THE 9TH GRIHA SUMMIT 2017

SUMMIT PROCEEDINGS

18–19 DECEMBER, 2017 | NEW DELHI

Sustainable is Affordable

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GRIHA

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THE GRIHA SUMMIT

Abraham Maslow, the American psychologist and creator of the hierarchy of needs theory, proposed food and shelter as the most basic needs that motivate human behaviour.

In a developing country such as India, access to affordable housing is vital and is the key to achieve a number of social policy objectives, such as reducing poverty. According to 'White Paper – Indian Housing Industry' by RNCOS, the shortage of urban housing stood at 18.8 million units in 2012, which is expected to grow to 34.1 million units by 2022 (compound annual growth rate of 6.6% for 10 years). The Government of India has taken steps to counter this demand by launching the 'Housing for All' scheme which aims to bring 'pukka' houses to every family in urban cities by 2022, which means the construction sector will continue to grow exponentially.

The construction industry in India represents 30% of the country's electricity consumption and accounts for about 24% of the greenhouse gas (GHG) emissions. About 80% of the emission is attributed to materials, such as steel, cement, bricks, etc., and this number is bound to increase owing to the steady growth in the industry. Therefore, there is a need to change the construction practices towards a more sustainable development path.

A common myth about sustainable building development is that they cost more, especially while building affordable houses. Recent studies have shown that the incremental capital cost has decreased owing to the increase in market for green buildings. There is also a considerable scope to reduce both the embodied and the operational energy consumption of the building.

The theme of the GRIHA Summit held in New Delhi from 18–19 December, 2017, was **'Sustainable is Affordable'.** Few events were organized as a prelude to the Summit, starting with "Chhaya", a tree plantation drive in association with Airports Authority of India (AAI)The Summit comprised two plenary sessions, two keynote sessions, and 10 parallel tracks.

THE GRIHA COUNCIL

Construction activities in India have been pursued without giving much attention on environmental issues. This has resulted in pressure on its finite natural resources, besides creating impacts on human health and well-being. Unplanned and unsustainable urban development has led to severe environmental pressures. Modern buildings built in our cities have high levels of energy consumption because of requirements of air-conditioning and lighting. Such buildings consume copious quantities of water for building use and landscaping and generate substantial waste during construction and operation.

Green buildings on the other hand, can reduce energy demand by as much as 40% and water demand by more than 30%. They let in more natural light, recycle wastewater, integrate natural cooling systems with conventional air conditioning systems, use renewable sources of energy to reduce dependence on conventional sources and contribute towards sustainable development.

GRIHA Council, is mandated to promote development of buildings and habitats in India through GRIHA. It was founded by TERI (The Energy and Resources Institute, New Delhi) with support from MNRE (Ministry of New and Renewable Energy, Government of India) along with a handful of experts in the sustainability of built environment from across the country.

The Ministry of New and Renewable Energy (MNRE), Government of India and TERI have jointly developed GRIHA (Green Rating for Integrated Habitat Assessment), which has been endorsed as the national rating system for green buildings in India. With support from the Government of India and active participation of the private sector, over 43 million square metres of built up space is registered to be GRIHA compliant.

GRIHA Council, is mandated to promote development of buildings and habitats in India through GRIHA. It ensures implementation of GRIHA benchmarks in full compliance with various relevant national codes and standards (such as the Energy Conservation Building Code, the National Building Code, guidelines issued by the Central Pollution Control Board) and contributes to meeting objectives set forth in the National Mission on Sustainable Habitat and the Jawaharlal Nehru National Solar Mission. The demonstrated impact of GRIHA projects includes quantification of resource use optimization, implementation of environmental commitments and enhanced transparency through a web based portal.

In addition to all Government of India and Public Sector Undertaking buildings that have to be minimum 3 Star GRIHA compliant, the Central Public Works Department (CPWD) has also notified that all their construction shall be minimum minimum 3 Star GRIHA rated.

AGENDA

CURTAIN RAISER 17 December 2017 Venue: Hotel Claridges, New Delhi	
07:00 PM onwards	Setting the theme followed by cocktails and dinner
	▪ Welcome Address - **Dr Ajay Mathur,** President, GRIHA Council ▪ Keynote Address – **Mr Anders Hall**, Chairman, Marketing & Communication, ES-SO (EU Solar Shading Organisation), International Business Development, Somfy International ▪ Vote of thanks - **Mr Sanjay Seth,** CEO, GRIHA Council

Day-1 18 December 2017 Venue: India Habitat Centre, New Delhi	
0900 – 0930	Registrations
0930 - 1130	**Inaugural Session** Venue - Stein Auditorium
	▪ Lighting the lamp ▪ Welcome Address - **Dr Ajay Mathur**, President, GRIHA Council & Director General, TERI ▪ Keynote Address – **H. E. Dr Andreas Baum**, Ambassador of Switzerland to India & Bhutan, Embassy of Switzerland Launch of GRIHA Rating for Affordable Housing MoU signing between NBCC & TERI MoU signing between EESL & GRIHA MoU signing between NHB & GRIHA MoU signing between ISHRAE & GRIHA ▪ Vote of Thanks – **Mr Sanjay Seth,** CEO, GRIHA Council & Senior Director,TERI
1130 - 1200	**Tea** (Venue – The Hub)
1200 - 1330	**Plenary Session I – Cost of Sustainability** Venue - Stein Auditorium

	Green building movement started about two decades back across the globe. The movement was triggered by the extravagant use of resources in modern buildings and it was imperative to curb the wasteful consumption. So, the initial programmes targeted the affluent section of buildings such as commercial buildings. Simultaneously, technology also grew towards more efficient solutions which were at times more expensive than the conventional options. This created a perception that sustainability comes at a cost. The word "sustainability" has woven itself into marketing and branding strategy such that companies use it to market themselves. But, considering the current challenges faced by humanity all over the world, sustainability is not an option; it is indeed the only way forward. This session will deliberate upon the cost of sustainability for affordable construction. In times when the economy is recovering and budgets are tight, corporate focus on sustainability can begin to drift because of the myth that sustainability is an unproven cost. Organizations must effectively balance short term investment toward proven sustainability measures while driving a vision and strategy of evolving their business for future environmental and social conditions. This session will deliberate upon the cost of sustainability for affordable construction.
	Introducing the World Urban Forum 2018 – **Mr Hitesh Vaidya**, Country Manager, India, UN-Habitat, New Delhi
	Moderator – **Prof. Kavas Kapadia,** Former Dean of Studies and Head department of Urban Planning, SPA Delhi Speakers: ▪ **Prof. Jagan Shah,** Director, National Institute of Urban Affairs (NIUA) ▪ **Dr Abhijit Banerjee,** Senior Adviser, Climate Change and Urbanisation, United Nations ▪ **Ms Cecilia Freire Costa,** Coordination Manager, European Union Delegation to India and Bhutan ▪ **Mr Rajesh Krishnan,** Managing Director & CEO, Brick Eagle Group ▪ **Mr S Senthil Kumar,** Business Head, Institutional Sales, AIS Glass Ltd Q & A session
1330 - 1430	**Networking Lunch** (Venue – The Hub)
1430 - 1515	**Keynote Address** Venue - Stein Auditorium
	Chair – **Mr Sanjay Seth,** CEO, GRIHA Council Keynote Address – **Prof. Christopher Charles Benninger,** Founder Chairman and Principal Architect , CCBA Designs *Architect Christopher Benninger is an Overseas Citizen of India, registered with the Council of Architecture, a Fellow of the Indian Institute of Architects and the Institute of Town Planners, India. In 1969 he accepted a teaching post at Harvard University's Graduate School of Design, his alma mater (Master's in Architecture, 1967). With Balkrishna Doshi, at age 28, he founded the School of Planning, teaching there and remaining a Distinguished Professor until today. Leaving Harvard, he resigned from a tenure track position of Assistant Professor, being his graduate school's youngest member of the Faculty Senate. In 1976 he founded the Centre for Development Studies and Activities (CDSA), a research and post graduate teaching institution of the Pune University, where he served on the Senate and Board of University Teaching and Research.*

1515 - 1530	**Tea/ Coffee** Venue – The Hub
	Parallel Tracks
1530 - 1700	**Track I – Existing today, Retrofitted for Tomorrow** Venue – The Theatre (Below Stein Auditorium)
	Despite rapid rates of construction in the country, existing building stock far exceeds new construction that is added annually; hence it is critical that policy interventions are made to improve sustainability in both, new construction as well as existing buildings. Improved efficiency of existing buildings through building retrofitting and other measures; represents a high volume, low-cost approach to reducing energy use and greenhouse gas emissions. This session shall showcase the work being done for making existing buildings green.
	Thematic Address: **Mr Santosh Kumar Thakur,** General Manager (Technical), EESL In charge of building energy efficiency program and AJAY programme of Govt. of India. Services Ltd Moderator: **Shri. Rajendra Chaudhari**, Director (Commercial), NBCC Panellists: ▪ **Mr Rumi Engineer, Head** – Energy Management & Greener India Initiative: Godrej & Boyce Mfg. Co. Ltd. ▪ **Mr Arun Bhatia,** Managing Director, UTC- Climate, Control and Security, India. ▪ **Dr G C Datta Roy,** Advisor- DESL ▪ **Mr Anders Hall,** Chairman, Marketing & Communication, ES-SO (EU Solar Shading Organisation), International Business Development, Somfy International ▪ **Mr Akash Jain,** Director, Alien Energy Pvt Ltd Q & A session
1530 - 1700	**Track II – Towards Zero Waste Buildings** Venue – Silver Oak A
	With increase in the global population and the rising demand for food and other essentials, there has been a rise in the amount of waste being generated daily by each household. This waste is ultimately thrown into municipal disposal sites and due to poor and ineffective management, the dumpsites turn into sources of environmental and health hazards to people living in the vicinity of such dumps. Waste management is a challenge for the city authorities in developing countries due to many reasons. Such as the increasing waste-generation, the burden posed on the municipal budget due to the high costs associated with its management, the lack of understanding over a diversity of factors that affect the different stages of waste management & linkages necessary to enable the entire handling system functioning. It is one of the most poorly rendered services by municipal authorities in developing countries as the systems applied are unscientific, out dated and inefficient. This session aims to provide a platform to discuss the opportunities and challenges of waste management.

	Thematic Address: **Ar. Chitra Vishwanath,** Principal Architects and Managing Director, Biome Moderator – **Dr Suneel Pandey,** Senior Fellow & Director, CWM, TERI Speakers: ▪ **Dr Asokan Pappu,** Senior Principal Scientist, CSIR- Advanced Materials and Processes Research Institute Professor Academy of Scientific and Innovative Research, CSIR India ▪ **Mr Ashish Jain,** Director, RecMech Enviro Pvt. Ltd. & Indian Pollution Control Association ▪ **Mr Sameer Divekar,** Director, dbHMS ▪ **Mr Gaurav Joshi,** Co-founder, Extra-Carbon Q & A session
1530 - 1700	**Track III – Sustainable Water Management: Affordable Solutions** Venue – Silver Oak B
	Ongoing global climate change, increasing population, urbanization, and aspirations for better living standards present a challenge to the sustainability. Water is one the essential resources for our survival. But, we have been changing the natural water system in globally significant ways, yet without adequate knowledge of the system and its response to change; and without sufficient understanding of how to govern the system at local and global scales. Today, water has come at the centre stage of the development and political debate. Water security in the 21st century will require better linkage of science and policy, as well as innovative cross-sectoral initiatives, adaptive management and governance models that involve all stakeholders. Ultimately, growth and development in India will be governed by the way water is used and managed. This session shall provide a platform for various agencies to come together and discuss the challenges and probable solutions to ensure water availability in appropriate quality and quantity for the buildings in the low-income groups.
	Moderator – **Dr. S K Sarkar,** Director Water Resources Division, TERI Panellists: ▪ **Dr. Renu Khosla,** Director, Centre for Urban and Regional Excellence (CURE) ▪ **Ms Hina Zia,** Professor, Faculty of Architecture & Ekistics, Jamia Millia Islamia ▪ New Delhi ▪ **Mr. Sandeep Narang,** Independent Consultant - Sustainable Construction Practices ▪ **Mr. Rajesh Jain,** Managing Director at Enhanced WAPP Systems (India) Pvt. Ltd. Special Address: **Mr. Jyotikumar Jha,** Deputy GM Sales (North), Roca Bathroom Products Pvt Ltd Q & A session
1530 - 1700	**Track IV – Thermally Comfortable and Energy Efficient Group Housing** Venue – Jacaranda
	The production of residential building stock in urban areas is shifting quickly toward Group Housing across the socio-economic spectrum, from low-income (affordable) to the middle and high-income categories. Recent data on energy consumption, shows an exponential increase in electricity use in urban housing -- a large part of which is attributed to the increased use of air conditioning. Research has established a direct correlation between the design of building envelop of the Group Housing projects with the thermal comfort (in naturally ventilated housing) and energy demand for air conditioning (in mixed mode or air-conditioned housing). As India plans to construct 12 million affordable housing units and millions of MIG and HIG housing units, the issue of thermal comfort, and exponential growth in air-conditioning electricity consumption and associated GHG emissions, takes a center stage. This calls for an urgent and immediate plan to promote design of energy efficient building envelopes in new Group Housing.

	This session aims to provide a platform to discuss the design options and regulatory possibilities (in the form of a residential building envelope code) to promote thermally comfortable and energy efficient Group Housing.
	Thematic Address: **Mr. Abhay Bakre,** Director General, Bureau of Energy Efficiency Chair – **Ms. Marylaure Crettaz Corredor,** Head, Swiss Cooperation Office in India Speakers: ▪ **Ar Ashok B Lall,** Principal, Ashok B Lall Architects ▪ **Mr Pierre Jaboyedoff,** Senior Engineer and Energy Consultant, Partner in Effin'Art Sarl, Indo-Swiss Building Energy Efficiency Project ▪ **Shri K.K. Joadder,** Chief Town Planner, Town & Country Planning Organization Q&A session
End of Day 1	

DAY-2

19th December 2017

Venue – India Habitat Centre, New Delhi

1000 – 1130	**Plenary session – Sustainability as a Driver for New Ideas** Venue - Stein Auditorium
	Change and innovation are closely related. The opportunities and possibilities for change through innovation have never been this abundant. A lot of start-ups focusing on environment, waste, water, construction etc. have evolved in India. Sustainability will be a major driver behind innovation in the challenging new world full of opportunities for strategic innovation. Embracing a sustainability agenda can stimulate innovation, pushing companies to rethink their operations, products and business models. "Green products" or "techniques" often refer to products, services or practices that allow for economic development while conserving for future generations. This session will showcase a few of such innovative products and practices.
	Thematic Address: **Ar. Vijay Garg**, Vice President, Council of Architecture Moderator: **Mr Gaurav Shorey**, Founder Member, 5waraj & Managing Director, PSI Energy Speakers: ▪ **Mr Kushagra Srivastava**, CEO, Chakr ▪ **Mr Vinay Kumar Tiwari**, Vastu Vihar ▪ **Mr Swapnil Chaturvedi**, Founder, Samagra ▪ **Mr Ashwath Hegde**, Founder, EnviGreen ▪ **Mr Narayana Peesapaty**, Founder, Bakey's Food Pvt. Ltd (edible cutlery)
1130 - 1200	**Tea** (Venue – The Hub)
	Parallel Tracks
1200 – 1330	**Track I: Financing Sustainable Affordable Housing** **Venue - Silver Oak**

	Cities around the world are struggling to find solutions for housing shortage. While the global real estate sector is intensifying its focus on sustainability, their efforts are concentrated in the luxury and upper-mid housing sector, while the affordable housing sector is by far avoided due to low return on premium. Governments have a key role to play in strengthening domestic policy frameworks to catalyse and mobilise private finance and investment in support of sustainable development in the affordable housing sector. It is therefore essential to better align and reform policies across the regulatory spectrum to overcome barriers for providing greater access to institutional finance for developers to push up the supply of affordable and low-cost homes. This session aims to provide a platform to discuss the opportunities of financing sustainable affordable housing.
	Thematic Address : **Mr Sriram Kalyanaraman**, MD & CEO: National Housing Bank Moderator: **Mr Krishan Dhawan**, CEO, Shakti Sustainable Energy Foundation Panellists: ▪ **Mr Vikramjit Singh**, Senior Country Officer, International Finance Corporation (IFC) ▪ **Mr R Vaithianathan Ramachandran,** Managing Director, Tata Capital Housing Finance Limited ▪ **Mr Pankaj Dugar**, Chief Executive Officer of Hospitality & Delhi, IREO Management Pvt. Ltd. Vote of thanks
1200 – 1330	**Track II – Preparing the Next-Gen for Sustainability** Venue - Jacaranda
	Innovation can infuse fresh life into academics. New experiments in teaching methods establish a new culture of learning. Experiential learning is all about 'seeing is believing' and it sets a positive climate for learning, organizing, availing resources, and balancing the intellectual and technical components of learning. Schools can no longer function in isolation, but they need to build bridges with the world outside, providing exposure to the students to appreciate and respect the need to use resources efficiently and responsibly. Green architecture enhances sustainability at the earliest learning level.
	Moderator: **Ms Livleen K Kahlon**, Fellow & Associate Director, School Outreach, TERI Panellists: ▪ **Prof Rashmi Diwan**, Head- School Leadership, N.U.E.P.A ▪ **Prof Dinesh Kumar**, Head- DESM, NCERT ▪ **Mr Ratish Nanda**, Conservation Architect, India CEO- Aga Khan Trust for Culture ▪ **Ms Ishita Jalan,** Environmental Engineer, Dr Reddys Labs ▪ **Dr B C Sabata**, Sr. Scientific Officer, MGICCC, Delhi Government ▪ **Ar. Ankit Bhalla**, Deputy Manager, GRIHA Council Q & A session
1200 – 1330	**Track III – Occupant Wellness : How buildings shape health and habitats** Venue - The Theatre (Below Stein Auditorium)
	The on-going research on buildings all over the world emphasises the link between building indoor environmental quality and occupant health & productivity, driving the corporate real estate industry to investigate how to integrate wellness features in both new and existing building stock. Many wellness enablers also play a key role in improving energy efficiency, for example improved day lighting leads to reduction in energy demand for artificial lighting. On the other hand, strategies such as enhanced ventilation provisions are associated with increased energy consumption. This session shall deliberate upon the various aspects of buildings that affect occupant wellness of occupants.

	Moderator: **Mr. Tanmay Tathagat**, Director, Environmental Design Solutions Pvt. Ltd. Speakers: ▪ **Dr Kapil Goel**, Medical Epidemiologist/Senior Medical Consultant ▪ **Dr Jyotirmay Mathur**, Professor, Mechanical Engineering, Malaviya National Institute of Technology, Jaipur ▪ **Dr Shweta Manchanda,** School of Planning & Architecture ▪ **Mr Anand Murty**, Technical Training Manager – APAC ▪ **Mr Sayantan Sarkar,** NRDC Q & A session
1330 - 1430	**Networking Lunch** (Venue – The Hub)
1430 - 1515	**Keynote Address** Venue - Stein Auditorium
	Chair – **Dr Ajay Mathur,** President, GRIHA Council & Director General, TERI Keynote Address – **Prof. G Shankar**, Head & Chief Architect, Habitat Technology Group Prof. G. Shankar is the pioneer of a people's housing movement based on cost effective and sustainable building technologies in India. He completed his architecture studies from College of Engineering Trivandrum (1982 batch) and later did M.S. from Birmingham School of Architecture, UK and Post Graduate Diploma in Journalism. His concept of green architecture has brought about a much-required qualitative change to the shelter sector in Kerala, India. He is the founder and chief architect of Habitat Technology Group, an NGO working in the shelter sector in south Asia with responding centers in India and in other developing countries like Bangladesh, Sri Lanka, and Nigeria. He has been awarded the 2011 Padma Shri by the Government of India.
1515 - 1530	**Tea/ Coffee** Venue – The Hub
Parallel Tracks	
1530 - 1700	**Track I – Rethinking construction materials for sustainable future** Venue - The Theatre
	Buildings sector contributes to 30% of the global greenhouse gas emissions and accounts for one third of the global raw materials removed from earth. In addition, the extraction, processing, transport and installation of materials associated with construction consume large quantities of energy and water. This calls for an immediate action to direct the building materials towards sustainability. This session shall showcase on-going work to quantify greenness of building materials.
	Thematic Address: **Dr Shailesh Kumar Agrawal,** Executive Director – Building Materials & Technology Promotion Council (BMTPC), Ministry of Housing and Urban Affairs, Government of India Chair: **Shri Saurabh Diddi,** Director, Bureau of Energy Efficiency Panellists: ▪ **Mr Cesare Saccani,** Managing Director, ICMQ Certification India Pvt. Ltd. ▪ **Dr Sameer Maithel,** Director at Greentech Knowledge Solutions ▪ **Mr V Revindran,** Director – Sales and Marketing, Sinicon PP ▪ **Ms Megha Behal,** Research Associate, Sustainable Buildings Vote of Thanks

1530 - 1700	**Track II – Alternative efficient cooling technologies** Venue - Silver Oak
	Thermal comfort is one of the primary purposes of constructing buildings. The advent of air-conditioning has made it possible to artificially control indoor temperatures and provide comfort in extreme temperatures. It is notable that today, more than 50% consumption of electricity in a building is attributed to air-conditioners (AC). India, which is one of the fastest developing economies is also one of the fastest expanding markets for ACs. This is because of increasing affordability of ACs by the middle class and the continuously rising temperatures due to climate change. It is estimated that only 4-5% Indian households have ACs at present and NITI Aayog envisages that fifteen years from now, every household will have an AC. Due to the large impact of ACs and urgent need to address check the greenhouse gas emissions, alternative and efficient air-conditioning methods are being explored by the industry. This session will showcase some case studies where alternative and efficient cooling technologies such as district cooling, radiant cooling, geothermal cooling, solar air-conditioning and thermal storage have been implemented.
	Thematic Address: **Mr Soumya Prasad Garnaik**, Chief General Manager (Technical), Energy Efficiency Services Ltd. Chair: **Mr Vishal Kapur**, President, ISHRAE Panellists: ▪ **Mr Jagdeep Singh,** Managing Director, Aeon Ecotech Pvt. Ltd. ▪ **Mr C Subramaniam,** Director, SSS Consultants ▪ **Mr Richie Mittal,** Managing Director, Overdrive Engineering Pvt. Ltd ▪ **Dr R Saravanan,** Professor & Head, R&AC Lab, Anna University, Chennai ▪ **Mr Mohammad Adil,** Engineer, SEVCON Q & A session
1530 - 1700	**Track III – Renewable Energy** Venue – Jacaranda
	The building sector poses a major challenge to the environment. It is noteworthy that buildings consume about 40% of energy globally. In India, as compared to 2011, by 2021 the electricity consumption by space cooling and heating appliances will grow by 180% due to affordability of appliances and changing lifestyles. To reduce the environmental impact of buildings, it is not sufficient to just reduce the electrical demand, but it is equally important to substantially generate electricity from green sources. Due to its relevance in the current scenario, Net Zero Energy concept in buildings is gaining wide popularity. Installing renewable energy on a building is not only green but it also reduces the dependency of the project on grid supply. Innovations such as Building Integrated Photo Voltaic (BIPV) and solar tiles demonstrate the mass appeal of integrating renewable energy in buildings. This is a great advantage for projects located in remote areas where access to electricity through grid can be difficult and expensive. Whilst, in the urban context reducing dependency on grid power shall equip the building to withstand events of grid failure and decreasing the electricity bill at the same time. Other than the new buildings, the existing rooftops have a large potential for solar energy generation, most of which is untapped at present. It is noteworthy, that 40 GW out of the 100 GW target of the National Solar Mission is proposed through solar rooftop. Hence, facilitating renewable energy installation on buildings will play an important role in achieving the mission as well. This session shall assess the challenges and opportunities for increasing the integration of renewable energy in buildings.

	Chair: **Mr Amit Kumar**, Senior Fellow & Senior Director, Cent. for Impact, Eval & Energy Access, TERI Panellists: ▪ **Dr. Arun Kumar Tripathi**, Director General, National Institute of Solar Energy ▪ **Mr Sandeep Sonigra**, Managing Partner, Orange County Group, Pune ▪ **Mr Shirish Garud**, Senior Fellow & Director, Renewable Energy Technologies, TERI ▪ **Ms. Ritu Lal**, Vice President, Business Development, Amplus Energy Solutions Q & A session
1700 -1730	**Coffee Break**
1730 - 1930	**Valedictory & Award Evening** Venue – The Hub
	▪ Welcome Address: **Dr. Ajay Mathur,** President, GRIHA Council ▪ Special Address: **Mr. Francesc Recasens,** Deputy Managing Director, Roca Bathroom Products Pvt Ltd ▪ Valedictory address: **Shri Durga Shanker Mishra**, Secretary (HUA), Ministry of Housing & Urban Affairs Vote of thanks: **Mr. Sanjay Seth,** CEO, GRIHA Council
1930 onwards	Cocktail & Dinner Venue – The Hub

PRELUDE EVENTS

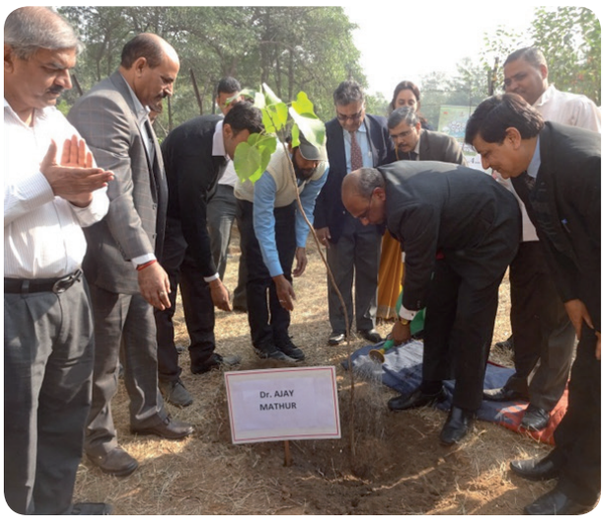
'Chhaya'–Tree Plantation Drive:

As a prelude to the 9th GRIHA Summit and in a bid to create awareness to reduce the pollution level and maintain ecological balance in the capital, GRIHA Council, in association with Airports Authority of India (AAI), organized 'Chhaya' – Tree Plantation Drive, at Kendriya Vidyalaya, Vasant Kunj, New Delhi, on **November 30, 2017.**

During the drive, saplings were planted by AAI officials, dignitaries of GRIHA Council, and students from Kendriya Vidyalaya AAI, Suraj Bhan DAV Public School, DAV Public School, The Heritage School, Bhatnagar International School, and G D Goenka Public School.

The dignitaries present at the occasion are listed as follows:

1. Mr Rakesh Kalra, Regional Executive Director, Northern Region, AAI



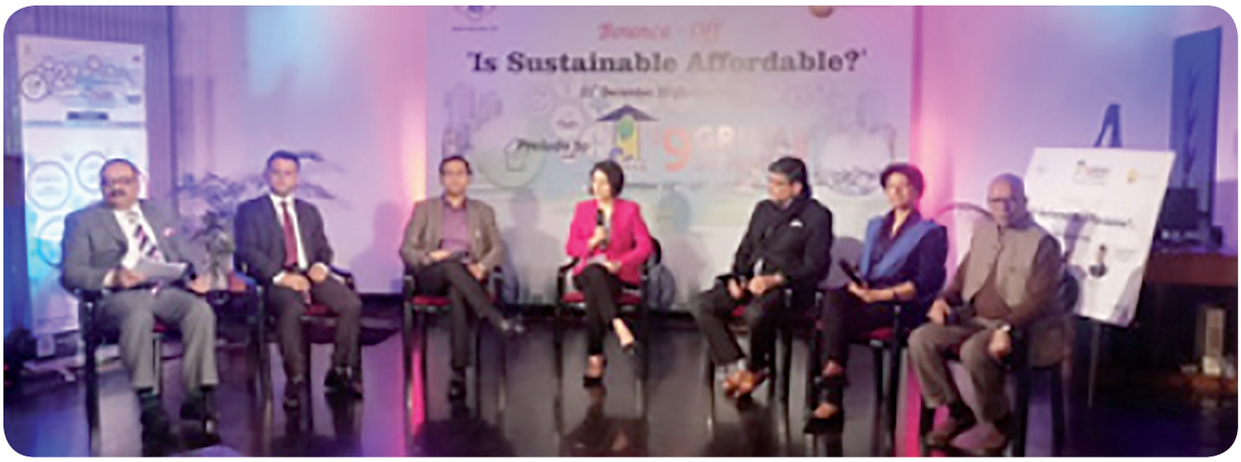
2. Dr Ajay Mathur, President, GRIHA Council and Director General, TERI
3. Mr Sanjay Seth, CEO, GRIHA Council and Senior Director, TERI
4. Ms Shabnam Bassi – Secretary, GRIHA Council
5. Mr Sanjeev Jindal, General Manager (CSR), AAI
6. Ms Charul Shukla, General Manager (Architecture), AAI
7. Mr K C Meena, General Manager (Horticulture), AAI

'Bounce Off'–Debate on "Is Sustainable Affordable?"

Green building movement started about two decades back across the globe. The movement was triggered by the extravagant use of resources in modern buildings and it was imperative to curb the wasteful consumption. So, the initial programmes targeted the affluent section of buildings such as commercial buildings. Simultaneously, technology also grew towards more efficient solutions which were at times more expensive than the conventional options. This created a perception that sustainability comes at a cost.

But, considering the current challenges faced by humanity all over the world, sustainability is not an option; it is indeed the only way forward. However, is sustainability affordable?

'Bounce Off' was organized by GRIHA Council on December 11, 2017, as another prelude event to the GRIHA Summit to debate on the question. A panel of 6 eminent personalities, enumerated as follows, deliberated on the theme "Is Sustainable Affordable?"



Panellists:

For the motion – Yes, sustainable is affordable

- Ar. Vinod Gupta, Space Design Consultants
- Ms Anumita Roychowdhury, Executive Director – Research & Advocacy, CSE
- Ar. Vivek Gupta, AVA Architects

Against the motion – No, sustainable is not affordable

- Mr Prashant Thakur, Head of Research, ANAROCK Property Consultants
- Mr Sunil Aggarwal, Adjunct Professor, School of Real Estate RICS and Managing Director, Black Olive Ventures Pvt Ltd.
- Mr Gaurav Gupta, Joint Secretary, CREDAI and Director, SG Estates Ltd

The event was covered and moderated by Zee Business and aired on 16 December at 10:30 a.m. on Zee Business.

'Daylighting' Workshop

A workshop on daylighting was organized on December 13, 2017, at TERI with the objective to deliver practical knowledge to access and monitor daylighting via simulation of three-dimensional models. The session covered fundamentals of lighting and application of software tools for daylight simulation for assessing visual comfort.

A total of 24 participants, comprising architects, consultants, and academicians, attended the workshop..

'Spectrum of Glass'–A workshop on Glass

The 'Spectrum of Glass' workshop organized by GRIHA Council, in association with AIS India Glass Ltd, highlighted all aspects of how glass is a green and sustainable material right from the cradle to grave. The intent of the workshop was to help stakeholders understand glass as a building material and aid in selection of glass, based on its safety aspects, structural stability, aesthetics, thermal and optical properties, and so on.

The workshop was received very well by the participants.

CURTAIN RAISER

To mark the inauguration of the Summit, a curtain raiser dinner was organized on December 17, 2017, at The Claridges Hotel, New Delhi. The welcome address was delivered by Dr Ajay Mathur, President, GRIHA Council and Director General, TERI, followed by the keynote address by Mr Anders Hall, Chairman, Marketing & Communication, ES-SO (EU Solar Shading Organisation), International Business Development, Somfy International, and the vote of thanks was delivered by Mr Sanjay Seth, CEO, GRIHA Council and Senior Director, TERI.

Dr Ajay Mathur in his welcome address urged all the participants to ensure that buildings consume lesser energy as compared to earlier. He stated that in years to come, the cooling loads will govern the space conditioning in the country. He went on to enumerate the various factors which are responsible for space conditioning which include the type of fenestration, quality of glazing, and so on, and how it is imperative that these are reviewed carefully in order to achieve the targets set in India's intended nationally determined contributions in the global agreement on sustainability.

Mr Anders Hall stated how energy democracy is a unique term in the Indian context, subject to achievement of certain challenges. Owing to tropical climate, India has a huge potential for efficient solar shading devices. In Europe, the transportation sector accounts for 25% and the building sector accounts for 45% of the total energy consumption. In India, 40% of the energy is consumed for cooling buildings. At present, India has 1.5 million solar shading devices whereas there are 10 million in the United Kingdom. It has been observed that majority of the residential and commercial establishments running in the country consume way more energy than required. Mr Hall illustrated that dynamic shading can be helpful in this regard as it regulates the amount of light and heat entering the building spaces according to the requirement. It shall also account for dynamic Solar Heat Gain Coefficient (SHGC) and flexibility in the operation of windows, glazing, blinds, and so on. He also finds it important that people are extended the flexibility to intervene in centralized energy management system in a building. Specification of solar shading is also critical as it guides the selection of the right kind of glass. It has been found that the average movement per blind per week is only 1.75 times all over the world. It is important to factor such considerations while conducting energy simulations for buildings in order to derive correct results. He stated that current simulations work only for meeting compliance. He also spoke about Early Stage Building Optimisation (ESBO), a building simulation tool which aids in identifying gaps in design and construction processes at early stages of design development and opined that involvement of energy consultants early in the project would help in achieving better results. Conventional ideas need to be challenged and adoption of a holistic approach since the beginning of the project is the only way to achieve affordable sustainability. He further explained that incorporating solar shading devices need not increase the project cost; in fact it can cut down other costs related to electro-mechanical equipment to achieve better thermal and visual comfort. He announced that solar shading building system has been recognized in the 2018 version of Energy Performance of Buildings Directive (EPBD) in the European Union.

Mr Sanjay Seth delivered the vote of thanks and presented a brief of the summit line-up.


Ministry of New and Renewable Energy
Government of India
THE 9TH GRIHA SUMMIT 201
Delhi
NATIONAL HOUSING BANK
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SINICON
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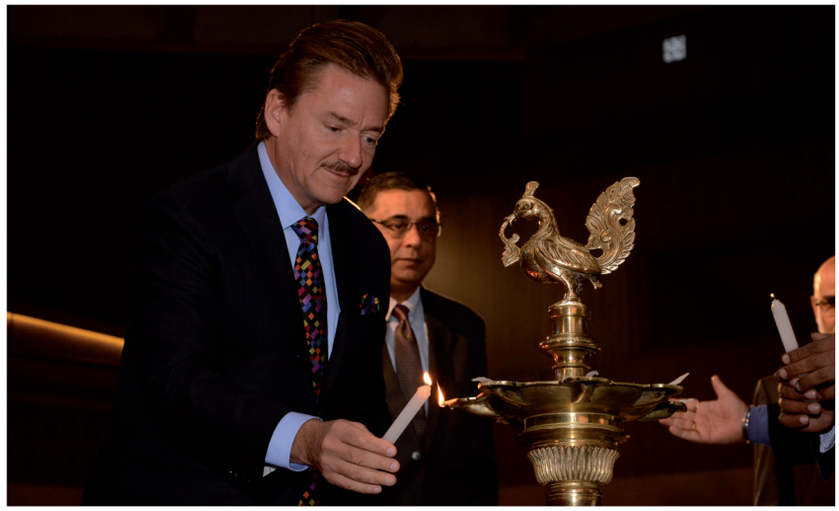
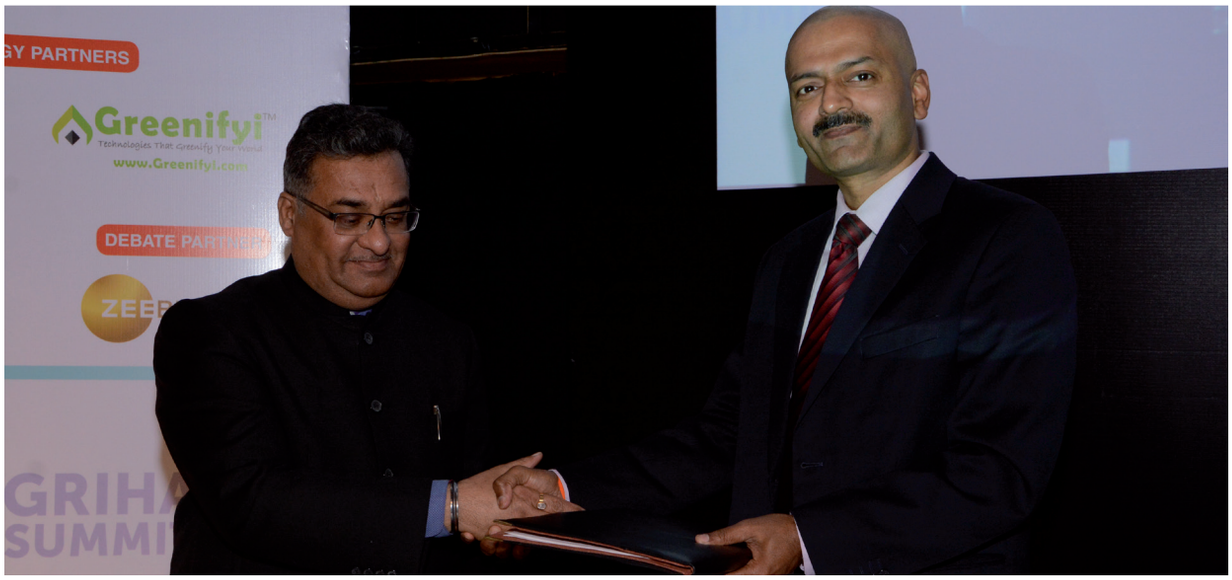
Ministry of New and Renewable Energy
Government of India
The Energy and Resources Institu

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INAUGURAL SESSION

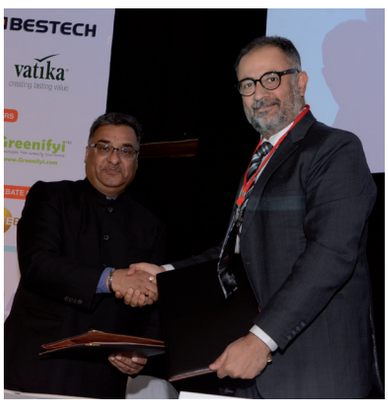
The 9th edition of GRIHA summit inaugurated on December 18, 2017, at India Habitat Centre, New Delhi. The inaugural session was graced by prominent dignitaries from in and around the country.

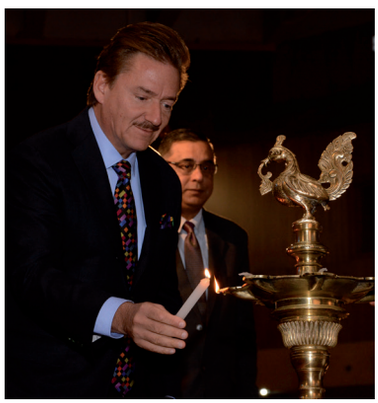
Dr Ajay Mathur extended a warm welcome to all the dignitaries, partners, and participants present at the inaugural session, organized at Stein Auditorium, India Habitat Centre, New Delhi. Dr Mathur emphasized on the theme of the summit, 'Sustainable is Affordable' and its significance in the present times. With a vast amount of infrastructure yet to be developed to meet the needs of the common man, going green through affordable means is imperative. GRIHA as an indigenous rating tool shall act to dispel the myth that sustainable is not affordable.

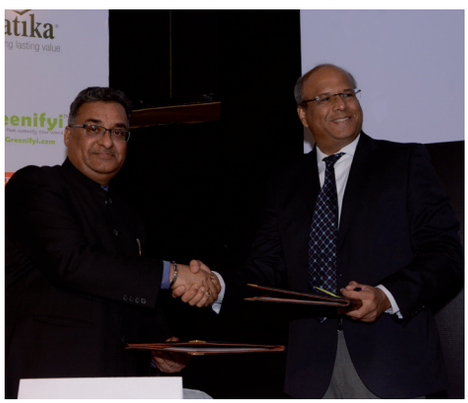
H.E. Dr Andreas Baum, in his keynote address, reiterated that sustainability should not be compromised keeping affordability in mind. The core areas of built environment—building materials, building design, and resilient cities—were highlighted such that sustainability and resource efficiency go hand in hand. Concluding the address, he laid emphasis on integration of government policies in urbanization for the development of resource and energy-efficient infrastructure.

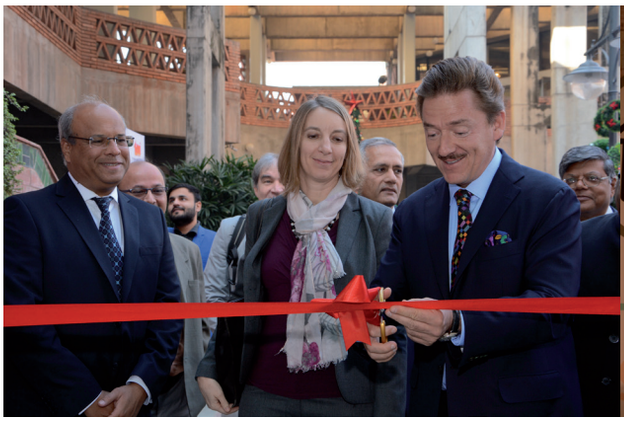
> *The biggest challenge today is the necessity to enhance resource efficiency.*
> ***-Dr Ajay Mathur***

While enumerating the achievements of significant milestones and developments of GRIHA Council during 2017, Mr Sanjay Seth, CEO, GRIHA Council and Senior Director, TERI, highlighted the exponential growth in the GRIHA footprint over the years. He spoke of the new partnerships forged during the 9th GRIHA Summit with esteemed organizations such as the National Housing Bank (NHB), Energy Efficiency Services Ltd (EESL), National Buildings Construction Corporation (NBCC), and Indian Society for Heating, Refrigerating, and Air Conditioning









> *Sustainability should not be compromised while keeping affordability in mind.*
> ***-H.E. Dr Andreas Baum***

Engineers (ISHRAE), with whom the Memorandum of Understanding (MoU) was signed during the inaugural session. In line with the theme, and walking the talk, GRIHA Rating for Affordable Housing was launched.

Mr Saurabh Kumar, Managing Director, Energy Efficiency Services Ltd (EESL), Mr Yogesh Sharma, Executive Director, National Buildings Construction Corporation (NBCC), Mr K Chakravarthy, General Manager, National Housing Board (NHB), and Mr Vishal Kapur, National President, Indian Society for Heating, Refrigerating, and Air Conditioning Engineers (ISHRAE) joined the dignitaries to commemorate the signing of MoUs.

PLENARY SESSIONS

Session I–Cost of Sustainability

Mr Hitesh Vaidya initiated the session by inviting those present for the World Urban Forum 2018 in Malaysia, to participate and understand the upcoming urbanization challenges. Shedding light on current environmental and urbanization issues, he said that the Forum can be one of the platforms where stakeholders from various fields come together, and participate in talks to exchange knowledge and experiences.

Moderator & Chair: Professor Kavas Kapadia, Former Dean of Studies and Head, Department of Urban Planning, School of Planning and Architecture, New Delhi

Panellists:

- Professor Jagan Shah, Director, National Institute of Urban Affairs (NIUA)
- Dr Abhijit Banerjee, Senior Adviser, Climate Change and Urbanisation, United Nations
- Ms Cecilia Freire Costa, Coordination Manager, European Union Delegation to India and Bhutan

> *Alternative thinking is required to move away from business as usual practice.*
> ***– Hitesh Vaidya***

> *It is a shared responsibility to make sustainability affordable.*
> ***– Cecilia Costa***

- Mr Rajesh Krishnan, Managing Director & CEO, Brick Eagle Group
- Mr S Senthil Kumar, Business Head, Institutional Sales, AIS Glass Ltd

Professor Kavas Kapadia initiated the panel discussion by emphasizing the symptoms of rudderless urbanization and highlighted the struggle in the form of polluted air and water bodies, exorbitant vehicular traffic, water and electricity shortages, housing sector backlogs, and so on. He highlighted the need to think about recycling, resource efficiency, and optimal use of resources, given the unrestricted consumption of goods and the prevalent 'use and throw' mentality.

Ms Cecilia Freire Costa presented a case for reconciling sustainability and affordability in the ever-expanding construction sector. She spoke about the steady increase in urban pressures and highlighted the absence of housing facilities for 40%–42% of the economically weaker sections (EWS). Interestingly, the building sector is already responsible for about 24% of greenhouse gas (GHG) emissions. Presenting experiences from the European Union (EU), she elaborated how there has been an increase in manpower production, reduction in waste, and consumption of lesser resources in the buildings sector. EU climate finance is providing funds for low carbon and sustainable development and has been motivating similar developments. Ms Costa also emphasized how private sector investment may act as an enabler to rapid development along with public partnership.

Next, **Mr Rajesh Krishnan** showcased a few case studies of successful models of low cost, user friendly, and space efficient housing. He showcased projects where construction costs were reduced by up to Rs. 300/- per square feet by considering occupant habits and preferences, and by using locally sourced construction material. This also helped reduce the carbon footprint by 30%–40%. He emphasized that the true cost of sustainability is not just in going green and it is imperative that priorities of sustainable development are optimized to ensure their affordability.

Mr Senthil Kumar began by quipping that glass and sustainability are generally dissociated from each other. He elaborated on the complexity of glass selection by saying that it is a challenge of fitting in budget, controlling heat, and yet providing optimum daylight, while simultaneously providing safety. He explained the parameters of glass selection considered by buyers, architects, and end-users, in order to meet the "happiness index", and that glass selection requires a 361° approach, achieving a balance between operating and capital expenditure. Further, he articulated how smarter glass technology, building orientation, and design play key roles while choosing glass type.

Finally, **Dr Abhijit Banerjee** highlighted how the material consumption economy in India is second or third largest in the world, along with highest material extraction in the world. The material sector does not have sufficient data to showcase the upcoming available material and energy consumption for extraction, carbon emissions, environmental impact, and so on. He emphasized the importance of enforcement of policy and code in facing the challenge of meeting basic needs. He forwarded the idea of labelling green products as a necessary tool to improve public procurement and that the government should invest in newer technologies to make it affordable for the general public.

> *Challenge is to understand how we can use glass and still be sustainable.*
> ***– Senthil Kumar***

Professor Kavas Kapadia concluded the session by emphasizing how it's the time to join hands together to think creatively and ensure implementation of ideas to make living sustainable and affordable.

Session II–Sustainability as a Driver for New Ideas

Thematic Address: Ar. Vijay Garg, Vice President, Council of Architecture

Moderator: Mr Gaurav Shorey, Founder Member, 5waraj & Managing Director, PSI Energy

Speakers:

- Mr Kushagra Srivastava, CEO, Chakr
- Mr Vinay Kumar Tiwari, Vastu Vihar
- Mr Swapnil Chaturvedi, Founder, Samagra
- Mr Ashwath Hegde, Founder, EnviGreen
- Mr Narayana Peesapaty, Founder, Bakey's Food Pvt. Ltd (edible cutlery)

The session deliberated on the new ideas and innovations which proactively address the cause of sustainability. The session was chaired by **Mr Gaurav Shorey** and the eminent speakers chronicled their journey of sustainability leading on the path to success.

Ar. Vijay Garg, in his thematic address, highlighted the serious considerations that need to be made to the notion that sustainability can be embedded in modern construction by adopting an innovative rather than checklist approach. The challenge now lies with the green building industry and various professionals involved in this sector to innovate a sustainable solution in.

> *Innovation is likely to take place in terms of finances, construction practices, products and solutions for masses.*
> ***– Ar. Vijay Garg***

> *I have made world's first automatic manufacturing edible cutlery machine.*
> ***- Mr Narayana Peesapaty***

Depleting ground water levels was the major cause which led to the innovation of edible cutlery by **Mr Narayana Peesapaty.** His edible cutlery, especially the spoons, were made of millets which consume 60% less water as compared to those of rice, having a shelf life of 3 years with no added chemicals or preservatives.

Mr Swapnil Chaturvedi touched on the topic of sanitation and his attempt to provide clean toilets to the poor. Till date, his team has constructed and regularly maintains more than 100 blocks of toilets, serving more than 1,50,000 people daily.

> *Any design has to be socially and financially sustainable for successful implementation.*
> ***- Mr Swapnil Chaturvedi***

Being inspired by Ar. Laurie Baker's work, **Mr Vinay Kumar Tiwari** spoke about his projects, which use broken and locally available construction material to accomplish splendid structures in Bihar. Alternatives

> *People oriented designs have inspired me to build more than 40,000 low cost and resource efficient buildings in India.*
> ***- Mr Vinay Kumar Tiwari***

to plastic are the need of the hour, as none of the players in world are manufacturing 100% compostable plastic.

Mr Ashwath Hegde has successfully demonstrated manufacturing compostable plastic alternatives, using Areca nuts (fruit of the Areca palm), vegetable oils, Tapioca starch, and other natural materials.

> *Concept of 'Make in India' can only be made successful by providing alternatives to plastic.*
> ***- Mr Ashwath Hegde***

Mr Kushagra Srivastava discussed about the adverse effects of air pollution in cities, while emphasizing on the fact that about 80% of premature births in the cities are due to particulate matter. The technology developed by his team is a minor retrofit that sits at the top of the diesel generators and captures the exhausts without reducing the engine's efficiency. The exhaust post collection can then be converted in paints that can be used to print T-shirts, canvas, and so on.

The session concluded with the understanding that there has been opposition to every innovation in the history of man, but unique ideas in the scope of sustainability must be chased without any resistance to passion and purpose.

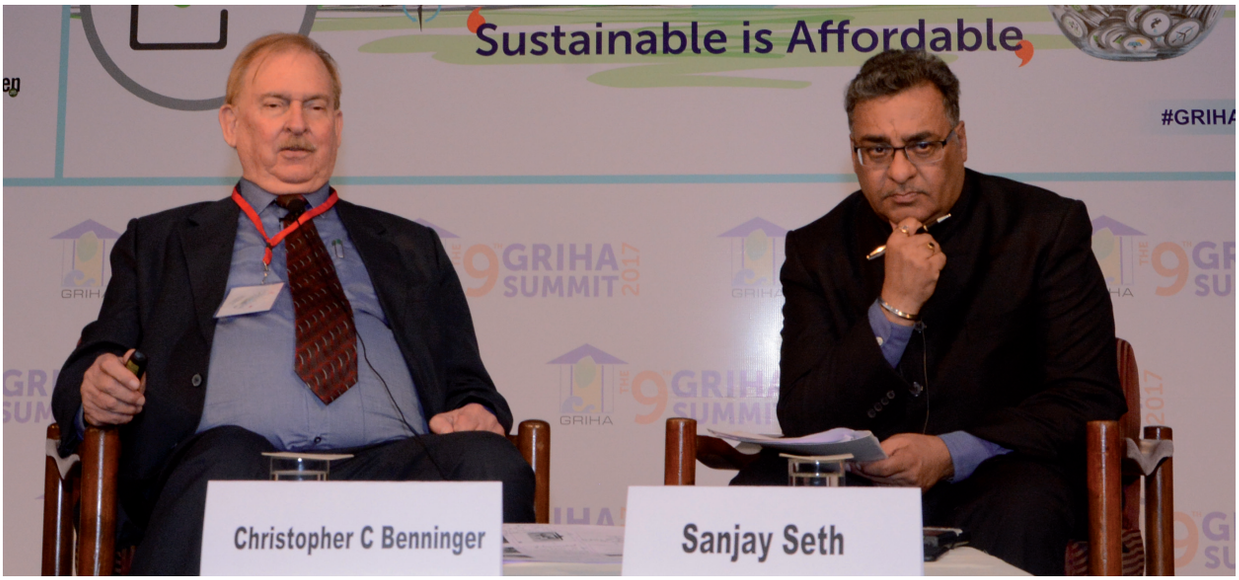
KEYNOTE ADRESSES

Keynote Address I

Mr Sanjay Seth, CEO, GRIHA Council and Senior Director, TERI, welcomed Ar. Professor Christopher Charles Benninger, Founder Chairman and Principal Architect, CCBA Designs and invited him to deliver the keynote address

Ar. Christopher Charles Benninger, a 'Great Master Architect' award recipient, founder of the School of Planning, Ahmedabad (now CEPT University) and the Center for Development Studies and Activities (CDSA), Pune, showcased his presentation on Green Cities, Green villages and Green People. According to him, "Green buildings can be categorized under green by nature, by number and one that is scientifically green." He showcased his designs since 1970, when the green building concept was at a nascent stage. Projects, such as Alliance Francaise, Ahmedabad and CDSA, Pune, were designed on sustainable (design) principles in order to achieve thermal and visual comfort without using air conditioners, fans, and artificial lighting during daytime. Their electricity bills were minimal, as compared to the current conventional building, and so was the carbon footprint.

Under the category of 'Green by science', he showcased his IA&B award winning project Kochi Refinery Headquarters, Kerala. The building concept evolved to integrate the spatial and functional requirement of the client, leading to a glass cylinder sitting inside a jaali tube. The strong building form offered beautiful views of the backwaters, coconut trees and thick forest cover, and optimum daylight in the interiors, while cutting down the direct heat gain. Similarly, at the Forbes Marshall Greenfield Field Industrial Campus at Chakan, he used aluminium jaali and skylight to allow filtered and indirect natural light inside, thus reducing the use



of artificial lighting. He highlighted another interesting project wherein Passive Downdraft Evaporative Cooling (PDEC) system was used to meet thermal comfort inside the space, based on scientific calculations, in order to reduce energy consumption along with other sustainable design strategies.

Under the category of 'Green by number', he presented Suzlon One Earth Global Corporate Headquarters, a 5 Star GRIHA rated project, as a blend of traditional architecture with cost-effective strategies, without compromising on the aesthetics and functionality of the spaces. Further, he discussed the 'Thimphu Structure Plan' city plan of Bhutan, specifically highlighting the participatory micro-level planning and the measures taken to protect the fragile ecosystem and open space of the city. While talking about the Smart City programme, he presented the case of Pune city and emphasized on the need for integrating the requirements of the informal sector in city planning.

He concluded his presentation by providing an insight on developing concept of 'Green People' such that, the low income and economically weaker section of the society can be involved in building storm water bunds and watershed management related projects, thus providing another source of income and contributing to the upliftment of their lifestyle.

Keynote Address II

Chair: Dr Ajay Mathur, President, GRIHA Council & Director General, TERI

Keynote Address: Professor G Shankar, Head & Chief Architect, Habitat Technology Group

Professor G Shankar, recipient of Padma Shri in 2011 and a pioneer of people's housing movement in the country, introduced a cost effective and sustainable housing concept which uses building technologies that are effective, user friendly, and sustainable. His concept of green architecture has brought multi-faceted change in the Indian shelter sector.

His perspective of transforming people's lives through his knowledge and skills was encouraged and motivated

> *"Sustainability needs to be implemented at that platform where poor people live."*

by the approach of "Different and Less Travelled Route", in turn inspired and motivated by poet Kamala Das and Saint Mother Teresa.

He emphasized that the theme of the GRIHA Summit, 'Sustainable is Affordable', lightens his heart and is a mandatory requirement in the present shelter sector of the country. He further added how sustainability in habitat provision can create better economic opportunities for the poor and marginalized by creating more livelihood and employment options and can also solve the problem of climate change.

According to him, considering the urbanization levels of India and increasing pressure on shelter sector, fringe areas will be the source of architectural and engineering solutions. He also mentioned that in order to achieve 'sustainable paradigm of building beautiful shelters' factors such as water and indoor air quality will play a critical role. Quoting Laurie Baker 'build only the essentials', he said that incremental housing should be promoted in order to achieve resource efficiency and site manipulation should be avoided with more focus on sustainability from the basic designing part of the house. He concluded on the note of promoting the use of environment-friendly resources, such as mud and bamboo, in construction and said that 'habitat literacy' should become a national acceptance.

PARALLEL TRACKS

Existing today, Retrofitted for Tomorrow

Thematic Address: Mr Santosh Kumar Thakur, General Manager (Technical), EESL

Moderator: Mr Rajendra Chaudhari, Director (Commercial), NBCC

Panellists:

- Mr Rumi Engineer, Head – Energy Management & Greener India Initiative: Godrej & Boyce Mfg. Co. Ltd.
- Mr Arun Bhatia, Managing Director, UTC- Climate, Control and Security, India
- Dr G C Datta Roy, Advisor, DESL
- Mr Anders Hall, Chairman, Marketing & Communication, ES-SO (EU Solar Shading Organisation), International Business Development, Somfy International
- Mr Akash Jain, Director, Alien Energy Pvt Ltd

This session deliberated on showcasing the work completed by each of the renowned speakers in retrofitting the existing building into sustainable buildings. Eminent speakers from the industry shared their experiences and techniques in tailoring energy consumption within the existing buildings industry.

In his thematic address, **Mr Santosh Kumar Thakur,** mentioned the steady growth rate of the construction industry at 10,000 sq. m per minute. Thus, there is a need to alter the usage of energy, if sustainable growth is to be ensured. He insisted that energy consumption can be reduced in three ways—intervening with the hardware (by replacing high energy consuming installations with low energy consuming installations), intervening with the software (installing sensors and similar devices), and by intervening with human consumption behaviour.

Mr Rumi Engineer shared his experience of retrofitting 8 buildings so far and its significance. He reiterated the mandatory nature of the exercise. Design and technology are integral to achieve energy efficiency. Along with an efficient design, periodic operation and maintenance is also required. He further stated that an integrated and systemic approach is required to create and sustain efficient buildings.

> *"Getting a technology is not like importing someone's solution and exporting your problems. Solutions have to be tailor made to meet that particular building/application."*
> ***- Mr Rumi Engineer***

Mr Arun Bhatia laid emphasis on passive design strategies in order to minimize future energy consumption. According to him, chiller plants consume the major portion of energy which is about 45%. He further states that buildings are generally designed on peak load consumption; however, they hardly work on peak loads. Hence, intelligent systems are required to

vary the cooling/heating depending on the fluctuations in load. Also, lack of synchronization is the major reason for non-performance of existing buildings.

Dr G C Datta Roy considers human ware as the biggest contributor towards inefficient buildings. He elaborated how minimum energy design is the only way to achieve a sustainable world and it is important to constantly manoeuvre challenges in order to devise effective and efficient mechanisms and create a more resource-efficient building.

Mr Anders Hall laid emphasis on the inclusion of solar shading strategies in the buildings, whether existing or new, in order to cut down the heat ingress of the building. To explain these, he cited various examples and researches. One of the researches demonstrated a comparison between manual blinds and automatic blinds. It was shown that the average movement/blind/week in case of a manual blind was 1.7 while that for an automatic blind was 42.

> *1 sqm of building façade in Delhi during 1 year is exposed to sun with enormous energy equivalent to that required to make 40,000 cups of coffee or boiling 30,000 eggs.*
> ***- Mr Anders Hall***

In this context, **Mr Akash Jain** elaborated his company's role in the field of auditing and retrofitting of existing buildings. He further gave examples of the different kinds of projects undertaken by his team, thereby contributing to improve the efficiency of existing buildings.

> *Analysing the energy consumption of an existing building is like analyzing cholesterol and BP of a system.*
> ***- Mr Akash Jain***

In order to retrofit the existing building as well as constructing energy efficient buildings, synchronization amongst the various building components is required. Also, with the advancement of retrofitting techniques and mandate of building codes, it is envisioned that almost all the existing buildings will be retrofitted by 2021.

Track II–Towards Zero Waste Buildings

Thematic Address: Ar. Chitra Vishwanath, Principal Architect and Managing Director, Biome Solutions

Moderator: Dr Suneel Pandey, Senior Fellow and Director, Centre for Waste Management, TERI

Speakers:

- Dr Asokan Pappu, Senior Principal Scientist, CSIR-Advanced Materials and Processes Research Institute Professor Academy of Scientific and Innovative Research, CSIR India
- Mr Ashish Jain, Director, RecMech Enviro Pvt Ltd. and Indian Pollution Control Association
- Mr Sameer Divekar, Director, dbHMS
- Mr Gaurav Joshi, Co-founder, Extra-Carbon

Moderated by **Dr Suneel Pandey,** the session initiated with a thematic address by **Ar. Chitra Vishwanath.** She spoke briefly about the positive imprint of buildings and elaborated by giving examples of her own projects at Biome Solutions. She highlighted how construction debris are growing since building houses is not an exercise in isolation; but we can build now in such a way that when it is broken it

> *Build now in such a way that when it is broken down, it can be reused.*
> ***- Ar. Chitra Vishwanath***

can be reused. She reiterated on perceiving "waste" as a "resource" and showcased a few examples on the same.

Dr Asokan Pappu began his presentation with "how waste can be utilized in construction". He presented the product 'hybrid green composites' and explained the scope of the material. Dr Suneel Pandey proposed inclusion of this material in the GRIHA catalogue.

> *As long as we are alive, we are going to generate waste. But the idea is to manage the waste 'Sustainably.*
> ***- Dr Asokan Pappu***

Emphasizing on the struggle to adopt the 2–3 bins segregation system, **Mr Ashish Jain** elaborated how during construction of a house, often the space for dustbins is neglected. He showcased different ways of composting organic waste materials and also introduced a new system, "Aerobin" which

> *Zero waste is circular economy.*
> ***- Mr Ashish Jain***

has a regular supply of oxygen for decomposing waste. He concluded saying that 'Solid waste management is the need of the hour and architects need to address the issue'.

Mr Sameer Divekar briefly explained the strategies adopted at Nalanda University for net zero energy, water, and waste buildings. He also explained how waste materials can be used for generating energy and electricity and admired the university for taking steps towards environmental conservation and judicious use of natural resources.

Mr Gaurav Joshi pointed out the fact that the 'problem of waste management is collection'. He explained how in United Kingdom, waste management is known as "material management" keeping in mind the importance of waste. He also highlighted his organization, Extra Carbon's efforts towards effective waste management. The system, Zoomley.com was also introduced wherein people can give their waste and earn credits which can be converted in PayTM, Freecharge, and other similar services as well as used for shopping. He also placed emphasis on behaviour before design to ensure a fantastic end product.

Track III–Sustainable Water Management: Affordable Solutions

Moderator: Dr S K Sarkar**,** Director, Water Resources Division, TERI

Panellists:

- Dr Renu Khosla, Director, Centre for Urban and Regional Excellence (CURE)
- Ms Hina Zia, Professor, Faculty of Architecture & Ekistics, Jamia Millia Islamia, New Delhi
- Mr Sandeep Narang, Independent Consultant - Sustainable Construction Practices
- Mr Rajesh Jain, Managing Director at Enhanced WAPP Systems (India) Pvt Ltd

Special Address: Mr Jyotikumar Jha, Deputy GM Sales (North), Roca Bathroom Products Pvt Ltd


Dr Renu Khosla


Ms Hina Zia


Mr Sandeep Narang


Mr Rajesh Jain

The session focussed on India's escalating water crisis and the plausible solutions available to the masses. The distinguished speakers of the session, with years of experience in the field and vast knowledge , enlightened the audience on how the nation has slithered from being water self-sufficient to water deficient, with more than half of its population without access to clean water. The reasons behind this unfortunate journey were discussed in order to understand the 'sustainable and affordable' way forward. Ancient India has been famous for its traditional water conservation strategies, such as bawdis, kund, and taanka. Both droughts and floods have been a common occurrence, however, the strategies to deal with the crisis situation were incredible back then. Agra, cited as an example during the session, was once brimming with 70,622 wells and 4,991 drinking wells. However, mismanagement, haphazard growth of cities, and institutional and political

> *We need to move towards water resilience instead of water sustainability.*
> ***– Dr Renu Khosla***

incompetence over the years led the country to a disastrous stage. Despite this sad state of affairs, the speakers guided towards the sustainable and affordable ways of fighting the crisis situation. Strategies, such as plain sailing as general awareness amongst the countrymen, use of water efficient fixtures in buildings, management of water at domestic level and construction sites to rainwater harvesting, and sustainable urban drainage strategies (SUDS) must be an integral part of our future,

> *Lack of urban planning is responsible for urban flooding.*
> ***– Ms Hina Zia***

The session concluded with an inspiring and thought provoking message "We as a nation need to move towards resilient water management system instead of water sustainability, as sustainability tends to loosen the grip in severe crisis but resilience has the power to deal with the changing dynamics".

Track IV-Thermally Comfortable and Energy Efficient Group Housing

Thematic Address : Mr Abhay Bakre, Director General ,Bureau of Energy Efficiency

Speakers:

- Mr Marylaure Crettaz Corredor, Head, Swiss Cooperation Office in India (Panel Chair)
- Ar Ashok B Lall, Principal, Ashok B Lall Architects
- Mr Pierre Jaboyedoff, Senior Engineer and Energy Consultant, Partner in Effin'Art Sarl, Indo- Swiss Building Energy Efficiency Project
- Shri K K Joadder, Chief Town Planner, Town & Country Planning Organization

Mr Abhay Bakre initiated the thematic address briefing the invention of air conditioners. He addressed that on 14th December, Hon'ble President also unveiled the interactive online portal, ECO-NIWAS (Energy COnservation – New Indian Way for Affordable & Sustainable homes) for increasing awareness to build sustainable and energy efficient homes in the country. The tool has developed after performing more than 1 lac simulations. The National Energy Conservation Awards Programme recognizes the energy efficiency achievements in 56 sub sectors across industry, establishments and institutions such as thermal power stations, office and BPO buildings, hotels, hospitals, shopping malls, zonal railways, railway workshops and stations, municipalities, State Designated Agencies and manufacturers of BEE Star labeled appliances/equipment and electricity distribution companies. He briefed that the policy interventions should be put in front of people.

> *Government of India has committed itself to being sustainable and provide housing for all.*
> ***– Mr Abhay Bakre***

Mr Ashok B Lall commented that development control regulation must be designed to produce low carbon urban fabric considering a 50 year perspective. He further emphasized on following subsets:

- Affordability – Cost/labor
- Resource efficiency – Load/Energy
- Low carbon - Materials

He drew attention towards affordability and resources efficiency by showing five states likely to be more than 60% urbanised.

> *A combination of resource-efficient and low-carbon construction with compact urban morphology and low-carbon city transport produces low carbon and affordable urban systems.*
> ***- Ar. Ashok B Lall***

Mr Pierre Jaboyedoff focused on residential buildings. He briefed about a code on envelope performance for buildings to assist architects and professional engineers to comply with the envelope thermal performance standards prescribed in the Building Regulations. He presented few calculations done on residential envelope transmittance value (RETV) considering the three basic components of heat gains through the external walls and windows of a building. These are:

1. heat conduction through opaque walls,
2. heat conduction through glass windows, and
3. solar radiation through glass windows

He concluded by briefing the importance of good thermal quality of building envelope.

Mr. K K Joadder started his session on energy efficiency in the context of urban planning & building regulations and elaborated components of energy efficiency and sustainability in planning that are:

- Efficient landuse planning
- Transport and landuse integration
- Efficient urban utilities and services
- Building regulations and sustainable energy solutions

He concluded by proposing building regulation in energy efficiency, water efficiency and waste management.

A question was raised that seabirds (solar chimneys) can be validated by RETV. Mr Pierre Jaboyedoff replied that RETV is based on the 40,000 simulations.

> *Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meettheir own needs.*
> ***- Mr K K Joadder***

Track V : Financing Sustainable Affordable Housing

Thematic Address: Mr Sriram Kalyanaraman, MD & CEO, National Housing Bank

Moderator: Mr Krishan Dhawan, CEO, Shakti Sustainable Energy Foundation

Panellists:

- Mr Vikramjit Singh, Senior Country Officer, International Finance Corporation (IFC)
- Mr R Vaithianathan Ramachandran, Managing Director, Tata Capital Housing Finance Ltd
- Mr Pankaj Dugar, Chief Executive Officer of Hospitality & Delhi, IREO Management Pvt Ltd.

The session focussed on the rising urbanization levels and the need to find solutions for housing shortage. The session kick started with a thematic presentation by Mr Sriram Kalyanaraman, covering the current scenario of financing affordable houses, government initiatives in this direction, challenges faced, and the road ahead. He spoke about some of the initiatives undertaken by National Housing Bank (NHB), such as introduction of pricing index, which is currently being used by several city agencies to determine circle rate; collaborations with multi-lateral and bilateral funding agencies, such as AFD, the World Bank, and DFID, to support development of affordable houses; and the credit-linked subsidy scheme. The need to involve urban planners in the housing sector, besides reducing the cost as well as time duration of construction, and undertaking adequate maintenance activities was also discussed. The ability of customers to pay for affordable houses can be increased through innovative measures, such as reduction in property tax or electricity tariff or even through participation of the house owners as labours.

> *When I say sustainable is affordable, I also say that affordable is sustainable.*
> ***- Sriram Kalyanaraman***


Mr Krishna Dhawan


Mr Vikramjit Singh


Mr R Vaithianathan Ramachandran


Mr Pankaj Dugar

Attention should also be paid by the industry regarding the embodied carbon of materials used while constructing affordable houses. Further, learning can be derived

> *Embodied energy of materials is an important aspect of affordability.*
> ***- Krishan Dhawan***

through other sector, like the LED lighting, for innovation in the affordable housing sector. It is important to factor in issues, such as thermal comfort, natural light, and quality and quantity of materials used to make affordable and sustainable buildings.

> *Strengthening of the supply side of affordable housing through government support is necessary.*
> ***- Vikramjit Singh***

> *The customer's ability to pay for an affordable house has increased through subsidies like reduced electricity tariff or lower property tax by Pune Municipal Corporation.*
> ***- R Vaithianathan Ramachandran***

> *There is myth that sustainability is associated with huge cost.*
> ***- Pankaj Dugar***

Going forward, the need to work with the state governments to overcome the supply side constraints was highlighted. Since land is the basic requirement, availability of land with basic infrastructure around it (power, water, transport, etc.) at a reasonable rate will be the key to attract private players in the affordable housing sector. Currently, there exists a disconnect between the central and state levels in terms of density norm or the floor area ratio. Also, the importance of urban local bodies cannot be ruled out and their capabilities need to be augmented.

Track VI–Preparing the Next-Gen for Sustainability

Moderator: Ms Livleen K Kahlon, Fellow and Associate Director, School Outreach, TERI

Panellists:

- Professor Rashmi Diwan, Head- School Leadership, N.U.E.P.A
- Professor Dinesh Kumar, Head- DESM, NCERT
- Mr Ratish Nanda, Conservation Architect, India CEO- Aga Khan Trust for Culture
- Ms Ishita Jalan, Environmental Engineer, Dr Reddy's Labs
- Dr B C Sabata, Sr. Scientific Officer, MGICCC, Delhi Government
- Ar. Ankit Bhalla, Deputy Manager, GRIHA Council

The session was initiated by **Dr B C Sabata** who spoke on the practical problems faced by institutional buildings in achieving a sustainable campus. Further, he emphasized on the need for green jobs and green skills that need to be inculcated to the younger generation. He also pointed out how potential cities, like Delhi, with more than 2,000 schools and colleges should be made sustainable by enforcing existing laws without any discrepancy. This was followed by **Professor Rashmi Diwan** who delivered a presentation on skills for leadership in transforming schools for change. She explained the various strategies undertaken to re-engineer school systems with respect to their context and the importance of integrating leadership development and management in academic curriculum.

> *When every child learns, then every school excels.*
> ***- Professor Rashmi Diwan***

Professor Dinesh Kumar, began his speech by analysing the impact of human civilization on the planet and further spoke on the positive aspect of government policies and bye-laws. However, he also pointed out that the execution of these policies is not effective in the long run to achieve sustainable goals.

> *Children are going to be the ambassadors for change.*
> ***- Professor Dinesh Kumar***

Mr Ratish Nanda from Aga Khan Trust for Culture presented a series of case studies on the sustainable process of conservation of historic sites and revitalization projects across the world. Apart from improving quality of local community and encouraging craftsmanship, he also stated how more than 5,00,000 children walked around these monuments every year as a part of their educational system. He also shared his experiences in renewal projects on an urban scale stating that the "principal problem in the community was not drug or security but cleanliness".

Ms Ishita Jalan spoke about the traditional methods of socio-cultural building designs. She conveyed the concepts behind the ancient water management system with step well as a case study. "Green buildings are the tread for students to connect with system, which impacts their real education."

Next, **Ar. Ankit Bhalla** delivered a presentation on "GRIHA for Existing Day Schools" – a rating cum evaluating tool. He highlighted the intent and the appraisal method of the rating. He also emphasised on the idea behind the working of the tool on how school children were involved in the rating process and empowered the next generation of citizens. The session concluded with Ms Livleen K Kahlon speaking on how cultural conservation lags behind environmental conservation. She also added that creating awareness among children on sustainable issues should be of utmost importance for a brighter and sustainable future.

Track VII–Occupant Wellness : How Buildings Shape Health and Habitats

Moderator: Mr Tanmay Tathagat, Director, Environmental Design Solutions Pvt Ltd.

Panellists:

- Dr Kapil Goel, Medical Epidemiologist/Senior Medical Consultant
- Dr Jyotirmay Mathur, Professor, Mechanical Engineering, Malaviya National Institute of Technology, Jaipur
- Dr Shweta Manchanda, School of Planning & Architecture
- Mr Anand Murty, Technical Training Manager – APAC
- Mr Sayantan Sarkar, NRDC

The session was moderated by **Mr Tanmay Tathagat** who introduced the subject of occupant wellness and its need in building science.

Dr Kapil Goel, a senior medical consultant elaborated on the subject of occupants' health and well-being with reference to Indoor Environment Quality (IEQ) of the building. He defined wellness as a state of healthy mind as well as healthy body and not just absence of any disease or infirmity. In the course of the discussion, he emphasized on parameters, such as humidity, visual comfort, ergonomics, thermal comfort, ventilation, and so on, that affect the occupants' overall comfort.

> *One spends 80% of the time indoor, hence it is important to have a balance between energy efficiency and level of wellness of occupants.*

Dr Jyotirmay Mathur covered the aspect of adaptive thermal comfort by describing the recent developments in India and broadly touching upon the ISHRAE 1001:2016. He emphasized procedures and specifications for measuring thermal comfort and also elaborated on the need of selecting the location and time-duration so as to ensure a representative sample.

Dr Shweta Manchanda presented the interrelation of occupant wellness and productivity in an office environment. She highlighted the need of sustainable building design since it not only increases the productivity of an employee but also positively affects the real-estate value of the building. Dr Manchanda cited examples from the United Kingdom and the United States of America of decreased absenteeism (i.e. increased productivity) of employees in a green building.

> *The procedure and specifications of measuring thermal comfort are highly critical.*
> ***- Dr Jyotirmay Mathur***

Dr Anand Murthy elucidated on the inter-linkages between role of insulation and Indoor Air Quality (IAQ) by drawing attention on how improper insulation leads to dampness and growth of moulds. He further discussed the various reasons causing dampness and condensation, such as inefficient material, improper installation, severe surrounding conditions, and wrongful insulation thickness design.

> *We have still to realize the exact impact of sustainable design on human resource development .*
> ***- Dr Shweta Manchanda***

Mr Sayantan Sarkar elaborated on the topic of cool roofs. He mentioned that the demand of cooling in Indian cities is unparalleled and the potential of cool roofs presents a promising solution. He highlighted the benefits of the same by citing examples from New York, USA and also discussed about the pilots in Indian cities, such as Ahmedabad and Hyderabad, for incorporating cool roofs as a part of the states' Heat Action Plan (HAP).

> *The material to be used for insulation should be accompanied with efficient installation; otherwise even the best of the materials available may fail to perform.*

Track VIII–Rethinking Construction Materials for a Sustainable Future

Thematic Address: Dr Shailesh Kumar Agrawal, Executive Director–Building Materials & Technology Promotion Council (BMTPC), Ministry of Housing and Urban Affairs, Government of India

Chair: Shri Saurabh Diddi, Director, Bureau of Energy Efficiency

Panellists:

- Mr Cesare Saccani, Managing Director, ICMQ Certification India Pvt Ltd.
- Dr Sameer Maithel, Director at Greentech Knowledge Solutions
- Mr V Revindran, Director–Sales and Marketing, Sinicon PP
- Ms Megha Behal, Research Associate, Sustainable Buildings

The session was initiated with a thematic address by **Dr Shailesh K Agrawal** on the present initiatives undertaken by Ministry of Housing and Urban Affairs, Government of India related to sustainability. He publicized new construction systems, such as sandwich panel systems, prefabricated concrete, and so on. He questioned the usage of certain building materials that have less dependence on natural resources, based on agricultural waste, or construction technologies which optimize the use of cement, sand, water. He quoted that, keeping in mind the availability in construction industry "the next World War would be on sand". He stated the innovations in European countries, such as prefabricated multi houses, 3D printed houses, geo polymer concrete, and so on. The Government of India aims to provide Housing for All by 2022; currently 12 million houses are to be built to fulfill the target, that is, 7,000 houses per day. It is important to question if this is possible with the existing construction materials and construction technologies. So, the need of the hour is to fast track the construction process in a sustainable way. He also mentioned that there is a need of a rating system for EWS housing in order to bring more sustainability in the industry. He discussed in detail the green aspects of construction, such as resource efficiency, energy efficiency, eco friendliness, health of occupants and workers, speed of construction, quality, and safety. He presented the construction systems promoted by BMTPC for mass housing, such as the Monolithic Concrete construction technology, Automated or self-climbing formwork, Modular tunnel formwork, Structural stay-in-place formwork, Precast Sandwich panel system, and so on. He endorsed the prefabricated construction technology by showcasing a steel building constructed in 48 hours in Mohali, Punjab, which was entirely factory made and assembled on the site. He declared the recent initiative undertaken by Ministry of Urban Development

> *The next world war would be on sand.*
> ***- Dr Shailesh Kumar Agrawal***

which aim to look for the future construction technologies around the globe that are sustainable, scalable, and adaptable.

Shri Saurabh Diddi cited that due to the high demand for construction materials and speed of construction, green aspects, such as quantity, cost, energy consumed for post and pre occupancy, should be anticipated.

Dr Sameer Maithel began his presentation by mentioning that only 25% of the total construction industry in India is organized and 75% continues to be unorganized in rural and small town areas wherein construction is conducted through small contractors, builders, and masons. He discussed the walling materials which are used for the later segment and mentioned that till 2011, 95%–98% of the existing building stock is from traditional building materials. Brick masonry has emerged as the most preferred type of construction in rural areas, replacingkacchha houses and in urban areas, particularly for low rise construction, it remains an important type. He believed that the share of alternate construction technologies will definitely increase, but brick masonry will remain an important construction type. He mentioned the study with BIS in which they considered resource efficiency of 11 types of bricks made from clay, namely solid bricks, hollow clay bricks, blocks, perforated, burnt clay, fly-ash bricks, compressed, earth blocks, and so on. in India, the production of bricks is quite dispersed, largely through clay brick production centres. He mentioned the annual production today stands at 250 billion bricks a year which will go up to 750 billion bricks considering that the market will shift to new materials. With reference of NITI Aayog, he declared the requirement will be very significant and seven environmental parameters, such as quantity of waste materials, energy used in manufacturing, carbon dioxide emissions, air pollution, thermal conductivity, transportation requirements have been considered. These are quantifiable parameters and data has been collected through actual monitoring of plants and other from literature to conclude relative score. He concluded that while choosing different materials and technologies, various parameters should be considered. In terms of policy, a healthier environment quality along with superior quality houses of all kinds is the need of the hour.

Mr Cesare Saccani discussed the transparency of materials in India to convey the environmental performance of materials. There are internationally recognized tools to provide the market with more transparency and reliability regarding the environmental performance of products. The NITI Aayog clearly addressed the huge need to develop a certification and standardization scheme for green building materials. Its four main objectives were environmental information to improve awareness, create demand in the market, scientific verification by third parties, and cost of building material. He defined EPD (Environmental Product Declaration) as quantified environmental data of the product with pre-defined parameters based on International Standards 14040 supplemented by qualitative and quantitative environmental information. He highlighted the issues of considering the parameters while comparing the life cycle of different products. GRIHA and LEED are already recognizing the credits for products carrying EPD. It is important to mention here that EPD is a communication tool and the main aim is to compare similar products considering different parameters. It is an open system which ensures credibility. He discusses different types of EPD, most common being EPD an individual product; average EPD for various products having same manufacturing process; and sector EPD. He mentioned PCR (Product Category Rules) as a specific type of standard used for referring the life cycle assessment. In India, they have published the first PCR for most of the materials. Interestingly, the same PCR has been adopted in Italy and approved in Europe by Eco platform, European Association. The process for preparing PCR takes around 4–6 months in India and involves multi stakeholder committee and verifies the compliance according to International Standard. EPD can be prepared once LCA is ready, but the EPD must include information related to the product, programme operator,

and PCR. He concluded that it should be certain that EPD is duly recognized in India. EPD India and EPD Italy signed a memorandum of understanding to recognize both the PCR and verified EPD through which there will be an open gate to the European market for Indian manufactures.

Mr V Revindran began his presentation by quoting "Sustainability word is quite fashionable and probably passionate for many of the affluent class". He showcased a product by the name of Sinicon PP, heat proof plaster aggregate, which can achieve a certain level of comfort to the live in a concrete building. Made of volcanic glass and mined from South African mines, crushed and processed, it is used like sand in plastering and cost of the product is not exorbitant. Sinicon PP is affordable through optimized applications, contingent on the usage. He mentioned that there are two ways to implement sustainable programmes; one is through government policies and other is through private models. He stated that "Sustainability can be made a requirement and not an option". He stated that the existing housing stock is huge and presents a great opportunity for retrofitting by Sinicon PP.. It avoids the ecological issues faced by M-sand, river sand. It helps in extending the life of a building through heat proofing and protects RCC from cracking, leakage, seepage development, and ensures fire proofing. He concluded that a lot of materials are available and research is an ongoing process. Thus, Sinicon PP will definitely make an impact on the construction industry.

Ms Megha Behal initiated her discussion by highlighting her research work related to building materials. She mentioned that the larger picture will evolve when it comes to building materials for affordable housing. The Sustainable Habitat Division at TERI works in the field of sustainable building design, policies and related studies, and building retrofits. She showcased a research project being completed for Mahindra Life Spaces, researching essentially on the building materials available to be able to create a database which will be available in the public domain to make a choice selection. Further, she pondered on Mainstreaming Sustainable Social Housing Project in India (MaS-SHIP) where the focus is on social housing. MaS-SHIP aims to create a Sustainability Index (SI) which would help the user in making a choice selection, eventually creating a Decision Support Tool (DST) which would be available in the public domain for the users. She highlighted that there is a fragmentation of green building certification market and there are incentives for registration. However, these incentives are essentially not linked with the actual certification. The tool has a combination of various climatic zones, and will be tested in 5 states. The data collection was carried out through manufacturers, developers, and homeowners survey and the challenge was in the availability of relevant published data sets. The shortlisted 19 attributes of the Sustainability Index have been derived from the BMTPC study. She circulated a survey form in which attributes were categorized under environmental performance, resource efficiency, user experience, economic impact, and operational performance, to assign weight to the attributes. She concluded by showcasing the progress achieved so far and shared website details.

Track IX–Alternative Efficient Cooling Technologies

Thematic Address: Mr Soumya Prasad Garnaik, Chief General Manager (Technical), Energy Efficiency Services Ltd.

Chair: Mr Vishal Kapur, President, ISHRAE

Panellists:

- Mr Jagdeep Singh, Managing Director, Aeon Ecotech Pvt Ltd
- Mr C Subramaniam, Director, SSS Consultants
- Mr Richie Mittal, Managing Director, Overdrive Engineering Pvt. Ltd
- Dr R Saravanan, Professor & Head, R&AC Lab, Anna University, Chennai
- Mr Mohammad Adil, Engineer, SEVCON

Mr S P Garnaik initiated the thematic address saying that air conditioning controls peak demand in summers. He commented that cooling is essential and the demand for it is growing every day. Two challenges were discussed—one is growing demand for air conditioners (ACs) and other being affordability. He emphasized that bulk procurements of ACs can lead to price drop; however, demand needs to be created. Three major pointers were discussed in conclusion—demand aggregation, district energy systems (DES) or tri-generation technologies, and ESCO systems moving from deemed energy savings to actual monitoring verification systems

Mr Vishal Kapur commented that occupant comfort is needed and should be generated in an affordable manner. He further emphasized that new technologies must be application appropriate.

> *Occupant comfort is needed and should be generated in an affordable manner.*
> ***- Mr Vishal Kapur***

Mr Jagdeep Singh discussed the working of radiant cooling systems. He highlighted that a whopping 80% saving was achievable in the flow of media by using radiant cooling systems. Radiant cooling systems cool only the occupied area and operate with chilled water at higher temperatures, thus leading to savings.

> *Divide and rule your temperature and humidity to manage cooling effectively.*
> ***- Mr Jagdeep Singh***

Mr C Subramaniam enumerated that district cooling systems deal with cooling at a district level for multiple buildings. He highlighted that district cooling systems make use of diversities and can operate at better efficiencies.

Mr Richie Mittal discussed how geothermal cooling systemsreject heat into the earth instead of air or water. Geothermal systems are a relatively new technology in India. The loop system can be horizontal, vertical, lake or open loop type system.

Dr R Saravanan briefly described solar air conditioning systems and mentioned that solar air conditioners produce on-site low grade energy for low grade applications on site. He compared solar photovoltaic and solar thermal technologies and spoke about how cost is a major factor that effects the implementation of solar cooling systems. He concluded that solar thermal cooling systems are a better technology in the present day situation.

> *Geothermal cooling is a simple technology that can be applied in India.*
> ***- Mr Richie Mittal***

Mr Mohammad Adil discussed thermal storage-based cooling systems. He commented that storage makes production and consumption an independent process. He highlighted that energy can be stored in an ice bank when the demand is not at peak and used when the demand rises.

A question was raised over integrating natural ventilation with radiant cooling. Mr Jagdeep Singh commented that integrating outdoor air depends on outdoor ambient temperature. It can be mixed but is difficult and applicable only in specific areas and conditions. Another question was raised over why the discussed alternative cooling technologies are not used in the mainstream. The panel responded by saying that it is due to various factors, including the need for government legislations, high first cost, not enough players, newness of technology, and a lack of awareness.

Track X–Renewable Energy

Chair: Mr Amit Kumar, Senior Fellow & Senior Director, Centre for Impact, Evaluation & Energy Access, TERI

Panellists:

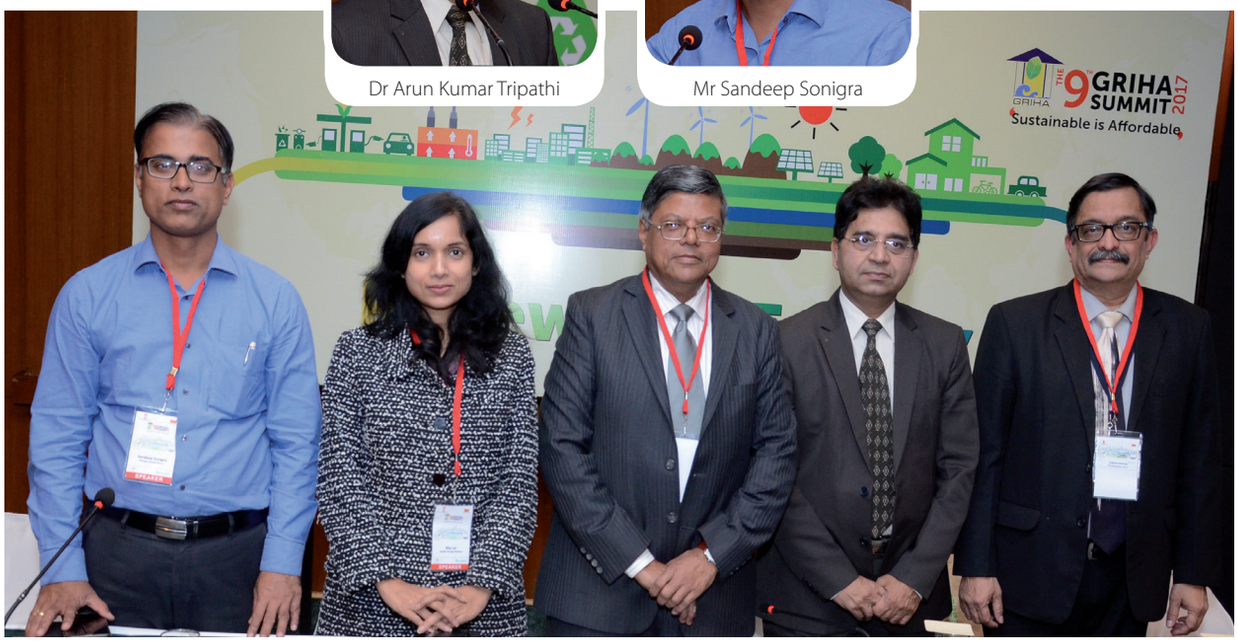
- Dr Arun Kumar Tripathi, Director General, National Institute of Solar Energy
- Mr Sandeep Sonigra, Managing Partner, Orange County Group, Pune
- Mr Shirish Garud, Senior Fellow & Director, Renewable Energy Technologies, TERI
- Ms Ritu Lal, Vice President, Business Development, Amplus Energy Solutions

Energy generation from renewable energy sources is defined as a long term and the most effective way to contribute to a sustainable energy system. Measures have already been taken to improve and encourage renewable energy implementation at the building level; in municipal/ local, state, and national policies.

In the current scenario, developers/industrial community have always been in a state of flux for achieving integration

Dr Arun Kumar Tripathi

Mr Sandeep Sonigra



of renewable energy systems in sustainable design which face issues in terms installation cost and payback period. In addition, after implemention of renewable energy systems in building design, there are other significance factors, such as operation & maintenance and net metering to earn payback in a given time frame.

The Power Purchase Agreement (PPA) financial agreement was available in the market which can arrange for the design, permissions, financing, and installation of a solar energy system on a customer's property at little to no cost. It also encourages the developers and building designer to integrate renewable energy, especially solar rooftop in building design.

> *While buying furniture we don't worry about payback period then why do we do it while talking about sustainability.*
> ***- Mr Amit Kumar***

Mr Shirish Garud

Ms Ritu Lal

> *Any building design must integrate at least renewable energy systems for building self-sufficiency.*
> ***- Dr Arun Kumar Tripathi***

The key installation costs, benefits, and payback period associated with the production, distribution, and consumption of energy from various renewable energy sources, such solar, wind, geothermal and biogas, and so on, have been defined and evaluated . The developers must ask the building designer to focus on renewable energy system integration in building design to create self-sufficiency for energy consumption. Additionally, there

> *When intent meets science, it creates a new world.*
> ***- Mr Sandeep Sonigra***

are several benefits pertaining to health, environment, security, and infrastructure effects that are not or may not be fully incorporated into the market price consideration of energy or into government policies related to energy production, distribution, or consumption.

> *New technology and development in control using AI and IOT is going to change the landscape of renewable integrate in building dramatically.*
> ***- Mr Shirish Garud***

The session concluded with the agreement that measures to improve and encourage renewable energy sources should be implemented at consumer level. Prices can be an effective instrument but need to be combined with systemic level measures. The transport sector was identified as the one with the highest potential in the near future for decreasing dependence on conventional fuels.

> *Rooftop solar system is a very flexible, simple step to explore for energy efficiency.*
> ***- Ms Ritu Lal***

VALEDICTORY & AWARD EVENING

Valedictory & Award Evening

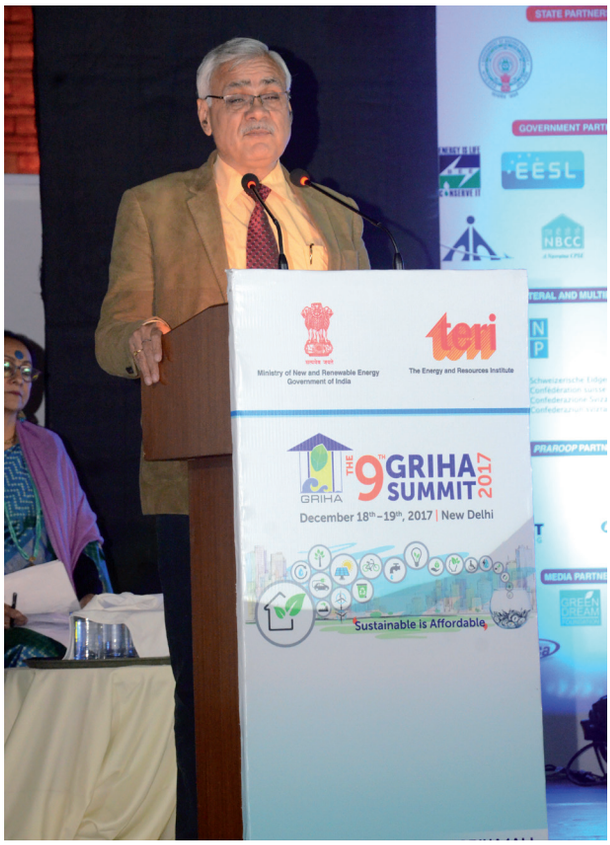
- Welcome Address: Dr Ajay Mathur, President, GRIHA Council
- Special Address: Mr Francesc Recasens, Deputy Managing Director, Roca Bathroom Products Pvt Ltd

- Valedictory Address: Shri Durga Shanker Mishra, Secretary, Ministry of Housing & Urban Affairs
- Vote of Thanks: Mr Sanjay Seth, CEO, GRIHA Council, TERI

As part of the valedictory session, projects rated during 2017 were conferred their respective GRIHA rating. The GRIHA Council also recognized the efforts of the project team in developing strategies implemented/ proposed for various projects registered under GRIHA Rating by awarding them with 'Exemplary Awards'.

The summit brought together experts from the industry, financial institutions, policy makers, decision makers, buyers, and sellers in a bid to develop and drive new initiatives, provide insights, and showcase sustainable product development and green business opportunities.

The two-day summit served as a platform for knowledge sharing and was well-attended by over 500 professionals from the construction and the building industry.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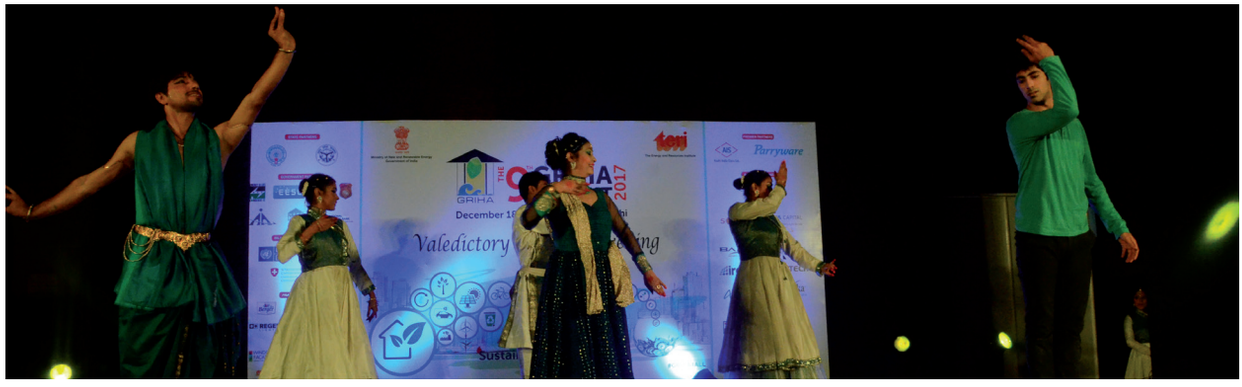
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