

# Proceedings of 6<sup>th</sup> GRIHA Regional Conference & Exhibition on Accelerating Sustainability in Built Environment The GRIHA Approach



ADaRSH - Association for Development and Research of Sustainable Habitats

The Energy and Resources Institute (TERI)

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सत्यमेव जयते

Ministry of New and Renewable Energy



Centre for Research on Sustainable Building Science

The Energy and Resources Institute - Southern Regional Centre

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## For more information

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## Acknowledgments

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The GRIHA Regional conference is organized every year with the aim of bringing together professionals from the allied fields to confer and share knowledge over the most relevant issues. This year's conference on 'Accelerating Sustainability in the Built Environment' brought together key stakeholders and deliberations to share solutions for accelerating and mainstreaming sustainability in the built environment.

The two day conference would not have been possible without the support of a lot of people and organizations. We would like to convey our deepest gratitude to the honourable speakers for their time and valuable contribution.

We would like to thank Dr. RK Pachauri, Director General, TERI for his Inaugural address and his support. We are grateful to Mr K Jairaj (IAS Retd.), Former Additional Chief Secretary, Government of Karnataka and Professor Krishna Rao Jaisim, JAISIM-FOUNTAINHEAD for delivering the special address.

We sincerely thank Mr Pranob Dasgupta, Distinguished Fellow and Director, TERI, Southern Regional Centre for his continuous support and encouragement in organising the event. We specially thank Ms Mili Majumdar, Senior Fellow & Director, Sustainable Habitat Division, for her constant guidance and for being a part of the conference.

We are extremely grateful to the Advisory Board members for the conference- Mr K Jairaj, Former Additional Chief Secretary, Government of Karnataka; Dr Ashwin Mahesh, CEO Mapunity; Prof. Krishna Rao Jaisim, JAISIM-FOUNTAINHEAD; Ms Vijaya R Vasu, Deputy General Manager (Projects), Housing and Urban Development Corporation Limited; Ms Maija Virta, Managing Director, Santrupty Engineers Private Limited; Mr Pranob Dasgupta, Distinguished Fellow and Director, TERI, Southern Regional Centre; Mr Krish Murali Eswar, Co-Founder of IdeinLab Architects, Arty Plantz Nature Revitalization, Marketing Hypnotism; Ms Mili Majumdar, Director & Senior Fellow, Sustainable Habitat Division, TERI; Ms Minni Sastry, Fellow & Area Convener, Sustainable Habitat Division, TERI for their valuable inputs and the constant guidance in shaping up the conference. The conference would not have been a success if not for their support.

The conference would not have been possible without the magnanimous support of our sponsors. We thank Asahi India Glass Limited, Ministry of New and Renewable Energy, Hindustan Petroleum Corporation Limited, Housing Development Finance Corporation Limited (HDFC Ltd.), Google, Housing and Urban Development Corporation Limited and Bangalore Electricity Supply Company Ltd., (BESCOM); not only for the financial support but also for their faith and belief.

We thank all the exhibitors for the conference - Asahi India Glass Ltd., HDFC Ltd., Somany Ceramics Ltd., Dessicant Rotors International, Klima Technologies, Building Protection Systems, IDDC Pvt. Ltd., Sobha Ltd., Derbigum Middle East & Asia and Farmland Rainwater Harvesting Systems; who displayed a variety of innovative technologies and products for green buildings and without whom the conference would have been incomplete. We would like to mention our media partners – Green Digest; L'Avenir Elevator Digest; Built Expressions; BuildoTech and Green + Construction Digest and thank them for covering the event.

We also thank all the delegates of the conference for their enthusiastic participation over the two days. Their passion and zeal gives us the impetus to organize a bigger and better conference every year.

Lastly, we would like to convey our gratitude to all the colleagues at TERI for their kind support and motivation.

## Executive Summary

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The 6<sup>th</sup> GRIHA Regional conference and exhibition themed 'Accelerating Sustainability in the Built Environment' was organized in association with ADaRSH (Association for Development and Research of Sustainable Habitats) and was held on the 3<sup>rd</sup> and 4<sup>th</sup> of February 2015 at the TERI Southern Regional Centre campus in Bangalore. It brought together scientist, research professionals, academicians, practitioners and other building industry stakeholders from across the country and abroad to present, debate, and discuss on how to accelerate sustainability in the built environment, with an objective of making 100% built environment in India, sustainable and efficient.

The conference covered a wide range of topics including discussions on Sustainability in liveable cities, Built environment in response to climate vulnerabilities, Efficiency of new & existing buildings, Air quality, Structural systems & construction technologies, the role of each sector in accelerating sustainability.

The conference also aimed at bringing together manufacturer's to show case their new and innovative products for Green Buildings. There were 12 exhibition stalls displaying a wide range of green technologies and products. The conference was attended by 150 professionals from India and abroad over the two days and provided the perfect platform to engage with key stakeholders and deliberations to share solutions for accelerating and mainstreaming sustainability in the built environment.

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## Conference in Detail

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### Background

The GRIHA Regional Conference is organized every year to create awareness and to increase the understanding about GRIHA as well as to facilitate development and mainstreaming of sustainable buildings. GRIHA (Green Rating for Integrated Habitat Assessment) was developed by TERI (The Energy and Resources Institute) and endorsed by the Ministry of New and Renewable Energy (MNRE). It was adopted as the National Rating System under the MNRE, Government of India, as of 1 Nov 2007. The current scope of criteria in the GRIHA rating system is the building and its immediate environment. It provides an evaluation method to design, build, operate and maintain a resource efficient built environment. The performance benchmarks in the rating system are developed for commercial, institutional and residential buildings. GRIHA is an indigenous building rating system particularly designed to address the climatic requirements in the country. The unique characteristic of the rating system is a single window process from design to rating because of its compliance with the relevant Indian Codes and standards for buildings.

The 6<sup>th</sup> GRIHA Regional Conference and Exhibition was organized by TERI in association with ADaRSH (Association for Development and Research of Sustainable Habitats). ADaRSH established in 2009 as an independent society, is the secretariat for GRIHA. It was founded by TERI with support from MNRE along with a handful of experts in the sustainability of built environment from across the country.

The 6<sup>th</sup> GRIHA Regional Conference and exhibition was organized with the objective of –

- Bringing together key stakeholders and deliberations to discuss on how to accelerate sustainability in the built environment, so as to make 100% built environment in India, sustainable and efficient
- Bringing together manufacturers to showcase the current most innovative technologies for green buildings.



**DAY 1: 3<sup>rd</sup> FEBRUARY 2015**

**6<sup>th</sup> GRIHA REGIONAL**

**CONFERENCE AND**

**EXHIBITION**

## Inaugural Session

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### Welcome Address



Ms. Mili Majumdar  
Director & Senior Fellow, Sustainable Habitat Division, TERI

Ms Mili Majumdar delightfully welcomed all the Dignitaries, Speakers and Guests on behalf of TERI and ADaRSH. In her address she highlighted the challenge faced today that is that sustainability is not yet mainstreamed. Indian cities she said are facing issues related to urbanization and the associated resource crunch. Most of the initiations in sustainability are in niche domain and are yet to be up scaled, she informed.

She pointed the pro-activeness of the new government to deal with urban issues and challenges – The 100 Smart Cities Programme, the Make in India Programme and the Swachh Bharat Abhiyan. She also expressed the purpose of organizing this conference as a platform for sharing of best practices through local as well as global expertise. She called upon for collective contribution to sustainability. Taking the participants through the agenda, she informed delegates of TERI's partnership with USGBC where in TERI would be customizing LEED for existing buildings in India and will be launched in The GRIHA Summit, Delhi in March. Hoping for an interactive and engaging two days, she once again welcomed the delegates, speakers and exhibitors.

## Inaugural Address



Dr. RK Pachauri  
Director-General, TERI

In his inaugural address through video conference, Dr R K Pachauri, called for radical transformation in design of buildings and building activities in order to reduce the greenhouse gas emissions. Buildings, he said have been identified as a major source of emissions by the 5<sup>th</sup> Assessment Report of the IPCC, which he chaired. He spoke about making buildings more resilient to climate change. To point out the seriousness of the issue in hand, he informed about the increase in frequency of heat waves from once in 20 years to occurring once in every 2 years by the end of the century, if greenhouse gas emissions are not reduced. Thus, he advocated for making buildings more energy efficient in order to ensure sustainability for this generation and the generations more to come.

Dr. Pachauri defined 'smart' as a comprehensive term covering not only the application of information technology in buildings but also the entire supply chain of materials that are used during building construction. He spoke about TERI's energy efficient buildings – TERI RETREAT building in Gurgaon which uses no power from the grid and TERI office building in Bangalore which is highly energy efficient and has built in features that are sensitive to the environment around. Dr Pachauri said, "We today are on the cusp of a major change to knowledge and its application when it comes to design and construction of buildings and therefore Bangalore being a city growing rapidly and with a stock of buildings that can be retrofitted presents a huge challenge". Calling the Prime Minister's 100 Smart City Programme has a very timely initiative; he hoped it would take off soon. He believes he said that there is a need to expand horizons, use the technology and the wealth of software available today to build and then to evaluate our buildings for finding solutions to make them more and more energy efficient. Ending the Inaugural address, he hoped that the delegates of the conference would effectively use the current platform of structuring a new era in building design and construction which would benefit generations to come.

## Special Address



Professor Krishna Rao Jaisim  
JAISIM-FOUNTAINHEAD

Professor Krishna Rao Jaisim, through his special address shared his view on the influence of key players in the built environment which were ironically not the architects but the builders and politicians. He pointed that India is a country growing rapidly but in an undefined direction. He also spoke about transforming cities into livable cities instead of smart cities. He denounced the practice of aping the western in this domain. He encouraged more of public transport and cycles. Stressing on the need to identify the direction of growth for the country he said that the conference could help identify solutions, objectives and goals for a sustainable growth.

## Setting the Theme



Mr K Jairaj  
Former Additional Chief Secretary, Government of Karnataka

Mr. K Jairaj's address most aptly set the theme of the conference. He expressed his delight in seeing that the conference has taken sustainability beyond the niche area focusing only on architects to a wider appeal. Singapore he said is a successful example of accelerating sustainability, which they achieved through strict enforcement of standards and law. "Conferences like these are an attempt to get people together so that they can deliberate on these subjects and in turn play the role of thought leaders so that in their environment they can try to bring about a difference", he said. He stressed on Emphasis on conservation, Lack of coherent state policy in built environment, Need for State enforcement at levels acceptable to the public and Lack of public awareness as points to set the floor for constructive discussions.

He pointed out government's inability to dismiss the wrong notion of sustainability as being a trend amongst people when it is something that governs the future of mankind. He illustrated through the case of large adoption of solar water heaters in Bangalore, the key factors that govern the adoption of sustainable measures and technologies. He conveyed the idea of the conference as one to bring a consensus among stakeholders to bring about acceptance and to promote sustainability as a day to day ethic among the people.

Ending his speech, Mr Jairaj said. "I am very happy that under the leadership of TERI such a conference has been thought out and I really hope and anticipate that with your support the conference will evolve a plan of action in order to build a stakeholder acceptance, to promote good public education and acceptance among the public on the need to adopt sustainability as a part of their daily lives."

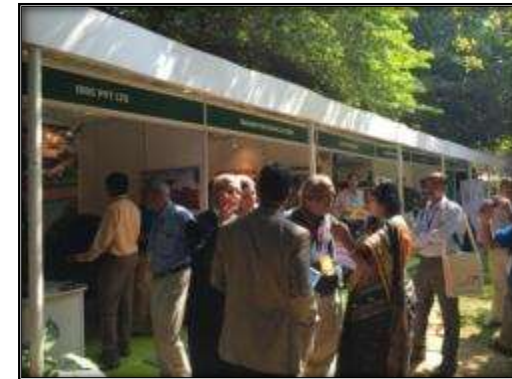
The inaugural session was concluded by presenting TERI mementos to all the dignitaries post which Ms. Minni Sastry, Fellow & Area Convener, Sustainable Habitat Division, TERI proposed the vote of thanks.

## Exhibition

### Green Building Materials and Technologies



The conference had a parallel exhibition on green materials and technologies which was inaugurated by the dignitaries after the inaugural session. The exhibitions aimed at bringing together manufacturers to show case their current most innovative technologies for green buildings. Asahi India Glass Ltd., Somany Ceramics Ltd., Dessicant Rotors International, Klima Technologies, Building Protection Systems, IDCC Pvt. Ltd., Sobha Ltd., Derbigum Middle East & Asia, HDFC Ltd., and Farmland Rainwater Harvesting Systems were present. AIS was present with their range of glass products to increase energy efficiency; BESCOM promoted Solar Rooftop PV System through subsidy schemes; Somany Ceramics displayed their range of tiles; Dessicant Rotors International exhibited direct & indirect evaporative coolers, air solutions and dehumidification systems; Klima technologies had on display heat pumps based water heaters; Building Protection Systems exhibited various fire detection and security products for buildings; IDCC Pvt Ltd displayed Indoor Vacuum toilet designs and Vacuum Sewer Network; Sobha Ltd. was present with their door and window assembly systems; Derbigum Middle East & Asia presented roofing solutions, light pipes and reflective coatings to enhance solar PV performance; HDFC Ltd. presented home loan packages; and Farmland Rainwater Harvesting Systems showcased rain water filters and demonstrated water harvesting for buildings.



## Panel Session: Accelerating Sustainability in Built Environment

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Chairperson & Speaker: **Dr Ashwin Mahesh**, Founder & CEO Mapunity; Editor - India Together

Speakers:

**Mr Anjum Parwez**, Chairman, Bangalore Water Supply and Sewerage Board

**Dr Chandrashekar Hariharan**, CEO, Biodiversity Conservation India (Pvt) Ltd.

The panel session focused on issues related to accelerating sustainability in built environment and sought to throw more light on the current scenario and barriers in the sector and also to present successful mechanisms. The chair and speakers were invited to the dais to present their ideas followed by a panel discussion.

Dr. Ashwin Mahesh opined that the problems and solutions in this domain are very well known to the public in general and so through his presentation he highlighted how sustainability could be accelerated. According to him in order to push the accelerator button, an entirely separate and independent approach was required. He said “if everyone does little, we will achieve only a little”. With this he shared his thoughts on up scaling the

efforts towards sustainability at an individual’s level. He cited few examples from his experience to support his views. He then talked about focusing on accelerating the adoption of sustainability in most relevant industries and in most impactful choices. At the end of his presentation he left his audience to ponder over a few questions which would have a long term impact on sustainability. The questions were mainly addressed to the state bodies and builders who wielded the power to bring about radical sustainable changes. For instance he asked BESCOM if the next 10 years of growth could be fuelled in the city without using additional resources; he questioned BWSSB (Bangalore Water Supply and Sewerage Board) if it was possible to drink the same drop of water twice;



he asked if it was possible to have the same number of cars on road for next 10 years as we do today.

Next, Mr Anjum Parwez talked about sustainability in water supply & demand in Bangalore. He quoted a few statistics on the population growth in the city and the consequent increasing demand for water. He said that in order to accommodate the 4.5% population growth per year, the planners of the civic body would have to expand the city area from 250 sq. km to 800 sq. km. He talked about the cost of producing and supplying water to the public and compared it with the price currently being paid by the public. He shared his plans to ensure sustainability of water management practices. He shared the list of issues that BWSSB plans to work on next, on a priority basis. The top most priority, he informed, was the arrangement of an additional supply of 500 million litres to the city. Next would be reduction in wastage of water, a wider outreach especially to the rural villages and a plan for reuse of sewage treated water would follow. He also mentioned about the launch of BWSSB's mascot called Panchayati Puttapa. Mr Parwez ended his talk by mentioning the scepticism of the general public and the need for a change of mind sets.

Dr. Chandrashekhar Hariharan, in his discussion emphasized on three key points – Purnaswaraj from the government, energy efficiency and private economy. He supported his discussions and views with examples from his past experiences. He spoke about the need for the public to move away from dependency on the main grid for both energy and water. He encouraged public investments in individual households for rain water harvesting and solar rooftop harvesting. This would help not only in ensuring long term sustainability but also would generate income for the household, he pointed. He mentioned the sharp focus that the Government and both, the utilities and the ULBs (Urban Local Bodies) need to bring on hard demand-side management and governance of it.

After the presentation from all the three speakers, the dais was opened for question and answer round. This round witnessed some excellent exchange of views between the audience and the speakers. Some of the discussion points raised from the audiences were on the role of industries and the demand for green products from customers and the quality control of building materials.

# HIGHLIGHTS OF PANEL SESSION



## Technical Session 1: GRIHA and its Role in Accelerating Sustainability in Built Environment in India; Green Initiatives in Affordable Housing – HUDCO Perspective



### Speakers :

**Ms Mili Majumdar**, Director & Senior Fellow, Sustainable Habitat Division, TERI

**Ms Minni Sastry**, Fellow & Area Convener, Sustainable Habitat Division, TERI

**Ms Vijaya R Vasu**, Deputy General Manager (Projects), Housing and Urban Development Corporation Limited (HUDCO)

The first session was on GRIHA and its role in Accelerating Sustainability in Built Environment in India. Ms Milli Majumdar introducing GRIHA spoke about its genesis and components. She pointed at the change brought about in construction style and the health and safety of the workers on site. GRIHA is specific to India and is in compliance with the NBC, ECBC and IS Codes, she informed. She told participants that the GRIHA rating is allotted only after the building starts performing. It is a versatile rating system customised to 5 climatic zones of India. She next briefed on the GRIHA Rating variants viz. SVAGRIHA (small Versatile Affordable GRIHA; 100-2499sqm area), GRIHA (area > 2500 sq. m.) and the GRIHA LD (Large Development; area >50 hectares). She also presented 'Indira Paryavaran Bhawan', Delhi which is the first

net zero government building at that scale. She called for a collective effort towards sustainability. Ms Minni Sastry, the second speaker highlighted on GRIHA rating and consultancy done for some of their projects. She presented some projects, the technical challenges faced and the innovative solutions and technologies adopted to meet the norms.

Next, Ms Vijaya R Vasu, Deputy General Manager (Projects), Housing and Urban Development Corporation Ltd, Bangalore Regional Office, presented HUDCO's contribution on Green Initiatives in the Affordable Housing Sector. Ms Vijaya introduced HUDCO as a premier techno financing institution under the Government of India which primarily does project & programme



funding complimented with planning and designing consultancy as well as policy & program support along with technical training and creating awareness & propagation of various programmes.

Presenting statistics on the projects funded by HUDCO, she showed that on a cumulative level, HUDCO has done about 16 million housing units over the last 45 years. This year she said, HUDCO focused only on affordable housing sector, sanctioning loans worth INR 4558 crores. She informed the participants about a discontinued initiative called the 'Building Centres' of the Government of India, which promoted cost effective technologies and materials and construction techniques, dealing directly with passive architecture to build houses for the Economically Weaker Sections across the country.

She then presented works of their earlier clients to show HUDCOs intervention into the space of green along with affordability. HUDCO to achieve this in the projects funded, suggested good consultants and contractors, adopted strict monitoring of projects, started advising during site visits and initiated training and capacity building during the course of project implementation.

She also mentioned about HUDCO's intervention through project design consultancy in Tier 2 and Tier 3 towns that help promote group cluster housing as a concept, which in builds the features

of social & community coherence, promotes efficiency in planning and designing & adoption of construction technologies, induces a sense of involvement by the beneficiaries in cost sharing for the operation & maintenance of the assets, thereby leading to sustainability in housing Neighbourhoods that are created.

Ms Vijaya then informed about the need for good public private partnerships to further upscale green affordable projects. HUDCO she said seeks support and partnership from parallel institutions to accelerate this process. She also presented some of HUDCO's projects on policy and programme support done with TERI and BDA.

Talking about sustainable affordable housing programmes, she stressed on the need to quickly relook into the Development Control rules and the Local planning norms with respect to provision of minimum car parking space which has a direct impact on accelerating creation of affordable / sustainable housing habitats. Thus, urging stakeholders to collectively work for a common goal of helping accelerating the Green Affordable Housing initiatives, she concluded her presentation.



## Technical Session 2: Sustainability in Liveable Cities

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Chairperson & Speaker:

**Prof Ashok B Lall,**

Principal Architect, Ashok B  
Lall Associates, New Delhi

Speakers:

**Ar. Natasha Iype**

Director, Good Earth;

**Mr Angshik Chaudhuri**

Executive Director

(Operations), Cisco

Development India Pvt Ltd.

Liveable Cities is the need today. How to make cities liveable? What are the best practices? What changes do we need? This session answered such questions and the speakers discussed replicable and scalable design models.

Prof Ashok B Lall presented various aspects of sustainable urban development in the present context, focussing on urban heat island and increase in urban sprawl. He opined that there could be various principles for development depending on the economic context; the wealthy could be focused on reducing carbon foot print, the middle income could focus on developing sustainable life style and the low income on improving their living standards. While highlighting the reasons for urban heat island he mentioned that urban high rise constructions along with the vehicular emissions and anthropogenic heat generated from air conditioning are the three major factors contributing to the increase in ambient temperature and building energy demand in urban areas. He stressed on life style and urban structure as the two important controllable factors that need to be focussed on for sustainable urban development. Discussing the

urban planning principle he emphasized on the “low rise and high density” in contrast to existing scenario of metropolitan cities having high rise and low density. Further he added that the solar exposure at the master plan level and multiple energy impacts by building materials (embodied energy and operational energy) need to be addressed by the urban designers and architects keeping in mind the reduction of urban heat island. At the end he presented a case study of the multi residential project his firm is doing with solutions they have suggested for various issues highlighted through his presentation.

Ar. Natasha showed various architectural works her organisation “Good Earth” has been doing for developing a sustainable habitat in the context of increasing urbanisation. The projects of Good Earth are inspired by the works of Laurie baker and the alternative technologies developed by the architects of Auroville, she informed. She mentioned the need of developing buildings in response to the local context, irrespective of the project type (institutional or a community level project). She reiterated the urban design principle for making the development

# HIGHLIGHTS OF TECHNICAL SESSION 2



## Technical Session 3: Built Environment in Response to Climate Vulnerabilities

Chairperson:

**Prof Krishna Rao Jaisim**  
JAISIM-FOUNTAINHEAD

Speakers:

**Ms Minni Sastry**  
Fellow & Area Convener,  
Sustainable Habitat Division,  
TERI;

**Ms Ulka Kelkar,**  
Fellow, Earth Science and  
Climate Change, TERI;  
**Mr Friedemann Roy**  
Global Product Lead Housing  
Finance Access to Finance  
Advisory at IFC – International  
Finance Corporation,  
Washington D.C.

With the climate changing world-wide, mitigation methods need to be adopted. A coherent response needs to be developed and followed. Most importantly, the built environment needs to respond to these climate vulnerabilities. Speakers in this session addressed this change and discussed various measures and tools for the future developments.

Ms Ulka Kelkar set the context for the session on “Built environment in response to climate vulnerabilities”. She started with a few examples on the past incidents for loss of habitat due to climate change. Her presentation was focussed on the impact of climate change and its relevance to building structures. She presented global and national level data on different weather parameters changing over the years. She also talked about the need of climate adaptation in the context of rapid urbanisation. She concluded with a few suggestions for decision makers to make climate resilient houses and neighbourhoods.

Dr Friedemann Roy presented case studies from across the globe. He gave a brief background on the current and future scenario of the green building market. His talk focussed on the green

incentives for the housing programs. He explained various tangible benefits and barriers involved with different stakeholders in the process of making green homes. He notified the delegates of IFC’s Edge Certification System for green homes which synchronises financial support, government regulations and the green rating. The rating system, he informed also suggests technical solutions for going green and reduces the capital as well as operational costs. Further he presented cases from Mexico and Albania on financing mechanisms and green mortgages. He pointed that Mexico presents the green building market with 6,00,000 homes per year which was made possible using the right financial incentives. He mentioned IFC’s interest in offering to promote green housing in India. He then concluded his presentation with a mention of IFC’s green home financing tool kit and several awards that IFC gives on transformational businesses.

Dr Divya Sharma began by discussing the issues of urbanisation and their impact on the urban infrastructure. She highlighted the impacts of climate change on Indian cities and suggested a few potential measures. She presented various activities that TERI has been doing with the local



governments to improve the city level infrastructure in the context of climate change. She presented two approaches in the implementation of climate resilience projects, viz., reactive approach during the aftermath of the climate change event and proactive approach to get prepared for the future events. She highlighted various initiatives taken by global level NGOs like C40, ICLEI on urban climate resilience. She talked about key steps on planning climate resilient cities in response to the local context. She mentioned the issues with governance and proposed a three tier approach to implementing suitable actions for climate change. She also presented the work done in cities of Gorakhpur and Panaji for making them climate proof in which TERI's work was majorly on mapping the vulnerability, assessing the impact on urban infrastructure, managing a database for interventions and brainstorming the concerned city development authorities in the respective areas. She projected an online database tool for selecting the right infrastructure solutions for the affected cities. She finally presented various policy briefs and working papers that TERI has published in the area of climate resilient cities.

Next, Ms Minni Sastry highlighted various green building features and their cost benefit analyses for promoting adoption and replication in affordable housing projects in India. She showcased the features of Climate Resilient Low Cost Homes and possible financial models for their implementation. With a brief background on the IPCC's Synthesis report, she continued the presentation by mentioning climate hazards like GLOFS in hilly areas, floods, cyclones in coastal areas, heat stress in urban areas and their impacts on the built environment. She presented a detailed list of interventions for each hazard at the settlement level as well as at the building level. She also gave a few examples of proposed climate resilient houses in hilly areas for different household economic groups. The later part of her presentation focused on how various green and climate resilient features could be made affordable with detailed examples from cases across the country in different climatic zones. At the end she spoke about the pilot program for climate resilience under which a barrier analysis was carried out for implementing climate resilient housing projects. Her presentation was concluded with policy recommendations for the proposed climate resilient housing models.

# HIGHLIGHTS OF TECHNICAL SESSION 3



**DAY 2: 4<sup>th</sup> FEBRUARY 2015**

**6<sup>th</sup> GRIHA REGIONAL**

**CONFERENCE AND**

**EXHIBITION**

## Technical Session 4: Efficiency of New and Existing Buildings



Chairperson & Speaker: **Prof Dr Uta Pottgiesser**, Dekanin – Dean, Detmold School of Architecture and Interior Design, Germany

Speakers :

**Mr Guruprakash Sastry**, Regional Manager , Infrastructure/Green Initiatives, Infosys

**Mr Debashish Chakraborty**, General Manager , Energy Efficiency & Strategic Alliances, Schneider Electric

**Mr B R Nagaraj**, Head – Real Estate & Workplace Services, Google India Pvt. Ltd.

**Mr Anand Sachithanatham**, Technical Manager , CPT South Zone, Asahi India Glass Ltd.

Buildings as we know today offer the maximum scope for energy savings. Speakers in this session threw light on some interesting facts sharing valuable techniques and best practices for attaining efficiency.

Prof Dr Uta Pottgiesser talked about Adaptive Building Design. She spoke about cities moving towards the concept of Ecopolis, where energy generation is not dependent upon grid power supply, but on renewable sources of energy and where community supported farming, sustainable transport, and water security are integrated and implemented.



Dr Uta shared the Energy Performance of Building Directive as per the European Union, which targets that by 2020 all new buildings be nearly zero-energy buildings. According to Dr. Uta, Rating systems are mechanisms which enable sustainable buildings. She said that online and mobile applications on energy consumption could help to raise user's awareness. She said, "Like health conscious people count calories when they are eating, rating system tools help account energy used by the building". Some of the implementation processes that Dr Uta stressed on were Regulations, Financial Drivers, and Information & Awareness. Dr Uta showcased many examples of energy efficient buildings and





presented challenges vs. solutions for each case study adopted. These included for example, Plus Energy Building of Federal Environmental Agency (UBA) in Dessau, Germany. She discussed how in different buildings through envelope design optimization, visual and thermal comfort is achievable. Dr Uta concluded by presenting some of the Research works being carried out by students in Detmold School of Architecture & Interior Design, Germany.

Next Mr B.R Nagaraj talked about Achieving Sustainability in Office Spaces- A Case Study from Google. At Google, he shared, emphasis is given on health and well-being of employees as part of their sustainability approach and hence their focus lays on healthy materials and spaces. They monitor their water, energy, waste and air quality, he informed. He then told the participants about Google's work with USGBC on research and deliverable of healthy materials, wherein they have also created a Library of Healthy and not-so-healthy materials. He informed that Acoustics, Thermal comfort, Electric Lighting, Daylighting, Biophilia and Indoor Air Quality are considered by designers at Google. Mr Nagaraj emphasised that at Google higher weightage is given to IEQ (Indoor Environment



Quality) than IAQ (Indoor Air Quality). They also integrate the concept of Biophilia, in the indoor spaces, for which the dictionary meaning is Strong attachment/attraction with the outside world, he continued. To give an example he showed one of their office spaces – a room which has sounds of birds chirping and that of air and light creating a soothing and positive impact on the occupants of the space boosting their performance.

Mr Nagaraj shared statistics stating that In the Asia Pacific Region Google has 14 LEED certified buildings and that In India, 10% of their energy demand is met by Solar Energy. Use of LED based lamps and lighting controls has reduced energy demand for lighting in Google offices by 50%. Other sustainability initiatives by Google include: use of cleaning products with least toxic alternatives, upgrading to waterless urinals, monthly monitoring indoor air quality and many more.

Next, Mr Guruprakash Sastry spoke on “Data driven approach to high performance buildings”. He began by presenting interesting statistics of how in spite of doubling of employees and space over the last 6 years, the absolute increase in energy has only been 13%. He showed that In 2007-08, the Per

capita electricity consumption was 297 Monthly Average kWh/employee, which reduced to 167 Monthly Average kWh/employee by the year 2013-14. He revealed the team's goal of reducing the Per Capita Electricity Consumption by 50% from 2008 levels by 2018, and informed that they are well on track. Mr Sastry presented the difference in approach of a Standard Design to an Efficient Design, where much lower benchmarks are set for building energy consumption design, lighting design, air conditioning design and building electrical design. He also confirmed that by adopting energy efficient design approach the initial cost of projects can be lowered as opposed to the myth that the initial costs are higher. He shared that due to overall reduction in sizing and number of equipment required, as a result of adoption of energy efficiency, Infosys has quantified reduction in initial cost by adopting efficient design. The Green Initiatives Team at Infosys follows a goal oriented design process, wherein for design of new buildings, consultants have to prove that their design meets the client goals, he shared. For example, The Architect and the HVAC team together have to work together to meet the Max. Envelope Heat Gain goal of 0.75W/ft<sup>2</sup>.

Mr Sastry showcased through his presentation, the difference in design approach of buildings in the past and the current approach at Infosys. He presented the energy efficiency features that Infosys has adopted in their recent buildings which include: Shape, orientation, shading, light shelves, selection of appropriate glass, cool roofs, efficient lighting system along with controls, efficient HVAC systems, radiant cooling, chillers with magnetic bearings, efficient data centres with PUE (Power Usage Effectiveness) of 1.13 and many more.

Besides, new buildings, Retrofit activities at Infosys to convert existing building stock into energy efficient buildings, include retrofit of Chiller plants, UPS systems and continuous monitoring. Monitoring and performance data is being used in Infosys to optimize future building designs.

Mr Debashish Chakraborty next started his presentation by quoting one of the Professors in Rice University, according to whom Energy will be on top list of Humanity's Top 10 problems for next 50 years. He also quoted that due to high rate of urbanization, energy demand by 2050 will be doubled. Mr Chakraborty, shared analysis results of energy savings data collected from 200 buildings,



from the database of Bureau of Energy Efficiency (BEE). He presented energy saving potential in an office building in terms of INR/employee/month after undertaking energy conservation measures, for hospitals in terms of INR/Bed/day, for hotels in terms of INR/room /month. Mr Chakraborty suggested that to achieve energy efficiency, organizations needed to adopt the Framework for enterprising energy management. This he classified into three maturity models. First one being Basic, Second Intermediate and Third as Advanced. For Basic level organizations, energy management is on site-by-site basis, for Intermediate level, it is centralized and for Advanced level, energy management is at their core, with a dedicated team for sustainable development and with strategic focus, he shared. He suggested one of the first steps for organizations desiring to integrate energy management was to adopt ISO 50001. He also made a point saying that “Energy use is invisible, however, it is important to make it Visible, meaningful and Actionable.”



Mr Chakraborty, explained that Enterprise Energy Management means setting energy efficiency targets, optimizing energy use at all levels through energy data collection, as well as data driven

decision making. He informed that the World has moved fast towards Building Energy Management System- which means methods to monitor, measure and control energy use. In this field cloud based software's are more prominent than site based software's, he stated.

Mr Chakraborty presented data for comparing the performance of two different retail outlets and two different offices. He told that the data for energy use can be helpful in making an already efficiently designed building more efficient. Measuring and monitoring of energy use reveal further scope for saving, which in case of office buildings was identified by additional electricity consumption in non-occupied hours. Mr Chakraborty concluded the presentation by saying that Energy Management is a journey, and the starting point could be by making employees aware of energy consumption levels. He was happy to announce that Schneider Electric had recently also won the Parivarthan Award.

Mr Anand Sachithanatham started his presentation by highlighting the importance of using the right technology in the right place. He said that selecting the right material is the most



important factor when considering energy efficiency. With this he discussed the various facades that have come up over the years and briefed the participants on the various factors that are important when selecting a glass type. He then presented some case studies with interesting statistics showing the effect of different AIS glass products on energy savings, cost and payback period.

Next, Mr Anand showcased some new and innovative techniques that AIS has in market. He informed the participants about 'Attoch', a new product and a means of façade retrofitting for better energy performance. Expanding on the product he told that Attoch is mechanically fitted on the existing glass (takes 30-60 minutes) with the low-e coating on the inside (to avoid corrosion through atmospheric exposure). The product he highlighted results in a 5 -6 °C temperature reduction. He also introduced 'Smart Glazing' for internal usage, which has glass types and devices that go transparent or opaque by the action of ion/particle re-orientation on passing an electric current through them.

Mr Anand also apprised the participants of their on-going research on building integrated photo-voltaic solar panels that follow the sun at the same time shading the inside of the building to reduce air conditioning. In the end, he mentioned innovative glass products for green buildings like the light shelves, and glass as structural material.

## Technical Session 5: Air Quality in Healthy Built Environment



Chairperson & Speaker: Ms Maija Virta, Managing Director, Santrupty Engineers Pvt. Ltd.

Speakers:

Mr Mohan Rao, INDE Integrated Design

Mr Shankar Rajasekaran, Director – Engineering, IMPEC FILTERS Pvt Ltd.



With the increasing industrialization, population growth and the pollution rates, air quality is only getting deteriorated. The speakers in this session talked about issues relating to Indoor and Outdoor air quality and presented some eye-opening facts urging the people to deal with it quickly and efficiently.

Ms Maija, in her presentation stressed on the fact that air quality issue in India and the rest of the Asia needs more attention as it a major health hazard. Defining air quality as the management of carbon monoxide in the building and the technology used to pull in fresh air into the building, she told that ventilation rate is the key solution to improving indoor air quality. She commented that outdoor air can merely now be called fresh air as the air today is very dense with particulate matter. She then threw light on the



ultra-fine (UF) particles (diameter < 2.5µm) in air and their sources of generation. UF particles she pointed out are very dangerous to the human health and when inhaled diffuse into the human blood stream staying captive there forever. Indian traditional methods of cooking, fanning, waste disposal she informed are a major source of UF particle generation in India and need to be foregone to improve the Air Quality in the country.

Ms Maija then presented some alarming statistics (by WHO: ambient air pollution in cities database 2014) of ultra-fine particulate matter in the air for US and India. The figure (153µg/m<sup>3</sup>) for Delhi (most polluted city in India) was 10-15 times higher than the limit set by WHO (World Health Organization). Talking about the ill-effects of these UF particles she presented the official statement of WHO which stated that UF particles are



carcinogenic to humans. She next informed that every third child in Delhi shows symptoms of Asthma and that the amount of pollutants that every new born in Delhi inhales in a day is equivalent to the harm done on smoking 20 cigarettes a day. Her facts pointed at the urgency and seriousness that is needed to deal with this issue.

Concluding her presentation, Ms Maija stressed on the need to adopt a holistic approach to deal with all the aspects of air pollution. She listed some important steps to deal with the problem in hand – user surveys, setting targets, planning and then implementing, validating the work of contractor, regular and systematic measuring of the IAQ and frequent system maintenance.



Next, Mr Mohan Rao spoke about landscape issues that are of relevance to the microclimate, the aspects which are not immediately measurable but are a part of the non-built environment. He spoke about the various factors and techniques that greatly affect the microclimate of a region. He talked about the role of vegetation in controlling the microclimate and the air quality. He stressed on the importance of studying tree behaviour carefully

before choosing it for a project. He also shared with the delegates the role of transitional spaces in reducing thermal shock.

Mr Mohan then shared a principal that he and his team try to follow, 'Designing with nature'. He said, "It is better than first creating piping systems and then trying to see how to make them efficient". He also talked about roofscape and the substantial difference it could create in the thermal load of a building. He enlisted different combinations and ways in which roofs could be designed with these. The most effective he pointed out was the combination of solar panels with vegetation planted under them. Since, solar panels in India need to be washed, the same water could be used to water the plants underneath these panels. According to a study that he had done with IIT Bombay, this technique increases the efficiency and life of the panels by over 30%, he presented. Thus, he encouraged integration of these landscape expressions, as he calls it, to roof and façade of the buildings. Coming lastly to the finances behind this integration, he informed the participants that planting such extensive vegetation (fully grown trees) on the roof and the site, increases the cost by only 3% on the raw structure and the maintenance

cost works out to be INR 1 per square foot. With this remark he ended his presentation and Mr Shankar Rajasekaran was invited for his talk.



Mr Rajasekaran in his presentation titled ‘Air filtration – an ideal solution to healthy indoor air’ talked about the health & well-being of inhabitants. He presented statistics of concentration of particles in an indoor environment, a study that he had done in his own office. He then presented calculations which showed that a human ingests 2.5 lakh particles of size 3 microns and above every hour.

He spoke about indoor air being more polluted than the outdoor air in developed countries due to bio aerosols (living dust), particulate matter and gases, unlike the situation in Indian cities, where it is the opposite. He discussed the concept of droplet nuclei, nosocomial infections/hospital acquired infections and presented statistics from a study by the PGIMER, Chandigarh, showing that Nosocomial infection rate in India is over 25%. Addressing the severity of the harm poor air quality can cause to human health, he presented facts and news reports showing the high mortality that these fungal infections cause globally and which match the mortality rates due to AIDS,



Cancer, malaria and tuberculosis. He also discussed about the compromised cognitive skills and logical reasoning due to long term exposure to poor indoor quality. Thus, he reinstated that indoor air quality control through filters and humidity control is very vital for a healthy environment.

He then discussed some tools available for removing contaminants. He listed dilution with clean air, particulate filtration and gas phase filtration as the most efficient tools and expanded on them. He brought ASHRAE table 52.2 and European Nations Standard EN779 to the attention of the audience and urged everyone to be aware of them. He then presented on cleaning and reusing filters and mentioned some basic but important points that one must know about filter cleaning and reusability. He also brought to the attention of participants the fact that the cleanable and reusable filters are more sustainable and hence should be encouraged. Mr.Rajasekaran hence discussed some effective cleaning techniques and presented stats for Outdoor Air Quality for some cities in India which were very high from the limit set by WHO. Thus, he gave some solutions to improve air quality and some smart solutions for a consistent good air

quality. He ended by quoting WHO, “Good IAQ is a person’s right”.

Post the presentations, the speakers opened the floor to questions and discussions on Ionization, Ozonization and UV Sterilization were carried out. Standards for distribution of fresh air at AHU (Air handling Unit) level and issues related to fresh air reaching high density areas were also expanded upon.

As an end note for the session, the chair, Ms. Maija said that we have the right technology in hand to deal with the growing issue of air quality; the public however needs to be aware of the gravity of the problem and the solutions for them to be able adopt them. She insisted people think of solutions at individual levels and posed a question to the audience- “Do you first want to create a problem and then look for a solution or do you want to curb the problem in the first place, so that there is no crisis at all?”

## Keynote Address

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### Mr S Vishwanath, Rain Water Club

Mr Vishwanath started his talk with the idea of moving away from individual projects to projects that are community based. He discussed 'Permaculture' which is creating sustainable habitats by following nature patterns and also highlighted its' principles. He then presented some models and routes that involve community engagement and urged the participants to learn about them.

Mr Vishwanath then spoke about water, pointing out that we are a ground water civilization. Denouncing the practice of digging bore wells, he stressed on the need to move back to the culture of open wells. He discussed the much sustainable practices of the past and said, "When we discourse on the future, the past should ever be present". He told the delegates that today technology has overpowered the resource availability and what we need to realize is that the greatest stakeholders of water are the citizens and not the utility. Active involvement of these stakeholders is needed to

come up with the most efficient practices. He then presented four examples showcasing some best practices to attain self-sufficiency and sustainable solutions.

The first project was the 'Rainbow Drive' which is a 37acres project with 360 plots on Sarjapur Road. With only ground water as a source, the community created their water supply through proper demand management. They banned private bore-wells and dug 120 open wells with 3 families sharing one. A strict tariff system has been put in place to prevent over-extraction of water making the community self-sufficient

He, next presented Classic Orchards located on Bannerghatta Road in Bangalore in which an open well has been revived by digging 120 truckloads of silt and through efficient management of demand & supply. This well can suffice the community for a period of 8 months proving to be a classic example of achieving sustainability utilizing the locally



available resource, he said. Next, he shared with the participants the case of Belgaum city which has a population of 5 lakh people. On finding that the area had enough ground water to support them, the community identified wells, cleaned them up with people sponsoring filters and chlorinators and by linking the wells, a supply network was created. This brought down the water cost as well as the carbon emissions creating a successful link between economy and ecology, he said. Thus, this way the community members in Belgaum city started protecting and reviving all the sources affecting ground water resulting in clean rivers, treated waste water etc.

Next, Mr Vishwanath talked about Jakur Lake that flows through the North of Bangalore. He projected images showing rivers full of foam due to discharge of sewage water into it. He highlighted how this water was affecting the health and crop production of the farmers staying in those regions. He then showed how a solution was developed through a constructed wetland and a waste water treatment plant. The scheme involves, the treated water flowing into the constructed wetland from where the water goes to the river. This way he pointed out, local simple solutions can be created using nature itself as treatment for creating an ecological balance.



## Technical Session 6: Structural Systems and Construction Technologies for Green Buildings

Chairperson & Speaker:

**Mr. S C Mehrotra**

CEO, Mehro Consultants;  
President, Indian Association of  
Structural Engineers.

Speakers:

**Mr M G Gowdaiah**

Engineer Officer, Bangalore  
Development

**Mr Gautam Eunny**

Sr. VP & Head – Construction  
Development Lab, Lafarge  
Aggregates & Concrete India  
Pvt. Ltd.

**Mr D E V S Kiran Kumar**

Associate Fellow, Sustainable  
Habitat Division, TERI

The chair for the session, Mr SC Mehrotra before starting his talk expressed his delight at seeing a session on Structural Systems and Construction technologies as a part of the conference discussions. He said that sustainable design and construction is as important an aspect as sustainable architecture when the greenness of a building is considered. He stressed on the importance of creating an environment for innovative solutions to deal with the challenge of sustainable development. He mentioned that earthquake design is critical for structures which must perform during earthquake and should be sustainable too. He then discussed some key technologies for sustainable & green earthquake design in detail, equipping the audience with some important information and facts.

He concluded by saying, “While maintaining structural safety, it is also essential to incorporate structural design and construction aspects in the design of green building, as a very large per cent of energy requirement is affected by the basic structure of the building”.

Mr Gautam Eunny introduced Lafarge and spoke about the importance of long term building solutions with a positive social impact. He stressed on building better cities/neighbourhood as small settlements in cities like Mumbai with the help of concrete which is highly durable. He discussed the widely faced issues of inefficiency due to poor quality of concrete, its’ wastage, improper applications and the most predominant problem of concrete applications in packed neighbourhoods with no space for RMC trucks or transportation. He then shared with the delegates some current successful practices for overcoming these challenges. He introduced the Bucket concept wherein RMC is put into trucks, then packed into 15 litres bucket and delivered through rickshaws in the narrow lanes. He also discussed its drawbacks and shared an alternative concept. The Pilot project with this alternative concept was executed in Dharavi and Shivajinagar in Mumbai. It involved improved production line with 35 kg packs with the help of an in-house bagging unit on wheels having a plastic lock and packing mechanism. It facilitated delivery

to a larger site, with good quality concrete work, affordable, with no leakage, and lower wastage.

Next, Mr D E V S Kiran Kumar gave a background on low energy buildings and mentioned that the overall energy efficiency could be improved by selecting thermally appropriate building materials and promoting indigenous technologies. He discussed various nano technologies for roofing materials and their performance in the tropical climate scenario of India. He covered performance of coatings on roof with cenospheres & mica sheets and discussed the problems & solutions related to heat on wall, roof and windows. He explained about the material thermal performance evaluation at different scales with regards to the material's chemical composition, heat capacity, thermal conductivity, density/porosity, thickness, surface texture & reflectivity. He then presented the results of an experiment on performance analysis of roof application with cement tile, XPS insulation and POP false ceiling which showed that cement tile performs better in 24-hour occupied residential buildings in hot and dry climates due to its high volumetric heat capacity along with better thermal comfort.

Mr Gowdaiah, the next speaker gave an overview of Bangalore Development Authority (BDA). He

emphasised that BDA has diversified into affordable housing. Over 13000 units are being taken up for construction. To encourage adoption of latest construction techniques flexible tender conditions have been included, he informed.

Apart from conventional method, three fast track methods of construction are being adopted by BDA in its housing projects he stressed. Two of them are precasting methods. In one prestressing method, the structural elements like beams columns and slabs are precast which are subsequently used to build the housing complexes of any height. In the other method the load bearing wall panels are precast. These wall panels are assembled into cubicles comprising of different parts of a housing unit. The internal finishing is also carried out at factory. These finished parts of housing units are then transported, hoisted and assembled into a house. To ensure quality, onsite batching plants are made mandatory in all housing projects of BDA he stated. In both the projects usage of precast technology demonstrated reduction in usage of materials, lower embodied energy, high quality etc., he informed. The cost of each unit was 7.5 lacs for 450 sq. ft. including land cost, he shared ending his presentation.

# HIGHLIGHTS OF TECHNICAL SESSION 6





## Valedictory Session: Role of Private Sector in Mainstreaming Sustainable Buildings in India



### Moderator:

**Mr Friedemann Roy**, Global Product Lead Housing Finance Access to Finance Advisory at IFC – International Finance Corporation, Washington D.C.

### Speaker:

**Mr Brotin Banerjee**, MD & CEO, TATA Housing Development Company Ltd.

Mr Friedemann Roy handed over the dais to Mr Brotin Banerjee for his presentation. Mr Banerjee mainly addressed the current urban scenario and the works carried out by TATA Housing Development Company Ltd. with respect to the sustainability aspect.



control the carbon emission, he suggested car-pooling, no car day, rail travel, video-audio conference and the light off policy (including centralized ACs) be adopted on larger scales.

He emphasized on rain water harvesting, ground water recharging, use of waste water for construction, solar streetlights, solar water heaters, CFL/LED, top soil conservation and recycling of

He gave an overall picture of how the world is rapidly urbanising, with population growth and constant migration of people from villages to the urban zone, which in turn is leading to an increase in natural resources consumption in cities. The impact of construction industry in India and its consequences were also brought to light. To grey water as some of the practices that one should adopt to favour natural resources conservation. Some of the methods used by sustainability were described through various housing projects. Pre-cast, hollow RCB (reinforced Concrete Block), gypsum plaster, fly ash bricks, gabion wall, pervious concrete, No usage of red bricks except for water proofing, use of Terrazyme (bio enzyme) for

road paving and use of geo-green blanket for slope stabilization & beautification were some of technologies and innovations that were highlighted.



He shared his view on how Government alone is not enough to develop a sustainable and green habitat and that creating awareness and education is equally important like how the BIG Initiative has been developed by TATA Housing Development Company Ltd. for the same. He said that affordable housing needs to become more of a reality, in support to weaker sections. Measuring and reducing carbon footprint, water footprint and incorporating green features in buildings will favour a sustainable future.

2015 a grand success.

After the presentation, the dais was open to discussions wherein the main topic discussed was vertical rise vs. horizontal rise. Mr Friedemann Roy presenting his views on this context said that going vertical or horizontal could be a cultural and/or legal issue. City Planning he said plays a vital role in this and gave the example of Frankfurt where development in the central part of the city is prohibited leaving it green and clean.

Post this session, the conference was concluded by Ms Minni Sastry who presented the vote of thanks to all the speakers, participants, exhibitors and organizers in making the GRIHA Regional Conference



## Annexure 1

### Agenda

Day-1 (3 <sup>rd</sup> February, 2015)	
<b>08:30 – 09:30</b>	<b>Registration</b>
<b>09:30 – 10:30</b>	<b>Inaugural Session</b>
Welcome Address	<b>Ms Mili Majumdar</b> , Director & Senior Fellow, Sustainable Habitat Division, TERI
Setting the theme	<b>Mr K Jairaj (IAS retd)</b> , Former Additional Chief Secretary, Government of Karnataka
Inaugural Address	<b>Dr R K Pachauri</b> , Director General, TERI (through VC)
Vote of Thanks	<b>Ms Minni Sastry</b> , Fellow & Area Convener, Sustainable Habitat Division, TERI
<b>10:30 – 11:00</b>	<b>Inaugural of Exhibition followed by tea/coffee</b>
<b>11:00 – 12:30</b>	<b>Panel Session: Accelerating Sustainability in Built Environment</b>
	The session shall focus on issues related to accelerating sustainability in the built environment. There shall be a theme presentation on current scenario and barriers in the sector along with successful implementation mechanisms. This shall be followed by a panel discussion.
Chairperson & Speaker	<b>Dr Ashwin Mahesh</b> , Founder & CEO Mapunity, Editor – India Together
Speakers	<b>Mr Anjum Parwez</b> , Chairman, Bangalore Water Supply and Sewerage Board <b>Dr Chandrashekar Hariharan</b> , CEO, Biodiversity Conservation India (Pvt) Ltd
<b>12:30 – 13:30</b>	<b>Technical Session 1: GRIHA and its Role in Accelerating Sustainability in Built Environment in India</b>
	<b>Ms Mili Majumdar</b> , Director & Senior Fellow, Sustainable Habitat Division, TERI and <b>Ms Minni Sastry</b> , Fellow & Area Convener, Sustainable Habitat Division, TERI <b>Green initiative in Affordable Housing – HUDCO perspective - Ms Vijaya R Vasu</b> , Deputy General Manager (Projects), Housing and Urban Development Corporation Limited
<b>13:30 – 14:30</b>	<b>Lunch</b>

**14:30 – 16:00 Technical Session 2: Sustainability in liveable cities**

Cities worldwide face immense challenges with increasing population, demand for resources, pressure on transport systems and infrastructure. The session shall deliberate on these issues and demonstrate solutions that are replicable and scalable.

Chairperson & Speaker **Low Carbon urban living - Opportunities and Strategies - Prof Ashok B Lall**, Principal Architect, Ashok B Lall Associates , New Delhi

Speakers **Building Sustainable Communities - Ar Natasha Iype**, Director, Good Earth

**Sustainability in Liveable Cities - Mr Angshik Chaudhuri**, Executive Director (Operations), Cisco Development India Pvt Ltd

**16:00 – 16:30 Tea/Coffee**

**16:30 – 17:30 Technical Session 3: Built Environment in Response to Climate Vulnerabilities**

Changing climate is impacting mankind in several ways. The built environment also faces major challenge and needs to respond to climate vulnerabilities. A paradigm shift in design and planning approach is needed to address the climate impacts on built environment. The technical session will address the applicable mitigation and adaptation measures for built environment in response to climate vulnerabilities. Presenters and scientists will speak about tools available to inform future developments, policy changes/ initiatives required, and private sector involvement in delivering climate resilient built environment and infrastructure.

Chairperson **Prof Krishna Rao Jaisim**, JAISIM-FOUNTAINHEAD

TERI **Green Building Features for Climate Resilient Affordable Housing - Ms Minni Sastry**, Fellow, Sustainable Habitat Division & **Ms Ulka Kelkar**, Fellow, Earth Science and Climate Change

**Climate resilient urban systems- Opportunities and Challenges - Dr Divya Sharma**, Fellow, Sustainable Habitat Division

IFC **Mr Friedemann Roy**, Global Product Lead Housing Finance Access to Finance Advisory at International Finance Corporation, Washington D.C.

**Day-2 (4<sup>th</sup> February, 2015)**

**09:30 – 11:15 Technical Session 4: Efficiency in new and existing buildings**

There is a saving potential of 8700 million kWh of energy in India for existing building stock and 90,000 million kWh for upcoming commercial buildings by 2021. Experts in the subject shall present and debate on current gaps and barriers, retrofitting solutions for existing buildings, new and innovative measures for new buildings, financial mechanism, framework of standards and implementation strategies based on the successful experiences in India and outside India.

Chairperson & Speaker **Adaptive Building Design - Prof Dr Uta Pottgiesser**, Dekanin – Dean, Detmold School of Architecture and Interior Design, Germany

Speakers	<p><b>Data driven approach to high performance buildings - Mr Guruprakash Sastry</b>, Regional Manager – Infrastructure / Green Initiatives, Infosys</p> <p><b>Enterprise Energy Management - Mr Debashish Chakraborty</b>, General Manager - Energy Efficiency &amp; Strategic Alliances, Schneider Electric</p> <p><b>Building Energy Efficiency - Anand Sachithanantham</b>, Technical Manager – CPT South Zone, Asahi India Glass Ltd.</p> <p><b>Achieving Sustainability in Office Spaces - Case Study from Google - Mr B R Nagaraj</b>, Head - Real Estate &amp; Workplace Services, Google India Pvt. Limited</p>
<b>11:15 – 11:45</b>	<b>Tea/Coffee</b>
<b>11:45 – 13:00</b>	<b>Technical Session 5: Air quality in healthy built environment</b>
	<p>1.3 million Indians die every year of poor Indoor air quality which is the second biggest killer after high blood pressure. Landscape design to improve outdoor air qualities and products/technologies improve Indoor Air Quality will be presented. Impact of energy saving measures such as increasing set point and reducing ventilation rates on IAQ will be debated.</p>
Chairperson & Speaker	<b>Air Quality in India - Ms Maija Virta</b> , Managing Director, Santrupti Engineers Private Limited
Speakers	<p><b>Micro Climate and Landscapes - Issues and Amelioration - Mr Mohan Rao</b>, INDE Integrated Design</p> <p><b>Air Filtration - An ideal solution for healthy indoor air - Mr Shankar Rajasekaran</b>, Director – Engineering, IMPEC FILTERS Private Limited</p>
<b>13:00 – 14:00</b>	<b>Lunch</b>
<b>14:00 – 14:30</b>	<b>Keynote Address</b>
	<b>Mr S Vishwanath</b> , Rain Water Club
<b>14:30 – 16:00</b>	<b>Technical Session 6: Structural Systems and Construction Technologies for Green Buildings</b>
	<p>The session will showcase structural design solutions and innovative construction techniques that can be adopted for Green buildings. Discussions and presentations on embodied energy of construction technologies such as Prefab construction will be held. Innovative systems such as replacement of Steel with Bamboo, as reinforcement material, will be presented.</p>
Chairperson & Speaker	<b>Structural Design Aspects for Green Buildings - Mr S C Mehrotra</b> , CEO – Mehro Consultants; President, Indian Association of Structural Engineers

**Pre Cast Housing by Bangalore Development Authority (BDA) - Mr M G Gowdaiah**, Engineer Officer, Bangalore Development Authority

**Concrete & Mortar - Innovation approach to create profitable & sustainable solutions for Bottom of the Pyramid - Mr Gautam Eunny**, Sr VP & Head - Construction Development Lab, Lafarge Aggregates & Concrete India Pvt. Ltd.

**Thermally Appropriate Building Materials & Technologies - Mr D E V S Kiran Kumar**, Associate Fellow, Sustainable Habitat Division, TERI

**16:00 – 17:00 Valedictory session on 'Role of private sector in mainstreaming sustainable buildings in India'**

Moderator **Mr Friedemann Roy**, Global Product Lead Housing Finance Access to Finance Advisory at International Finance Corporation, Washington D.C.

Speaker **Accelerating Sustainability in Built Environment - Mr Brotin Banerjee**, MD & CEO, TATA Housing Development Company Ltd

**17:00 – 18:00 Tea/Coffee**

## Annexure 2

### List of Participants

SN	Name	Designation	Organisation
1	Smriti Bellad	Director	Bellad & Co. Hubli
2	Varna Venkatesh	Student	BMS School of Architecture
3	Nanda.B.S	Student	BMS School of Architecture
4	Komal Narendra	Student	BMS School of Architecture
5	Vidyashree. U	Student	BMS School of Architecture
6	Cephas Bhaskar	Student	BMSSA
7	Gavin Reis	Student	Goa College of Architecture
8	Swapnil Mangle	Student	School of Planning and Architecture, Vijayawada
9	Jayasree T K	Student	School of Planning and Architecture, Vijayawada
10	Pratiksha Chipade	Student	School of Planning and Architecture, Vijayawada
11	Pavithra Radhai KVN	Student	School of Planning and Architecture, Vijayawada
12	Shreeneha V S	Student	Acharya Institute of Technology
13	Yogesh V N	Architect	Archemist Architects
14	Divya B T	Architect	Archemist Architects
15	Dr Sapna Papu	Director	BMS School of Architecture



SN	Name	Designation	Organisation
16	Ar shreyas K	Assistant Professor	BMS School of Architecture
17	Ar Seema Naveen	Assistant Professor	BMS School of Architecture
18	Ar Shreyasi Pal	Assistant Professor	BMS School of Architecture
19	Ar Padmini Rajaram	Assistant Professor	BMS School of Architecture
20	Ar Prasad. S. Rotti	Faculty	BMS School of Architecture
21	Gurjinder Kaur	Architect	Indian Space Research Organisation
22	Jagannath C R	Consulting Civil Engineer	Individual
23	Rakesh Bohra	Associate Manager	Infosys Ltd.
24	Madhan Kumar		Infosys Ltd.
25	Nishita Baderia		Infosys Ltd.
26	Shrinath Narayanrao		Infosys Ltd.
27	Santhi Sree Nadimpall	Junior Architect	Jurong Consultants (India) Pvt Ltd
28	Om Kumar R	Project Architect	Jurong Consultants (India) Pvt Ltd
29	Ajay A Kotur	Junior Design Engineer	Jurong Consultants (India) Pvt Ltd
30	Malya Mishra	Sr Design Engineer	MECON Limited
32	Bruno		MECON Limited
33	Ashwini M N	Environmental Engineer	Salarpuria/Sattva Group
34	Anindya Ray	Environmental Engineer	Salarpuria/Sattva Group

SN	Name	Designation	Organisation
35	Vaishakh P P	Senior Executive- Green Building & Energy Services	SGS INDIA PVT LTD
36	Abdul Razakh P H	Deputy Manager(Safety)	Shapoorji Pallonji &Company Private Limited
37	Aiswarya Sankar	Environmental Engineer	
38	Divya	Architect	ACS Design Pvt Ltd
39	Mr Suman T	PE/Civil Est.	Bharat Electronics Ltd
40	Ms Akansha Arya	PE/Elec.-Fact.	Bharat Electronics Ltd
41	Mr Dileep Kumar Verma	DE/AC&R	Bharat Electronics Ltd
42	Mr Bishal Goswami	Architect/CNP	Bharat Electronics Ltd
43	Vithal Tanksali	Architect / HoD of Architecture	BLDEA's College of Engineering and Technical
44	Sushma Shrestha	Manager-Program Development	Habitat for Humanity International Nepal
45	Tripti		Habitat for Humanity International Nepal
46	Dr Abdul Matheen	Director-Mechanical	International Association of Plumbing and Mechanical Officials-India
47	Anilkumar N		McD Built Environment Research
48	Deepak Kumar C	Director	mindwagon Sustainable Design
49	Atish Parganiha	Senior Manager	Zuari Infracore India Ltd

SN	Name	Designation	Organisation
50	Ravindra Reddy	Senior Manager	Zuari Infracore India Ltd
51	Neetha K N	Architect	
52	P Selvadurai	Sr Planner CMDA	CMDA Chennai
53	Manjula		German Consulate
54	Tuhin Ghosh	Consultant	BCIL
55	R V Simha	Adviser	Airtron Consulting Engineers Pvt Ltd
56	Dr S A Hariprasad		
57	B R Nataraj setty	Deputy Director	BMRDA
58	Manish		CPWD
59	P K Naidu	Project Manager	CPWD
60	R N Ashwatiah		CPWD
61	Durga Prasad K V	Deputy Director of Town & Country Planning	BIAAPA
62	Sadananda Acharya	Deputy Director of Town & Country Planning	The Karnataka Town Planning Board
63	John Tan Cheng Soon	Senior Country Manager (International Development)	Building and Construction Authority, Singapore
64	Zeng Han Jun	Country Manager (International Development)	Building and Construction Authority, Singapore
65	Praveen Kumar K	Project Engineer	Godrej & Boyce Mfg. Co. Ltd.
66	Savitha Sudhakaran	Urban Designer	Embarq India

SN	Name	Designation	Organisation
67	Sivaramakrishna	CE-BWSSB	BWSSB
68	Jayamma Y B	Assistant Architect	Principal Chief Architect Office
69	Premalatha Kolor	Assistant Architect	Principal Chief Architect Office
70	Geetha Rani R K	Assistant Architect	Principal Chief Architect Office
71	Deepak Kulkarni		Tata Housing Development
72	Prashant	Manager-Program Development	Tata Housing Development
73	Aslam	Senior Manager	Tata Housing Development
74	Kartik Menon	Business Development Manager	ASAHI
75	Ajit A.R	Key Accounts Manager	ASAHI
76	Shanthi M	CGM CA	BESCOM
77	Lakshmipathy L	DGM	BESCOM
78	Jyothi Pani I S	Manager (DSM)	BESCOM
79	K R Natarajan	Commn (DSM)	EESC (BESCOM)
80	Rajasekhar Ramanath		Google
81	Srinvasa Naryanan		Google (CBRE)
82	Yuvaraj Mohanan		Google (JLL)
83	Lokesh M S	Dy. Manager	HDFC Ltd
84	Somendeep		HPCL

SN	Name	Designation	Organisation
85	K S Ananthalakshmi		HPCL
86	HT Suresh	RC	HUDCO
87	SV Kamath	GM	HUDCO
88	BT Umesh	DGM	HUDCO
89	Keshavamoorthy	SM	HUDCO
90	Seshadri	DGM(Fin)	HUDCO
91	Aditya Kaura	Director	Building Protection System Pvt Ltd
92	Raja	DGM	Building Protection System Pvt Ltd
93	Sunil Nayak		Building Protection System Pvt Ltd
94	Leonard Fernandes	Regional Head	Derbigum Middle East & Asia
95	Ravi Kumar H	G.M.	Derbigum Middle East & Asia / Greener - Steps
96	Rahul Aeron	National Sales Manager	Desiccant Rotors International
97	K E Venkatesh	Branch Manager, Chennai	Desiccant Rotors International
98	Vijaya Raj	Director	Farmland Rainwater Harvesting Systems
99	Akash	Site Engineer	Farmland Rainwater Harvesting Systems
100	Varuna	Marketing Exicutive	Farmland Rainwater Harvesting Systems
101	Sethu Madhavan		QUAVAC, IDDC Pvt Ltd
102	Venkatakrishnan J B	Director	QUAVAC, IDDC Pvt Ltd



<b>SN</b>	<b>Name</b>	<b>Designation</b>	<b>Organisation</b>
103	Balachandar		QUAVAC, IDDC Pvt Ltd
104	G Prashanth	Director (Sales&Marketing)	Klima Technologies
105	Thyagarajan	Director (Technical)	Klima Technologies
106	Vinayak R Hegde	AGM	Sobha Glazings
107	Deepa		Somany Ceramic Limited
108	Jagannath R	Associate Zonal Manager, Bangalore	Somany Ceramic Limited





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