority of the potential buyers belong to the age group of 18-49 years of

age, who are the major users of internet and social media as well, the promotional strategy should focus on using internet and social media as an effective tool for promotion of the green building concept.

- The Government of Madhya Pradesh should engage in organising training programs for developers and engineers in which they are trained on the technicalities associated with green building construction.
- The Government should also encourage partial funding of green building projects so that the developers can easily develop green residential projects and the potential buyers develop a sense of trust in the green home projects because of the Government intervention.
- The Green Building Principles (GBPs) and Rating Systems for Green should be revived and should be made favorable to the developers so that they can invest in green residential development projects.
- The various Government bodies like the Bhopal Municipal Corporation (BMC), Environmental Planning & Conservation Organisation (EPCO) and Bhopal Development Authority (BDA) along with the local developers and Non-Governmental Organisations (NGOs) should work in perfect harmony with each other in order to make residential green building development feasible and successful in the upcoming future.

Bibliography

- [1]. Anon, 2011, Real Estate, Indian Brand Equity Foundation, November, www.ibef.org, accessed on 24 November 2011
- [2]. Federspiel, C., Q. Zhang and E. Arens. (2002). Model-based benchmarking with applications to laboratory buildings, *Energy and Buildings*, Vol. 34(3), pp. 203–214.
- [3]. Hicks, T. and B Von Neida. (2005). US National Energy Performance Rating System and ENERGY STAR Building Certification Program.
- [4]. Kinney, S. and M.A. Piette. (2002). Development of a California commercial building benchmarking database, Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. LBNL Paper LBNL-50676.
- [5]. Matson, N., M.A. Piette. (2005). Review of California and national methods for energy-performance benchmarking for commercial buildings, California Energy Commission, Public Interest Energy Research Program, LBNL No. 57364.
- [6]. Olofsson, T., A. Meier and R. Lamberts. (2004). Rating the energy performance of buildings, Lawrence Berkeley National Laboratory: Lawrence Berkeley National Laboratory. LBNL Paper LBNL-58717.
- [7]. Sankhe, S. et al, 2010, India's urban awakening: building inclusive cities, sustaining economic growth, May, McKinsey Global Institute.
- [8]. Sartor, D., M.A. Piette, W. Tschudi, and S. Fok. (2000). Strategies for Energy Benchmarking in Cleanrooms and Laboratory-Type Facilities, Proceedings of the ACEEE 2000 Summer Study on Energy Efficiency in Buildings, Vol 10, pp. 191-203.