Energy in Buildings

Newsletter for the Indo-Swiss Building Energy Efficiency Project

Issue 4
September 2017

EDITORIAL

Over the past few years, government and development agencies have been able to put 'energy efficiency' on the centre-stage of discussions, deliberations, and action in the country. Considerable attention has been given to energy efficiency in the buildings. BEE came out with the Energy Conservation Building Code (ECBC) applicable to commercial buildings in 2007, with a revised version in 2017. Now BEE is also focussing on the residential sector, which is emerging as one of the largest electricity consuming sector.

The Building Energy Efficiency Project (BEEP), initiated by the governments of India and Switzerland in 2011, has been at the forefront of action on implementing energy efficiency measures in buildings, including the residential sector. The design guidelines published by BEEP, carry a number of recommendations for bringing energy efficiency in multi-storey residential buildings. Phase II of BEEP is slated to begin in 2018, with more work planned for energy efficiency in residential buildings.

With more than 1.2 crore affordable houses planned to be constructed in the urban areas under "Housing for All by 2022", the issue of thermal comfort and energy efficiency becomes more important. BEEP has been working closely with the Rajkot Municipal Corporation (RMC) for the design of an affordable housing project (1176 housing units). The lead article in this issue of the newsletter throws more light on the building envelope features that will reduce heat gains and provide thermal comfort to the residents in this project.

In a related coverage in the interview section, Dr Sameer Maithel digs deep into the multiple benefits of using resource-efficient bricks (REBs) as construction material. While REBs can potentially reduce embodied energy and carbon up to 30% in a building, their production and use has been limited to certain pockets in the country so far. Sameer calls for an integrated action plan to promote both production and use of REBs – a point that needs serious consideration from the policy makers of the country.

This issue of the newsletter also carried a brief report on the International Conference on 'Energy Efficient Building Design: Experiences and Way Forward, which was inaugurated by Mr Piyush Goyal, the then Hon'ble Minister of State with Independent Charge for Power, Coal, and New and Renewable Energy, Government of India.

As we eagerly look forward to BEEP Phase II (2018-2021), we strongly believe that your feedback and suggestions can go a long way in strengthening our resolve for an energy-efficient residential building sector in India.

Saurabh Diddi
Director, BEE

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Energy Efficient and Thermally Comfortable Affordable Housing

Introduction

In India, buildings account for one-third of the total electricity consumption, second only to industries. Of this, electricity consumption in residential buildings and commercial buildings accounts for ~23% and ~8%, respectively, in 2014/15. The projection done by NITI Aayog under different scenarios shows that the electricity consumption for the residential sector is expected to increase 6–13 times during the period 2012–2047. This increase of electricity consumption in residential buildings is primarily attributed to (a) the increase in building stock, with the built-up area in the residential sector expected to increase by approximately four times; (b) the expansion of electrification in rural areas; and (c) the increased intensity of electricity consumption in urban buildings, mainly due to the rapid growth of air conditioning.

In 2014, BEEP published the first set of guidelines for energy-efficient multi-storied residential buildings in composite and hot-dry climatic regions of India. The second set of guidelines on the warm-humid climate was published in 2016. During the preparation of these guidelines, surveys to collect design and electricity consumption data in middle class multi-family housing were conducted in Delhi-National Capital Region (NCR) for the composite climate and Chennai for the warm-humid climate.

Based on these surveys, the mean energy performance index (EPI) for sample residential flats of 2–3 bedrooms in composite climate (NCR) was found to be 48 kWh/m^2/annum and the same for warm-humid climate (Chennai) for the year 2009 was found to be 43 kWh/m^2/annum (BEEP 2014; BEEP 2016). It was also found that the energy consumption for comfort cooling varied from one-third to two-thirds of the total annual energy consumption, depending on the number of occupants and the number of air-conditioners.

The guidelines put significant emphasis on designing an appropriate building envelope to reduce solar heat gains and improving the natural ventilation potential to achieve thermal comfort and reduce energy use for comfort cooling in residential buildings. Heat gains from the envelope greatly influence the thermal comfort and consequently energy efficiency in residential buildings. Residential buildings have large exposed façade area to internal volume ratio, resulting in the space cooling loads dominated by heat gains from the envelope. The penetration of air-conditioners in residential buildings is negligible, more so in the affordable housing segment, meaning the envelope characteristics are vital in maintaining thermal comfort.

The building envelope

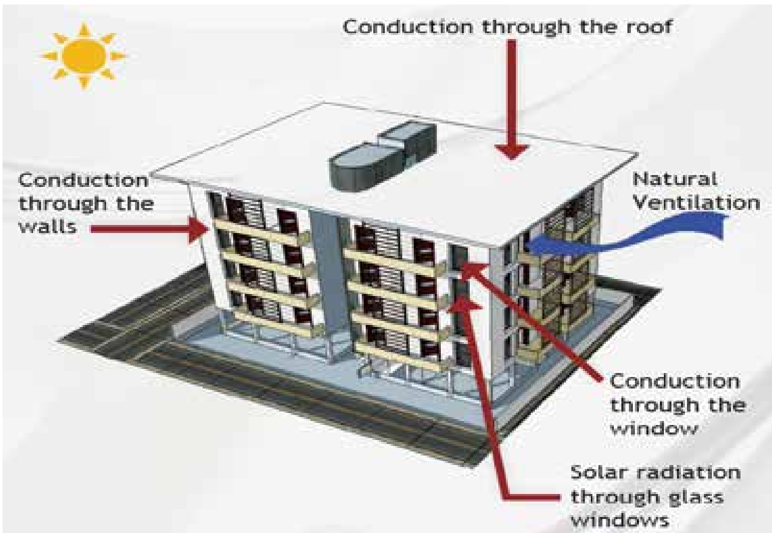
The building envelope refers to the boundary between the interior conditioned space and the outside. This includes all the components of the building's shell, i.e., walls, roofs, slabs on grade (in touch with ground), any basement walls, doors, and windows. The building envelope influences indoor thermal comfort and consequently energy consumption for cooling/heating by:

- controlling solar heat gains into the space and
- controlling the wind flow to and from the space, i.e., natural ventilation.

Controlling solar heat gains

In India, barring cold climate regions, one of the main objectives of designing energy-efficient and thermally comfortable housing is to reduce solar heat gains taking place from the envelope of the building (through conduction for roof and walls and through conduction and solar radiation transmission for windows).

For flats located on the topmost floor, the heat gain through the roof forms a significant portion of the

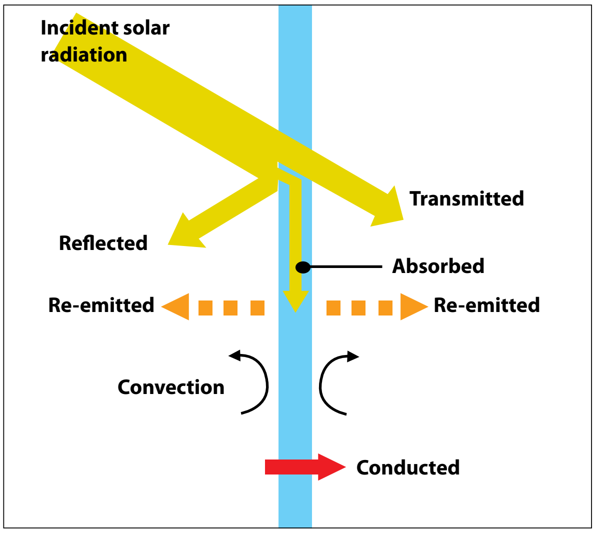


Heat gains through the building envelope

overall heat load. This is because the roof receives approximately four times more solar radiation (kWh/m^2) than walls during summer months. On other floors, heat gains through glazed windows and walls dominate. It is to be noted that for the same exposed surface area, the heat transfer rate with incident solar radiation from a glass window is usually two to four times higher compared to that of the wall. Therefore, due consideration should be given to the area of glazed surfaces and their protection from solar radiation.

- **Windows:** Heat transfer through the windows happens predominantly through direct transmission of the solar radiation falling on the glazed part of the window. A small part of heat is also transferred by convection and conduction; conduction happens through the glass and the frame.
  - As most of the heat transfer through windows happens through direct transmission through glass, reducing the glazed area – in other words, reducing the window-to-wall ratio (WWR) – will reduce heat gains through windows significantly. However, daylight inside residences is also important and hence a balance between solar heat gains and daylight needs to be struck. It is found that a WWR of 10%–20% enables to have this balance.
  - Shading helps prevent solar radiation from falling on the glass surface of the window. This is the most practical and effective way of preventing heat transfer through windows. Fixed shading (e.g., overhangs, vertical fins, and fixed louvres) are more common. However, external movable shading is more effective and gives more flexibility of usage to the user, especially on the east and west faces, as the sun is low in these two directions and its position changes through the year. Using external movable shading allows less than 15% of the solar heat falling on the window inside. Movable shading is also effective in shielding from diffused solar radiation, which is quite significant in India.

Large glazed surfaces are a major source of heat gains in residential buildings



Heat transfer through windows

  - One may also use a high-performance glass, which allows less transmission of solar heat gains (or glass with lower solar heat gain coefficient [SHGC]). However, this option is more expensive and also reduces daylight as glass with lower SHGC also has a lower visual light transmittance (VLT).
  - Use of double glass helps in reducing the heat gains through windows due to conduction. It does not significantly reduce the direct transmission gains through the glass.
- **Walls:** In the case of heat transfer through opaque surfaces in buildings (walls and roof), heat transfer mainly happens through conduction and convection. Insulating the walls to prevent heat gains through conduction works best in regions when the diurnal temperature range is high such as the hot-dry and composite climate regions in India. For example, 200-mm AAC blocks will result in a U value of 0.7 $W/m^2.K$, which is almost three times less than that of a 230-mm brick wall. Wall insulation should be designed integrating it with reduction in heat gains from windows and roof as well as with optimum provision of natural ventilation.
- **Roof:** For the flats located on the topmost floor, heat gain through the roof forms a significant portion of the overall heat load, as the roof receives approximately four times more solar radiation

(kWh/m[2]) than walls during summer months. The heat flux through the roof can be reduced by insulating the roof and by providing high reflective finishes/paints.

Controlling wind flow to and from the space (natural ventilation)

Natural ventilation serves two main purposes: (a) it provides fresh air for an acceptable indoor air quality; and (b) when the temperature of outside air is lower than the temperature inside the building, it removes heat from inside the building and facilitates cooling. One of the parameters to measure the effectiveness of natural ventilation is hourly air change rate (ACH), which is a measure of how many times the air volume inside a room is replaced by fresh air in an hour. Greater the number, the better is the cooling potential through natural ventilation. Usually, 8 to 20 ACH provides good natural ventilation.

Windows/ventilators are the main building component that controls the amount of wind flow to and from residence. While the orientation of the window with respect to the prevailing wind direction is a key factor for natural ventilation, this differs depending on the city and the surroundings of the site. Even with this uncertainty, the following points help in optimizing natural ventilation.

- Ideally, all habitable rooms of a dwelling unit should be cross-ventilated, as it brings about higher ACH. In the case of cross-ventilation, openable window area should be at least 10%–15% of the floor area, for both inlet and outlet openings. However, in most affordable housing, having two windows to allow cross ventilation is not possible.
- For effective natural ventilation, it is preferred to use casement windows, which utilize 100% of the opening area as compared to sliding windows, which use only 50% of the area. This becomes more important in affordable housing where most of the spaces are equipped have single-sided ventilation, i.e., only one window.
- In the case of single-sided ventilation, tall windows should be designed. These windows should have openings at the bottom (for entry of cold air into the room) and at the top (for the exit of warm air to the outside). The height/width ratio of 2 is practically feasible for such windows for regular bedroom sizes.

Other design features such as ventilation shafts help induce air flow in buildings. These may prove helpful in areas with dense settlements where buildings may not be able to access the wind. However, these need to be designed carefully on a case-by-case basis depending on the specific building context and design. One such design concept is described in the case study below.

Effectiveness of building envelope strategies: Case study of an affordable housing project in Rajkot, Gujarat

Smart GHAR III is an affordable housing project under Pradhan Mantri Awas Yojana - Untenable slum redevelopment, in Gujarat. The project consisted of 1176 dwelling units (1 BHK) with the built-up area of each flat at about 30 m[2]. These flats were designed in 11 towers of 7 storeys with stilt parking in a site area of about 17,000 m[2] resulting in a dense site.

The dwelling units of nine towers had the longer sides facing north and south, while the remaining two faced east-west. The building envelope of this project consisted of the following:

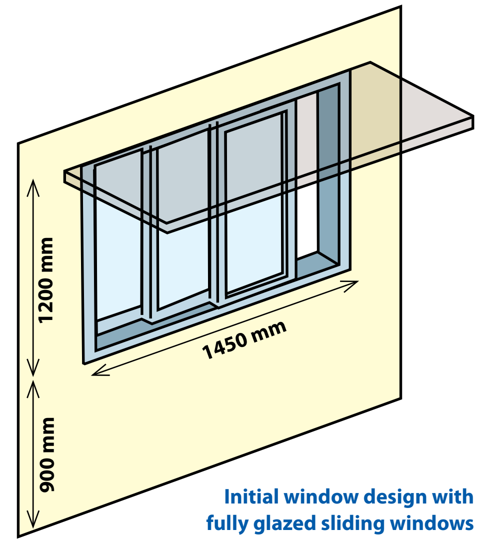
- Sliding windows with aluminium frame, single glass and fixed overhang of 600 mm
- 230 mm AAC blocks
- Roof with china mosaic finish.

As the flats had different orientations and different levels of solar and wind exposure, four bedrooms of four flats in different orientations were simulated and analysed. The results of this analysis showed that:

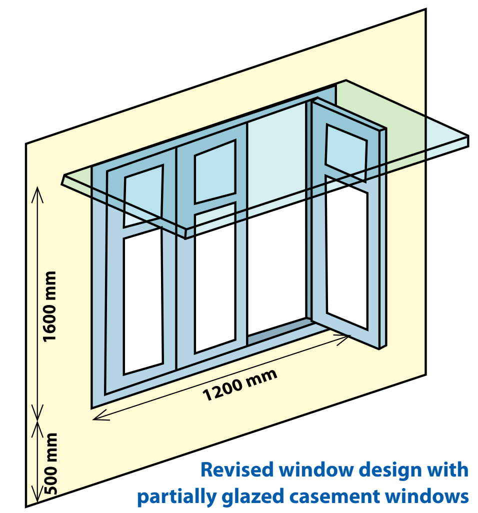
- On the intermediate floor, there was a temperature difference of about 2–3 °C between the north-south facing bedrooms and the east-west facing bedrooms. The annual peak temperature in the bedrooms ranged from 37 °C to 40 °C depending on the orientation of the bedroom.
- The top-floor bedrooms also had higher inside temperatures than the corresponding bedrooms on the intermediate floor.
- The main sources of heat gain were the windows and walls on the intermediate floors, whereas on the top floor it was the roof. However, the walls were already well insulated due to the use of AAC blocks.

The building envelope measures adopted in this project are given below.

- *Redesigning the windows to reduce solar heat gain (through shading) and improve ventilation (through*



Initial window design with fully glazed sliding windows



Revised window design with partially glazed casement windows

more openable area): The window design was revised to use partially opaque shutters to reduce the solar radiation entering through the windows. The shutters were also recommended to be of casement type instead of sliding to improve natural ventilation. This improves the ACH (or ventilation) inside the room. The window was also designed to be taller, i.e., with a higher height-to-width ratio, which improves ventilation, especially when there is only one window in the room.

- *Design for ventilation shaft to induce better ventilation through the building units:* A design solution for assisted ventilation was proposed to improve the air flow through the flats. This assisted ventilation concept will have a roof feature and a fan on top of the shaft, which will create negative pressure in the shaft (with/without ambient wind) improving the ACH through the flats. It must be noted that improved ventilation for cooling is recommended only when the outside temperature is cooler than that of the inside temperature; for example, during summer evenings and nights.

The simulation results showed that the above-mentioned design strategies can reduce the peak temperature in the worst bedroom, i.e., the west-facing bedroom by 4 °C to 5 °C during summer. The effect of these strategies over the year is that the inside temperature will be equal or below 30 °C for about 70% of the year, instead of 30% in the original design. This can be further improved by use of evaporative cooling, which is suitable for this climate.

- *Roof treatment:* External insulation (40 mm polyurethane foam) is proposed to be used. This will be finished with the original china mosaic reflective finish. A high reflective roof finish is proposed to be used. Insulating the roof can lead to further reduction of inside temperature by ~3 °C during summer. This would bring down the peak temperature on the top floor to similar level as that on the intermediate floors.

3D view of the project

Conclusion

The analysis done during the development of BEEP design guidelines, and its implementation later in actual projects, has highlighted the importance of reducing heat gains and improving natural ventilation as being central for improving the thermal comfort and energy efficiency in multi-storey residential buildings in most of the Indian climates.

At a broader policy level, it is necessary to develop similar codes to be included in the building bye-laws and national building code. This is necessary to make the new residential building stock in India adhere to minimum levels of thermal comfort and energy efficiency. ■

>Resource-efficient Bricks...

Dr Sameer Maithel
Director, Greentech Knowledge Solutions Private Limited, New Delhi

Masonry construction using bricks is the dominant form of construction for both rural and urban housing in India. Given that India has plans to provide housing to all by 2022, a large increase in demand for bricks for housing construction is foreseen in the near future. What are the energy and environment impacts of bricks? How does the bricks currently being produced fare on resource efficiency parameters? What can be done to improve their resource efficiency? Questions galore! To get answers to some of these questions, we met Dr Sameer Maithel, who is an expert in the area of sustainable buildings and building materials.

What are the different types of bricks used in India?

Solid burnt clay bricks are the dominant types of bricks. As per the Indian census 2011, burnt clay bricks were the predominant material for wall construction in almost 65% of the existing urban households. During the period 1991 to 2011, the number of households that live in houses made of burnt clay bricks doubled (an addition of 5.5 crore [55 million] new households). Solid and hollow concrete blocks, solid fly ash bricks, autoclaved aerated concrete (AAC) blocks, etc. are some of the other types of bricks/blocks besides the conventional solid burnt clay bricks that are popular in housing construction.

What are the key energy and environmental concerns related with bricks?

Almost 1 billion tonnes of primary raw material in the form of brick earth, sand, stone aggregates, etc. are used for manufacturing different types of bricks and blocks. Mining of raw materials for brick production is mostly unorganized and unplanned, be it extraction of top-soil from the agriculture fields or mining of sand from river beds. This results in the degradation of land and rivers.

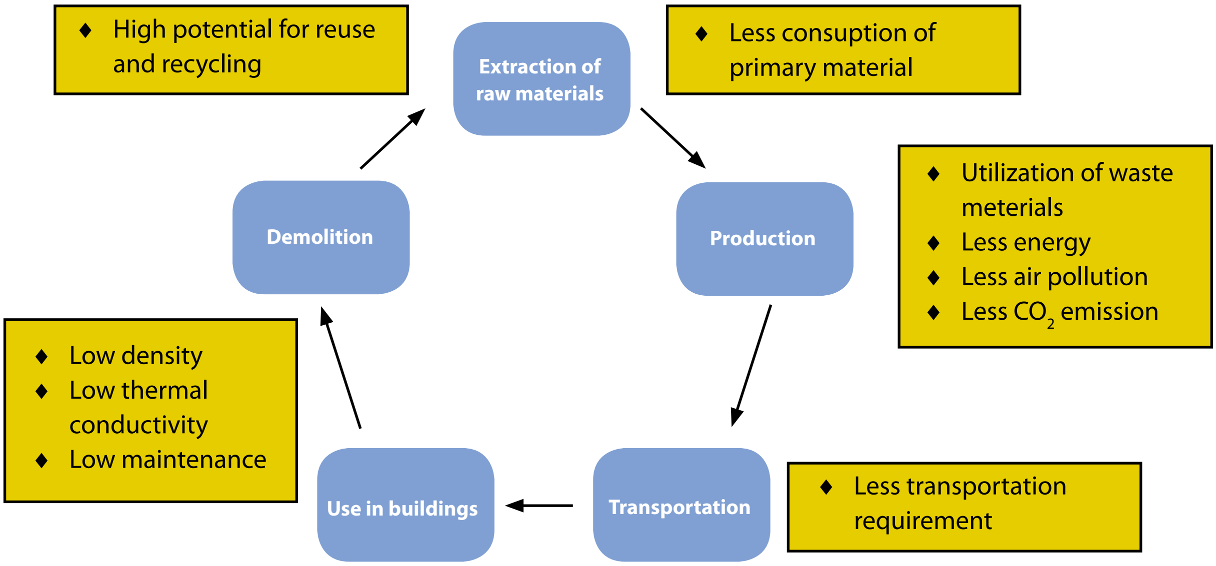
The other key concern is the large amount of fuel (coal or biomass), estimated to be over 30 million tonnes/year, that is used for the manufacturing of burnt clay bricks. Burning of this large amount of fuel results in CO_2 emissions (in the excess of 60 million tonnes/year) and emissions of suspended particulate matter and other air pollutants due to inefficient combustion. Fugitive dust emissions during handling and processing of raw materials (e.g., fly ash and clay) and from the unpaved surfaces of brick manufacturing facilities are also an area of concern.

As brick production is likely to double from the current production level of about 300 billion bricks/year by the year 2030, there is an immediate need to move to bricks that are resource-efficient.

What are resource-efficient bricks?

Resource efficiency is defined as 'using the earth's limited resources in a sustainable manner while minimizing impacts on the environment'. Bricks that cause lesser environmental impact during their life cycle may be called as resource-efficient bricks (REBs). Some of the key features of REBs are as follows:

- They consume less primary material (e.g., clay, sand, and limestone) for production.
- They use waste materials for production.
- They require less energy during manufacturing and result in less CO_2 emissions and air pollution.
- They are produced using local raw materials and consumed locally, thus minimizing the transport requirement.



Key features of resource-efficient bricks

- They have good thermal insulating properties, which helps in reducing heat gains or losses from the wall thus improving thermal comfort and reducing the energy use in heating or cooling of buildings.
- They can be recycled or reused after the demolition of a building.

Can you provide some examples of REBs?

Burnt clay hollow and perforated bricks, compressed stabilized earth blocks (CSEBs), hollow concrete blocks, AAC and cellular light weight concrete (CLC) blocks, and fly ash bricks are examples of REBs. These bricks/blocks result in 20%–60% reduction in energy consumption and CO_2 emissions compared to solid burnt clay bricks. AAC and hollow burnt clay bricks are light-weight and have good thermal insulation properties. AAC blocks and fly-ash bricks can use 60%–80% of industrial waste like fly ash, thus reducing the requirement for primary raw material to a great extent.


Hollow concrete block

Burnt clay hollow block


Burnt clay perforated brick


Fly ash bricks

Compressed stabilized earth block

AAC and CLC blocks

What is the status of REB production and utilization in India?

The total production of REBs in India is estimated to range between 30 and 40 billion bricks a year and make up for 10%–15% of the total market for bricks.

AAC blocks find main applications in medium/high rise housing in all major cities. Pune, Surat, National Capital Region (NCR), and Hyderabad are the main hubs manufacturing AAC blocks.

Hollow burnt clay blocks are used both for medium/high rise housing and individual houses. Their production and application are concentrated in the southern states of Karnataka, Kerala, and Tamil Nadu.

Fly ash bricks are used in all types of housing projects, particularly in the housing constructed by the government and public sector. Andhra Pradesh, Telangana, Maharashtra, and Odisha are some of the main hubs that produce fly ash bricks.

The application of compressed stabilized earth block (CSEB) is mainly confined to low-rise housing and individual houses. The know-how for the production and application of CSEB is confined to certain places such as Puducherry, Bengaluru, and Kachchh.

What can be done to increase the use of REBs in housing in India?

The application of REBs has been well demonstrated in the country. The use of REBs reduces the carbon intensity in housing. In general, 20%–30% reduction in embodied energy and carbon are possible using REBs. An integrated action plan is needed to promote both the production and use of REBs in housing.

The selection of REBs will vary from region to region and will also depend on the type of construction. While fly ash bricks, burnt clay perforated bricks, and CSEB are more suited for low-rise load bearing or framed masonry construction in rural areas and small towns, AAC blocks and burnt clay hollow blocks are more suitable for mid- and high-rise housing construction in metro cities and large urban centres. Indo-gangetic plains, which has good availability of brick earth, is the main region where the production of burnt clay hollow blocks needs to be promoted. The production of AAC blocks needs to be promoted in regions that are near to the power plants where fly ash is available.

Actions like providing assured access to raw materials and financing are needed to promote production of REBs. Awareness generation amongst architects and builders about the advantages of REBs along with the training of civil engineers and masons is needed to increase the demand. Regulatory interventions such as amending the building bye-laws for mandatory use of REBs in housing would also go a long way in promoting these materials. ■

New Co-Chair of JAC

Ms Marylaure Crettaz is the new co-chair of the Joint Apex Committee (JAC) of BEEP. She has joined as Director of Cooperation and Counsellor of the Swiss Agency for Development and Cooperation (SDC) in India in August 2017. She has more than 14 years of experience in international cooperation. Ms Crettaz joined the SDC in 2003 and has since then consolidated her experience in natural resources management and governance, rural development, agriculture and food security, and economic development.

BEEP International Conference on 'Energy Efficient Building Design: Experiences and Way Forward'

A 3-day international conference on 'Energy Efficient Building Design' was held in New Delhi from 28 to 30 November 2016. About 300 national and international experts participated in the event.

The conference was inaugurated on 28 November by the then Hon'ble Minister of State with Independent Charge for Power, Coal, New and Renewable Energy, Government of India, Mr Piyush Goyal. Thirty-seven speakers and panelists presented their work and thoughts on energy efficient buildings, through six technical sessions, two keynote sessions, one special session on 'external movable shading systems', and a concluding session on 'low carbon urban growth'.

During the conference, the participants discussed many ideas and experiences on building design, execution, and regulation for building energy efficiency. This sharing of knowledge could facilitate informed decision- and policy-making for building energy efficiency in India.

Integrated Design Charrettes

Three Integrated Design Charrettes were conducted by BEEP between October 2016 and September 2017.

1. Smart GHAR III, Rajkot: The charrette was held from 27 to 29 September 2016 in Rajkot. The charrette was conducted by experts, Ashok Lall (Architect) and Pierre Jaboyedoff (Engineer). The charrette recommendations would result in an estimated reduction of peak inside temperature by 5 °C during summer in comparison to the pre-charrette design.
2. Radical Projects, Noida: The charrette was held from 26 to 28 June 2017 in New Delhi. The charrette was conducted by Swiss expert Dario Aiulfi (Engineer). Energy saving is estimated at 40%.
3. Ela Green School, Chennai: The charrette was held from 3 to 5 July 2017 in Chennai. The charrette was conducted by Ashok Lall (Architect) and Dario Aiulfi (Engineer). The expected energy saving is 27% and the number of comfortable hours without air-conditioning has been doubled as compared to the pre-charrette design.

BEEP Charrette Project Updates

- Jupiter Hospital, Pune, has been made operational in December 2016. The energy monitoring for the building is set to start soon. The charrette for this project was held in February 2014.
- Construction of Smart GHAR III, Rajkot, commenced and the project is expected to be completed in late 2018. The charrette for this project was held in September 2016.

Integrated Design Seminar

- BEEP conducted two integrated design seminars between October 2016 and September 2017.
- The seminar in Shimla was held on 22 October 2016, which was attended by about 30 participants.
- The seminar in Vijaywada was held in association with the Andhra Pradesh Capital Region Development Authority (CRDA) and the State Energy Conservation Mission (SECM) on 2 May 2017.

Training programme

Two training programmes on 'Thermal Insulation of Buildings for Energy Efficiency' were conducted:

- The first training programme was held in New Delhi on 2 December 2016 by Prof. Claude Alain Roulet (Swiss Expert) and Mr Ravi Kapoor.
- The training programme in Jaipur was conducted on 29 April 2017.

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Knowledge products

Two major publications were released on 28 November 2016 by Mr Piyush Goyal, the then Hon'ble Minister of State (IC) for Power, Coal, New & Renewable Energy and Mines at the BEEP International Conference on Energy Efficient Building Design.

1. ***Design Guidelines for Energy-Efficient Multi-Storey Residential Buildings: Warm-Humid Climate***

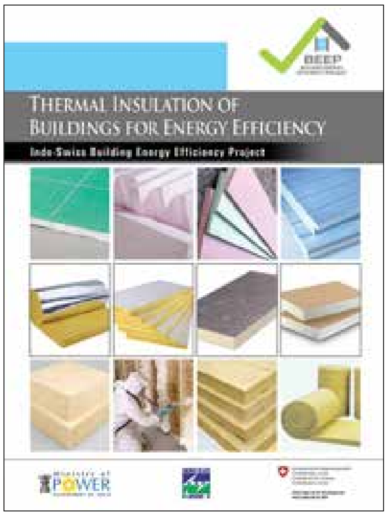
The design guidelines provide 14 recommendations on energy-efficiency features for consideration at the design stage of multi-storey residential buildings. These recommendations are classified in the following six sections:

- Building massing and spatial configuration
- Building envelope
- Space cooling
- Appliances
- Common services
- Renewable energy integration

The guidelines are aimed at builders, developers, architects, and other building-sector professionals involved in the design and construction of multi-storey residential buildings.

2. ***Thermal Insulation in Buildings***

The booklet, *Thermal Insulation in Buildings,* looks at various important aspects related to building insulation materials, from the principles of building science to the application of materials in buildings. It carries the specifications and testing standards of building insulation materials developed by the Bureau of Indian Standards and the prescriptive compliance requirements for using insulation in commercial buildings covered under the Energy Conservation Building Code (2007), Ministry of Power. It also addresses several important issues related to insulation materials and the salient initiatives undertaken by BEEP. It provides practice-oriented background information for building designers, architects, and various other stakeholders in the building construction industry. ■



BEEP 2011–2017: MAIN CONTRIBUTIONS

- Technical Assistance for Designing Energy Efficient Buildings through integrated design process: The project worked closely with builders and developers and provided technical assistance in developing energy efficient designs for a variety of commercial, residential, and institutional buildings (20 building projects till 30th September 2017) having total built-up area of more than 1.4 million m2. The estimated energy savings for most of these buildings range from 25% to 40%. BEEP has plans to monitor the performance of commissioned buildings; the first such building has been monitored for 1 year and has demonstrated 44% energy saving. BEEP has also provided technical assistance for energy - efficient mass housing projects. One such project which has been provided this support is Smart GHAR project being constructed by Rajkot Municipal Corporation under Pradhan Mantri Awas Yojna.
- Technologies for Energy Efficient Building Envelope: BEEP promoted indigenous development and testing of external movable shading systems through a national design competition. The competition resulted in the selection of five indigenous designs and their subsequent development and testing of the prototypes. BEEP also provided assistance to build technical capacities of selected Indian labs to test building insulation materials; and is assisting BEE in the development of a label for building insulation products, which can help in developing the market for building insulation products in India.
- Guidelines for design of energy efficient residential and public buildings: The project has developed design guidelines for the design of energy-efficient multi-storey residential buildings for all major climatic regions of the country. The publication providing guidelines for composite and hot-dry climatic zones was released in 2014. This design guideline document was highlighted in the Intended Nationally Determined Contributions (INDCs) submitted by the Government of India in the run-up to the Paris Climate Change Conference in 2015. The guidelines for the warm-humid climatic zone was released in 2016 while the one for cold climate shall be released in 2017. These guidelines are the basis of the energy efficiency code for residential buildings being developed by the BEE.
- Working with State Governments: BEEP worked closely with the state governments in Karnataka, Rajasthan, and Andhra Pradesh to develop guidelines for the design of energy-efficient public buildings.
- Knowledge Dissemination and Training: The project has created awareness and developed technical capacities of key stakeholders through training programmes, seminars, web, etc. Specialized training and awareness modules have been developed. BEEP has conducted over 20 seminars and training programmes, which were attended by over 1500 participants. The project has a dedicated website to disseminate knowledge generated under the project. Several thousand downloads of technical documents were made from the project website (www.beepindia.org).

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NEWS LETTER

NEWS AND EVENTS

ABOUT BEEP (2011 - 2017)

The Indo-Swiss Building Energy Efficiency Project (BEEP) is a joint project between Ministry of Power (MoP), Government of India, and the Federal Department of Foreign Affairs (FDFA) of the Swiss Confederation, aimed at increasing energy efficiency in new buildings in India and promote Energy Conservation and Building Code (ECBC) compliance in new commercial buildings. The Bureau of Energy Efficiency (BEE) is the implementing agency on behalf of the MoP while the Swiss Agency for Development and Cooperation (SDC) is the agency in charge on behalf of the FDFA.

Overall goal

To reduce energy consumption in new commercial buildings and to disseminate best practices for the construction of low energy residential and public buildings

Key objectives

Contribute to strengthening and broadening the Bureau of Energy Efficiency's (BEE) building energy conservation programme for the 12th Five-Year Plan.

Assist BEE in achieving its target of ensuring that 75% of all new commercial buildings initiated during the 12th Five-Year Plan period are ECBC-compliant, and in addressing the issue of energy efficiency in new residential and institutional buildings.

Project Components

- **Component 1:** Integrated Design Charrettes
- **Component 2:** Technical assistance in developing building material testing infrastructure
- **Component 3:** Design guidelines and tools for the design of energy-efficient residential and public buildings
- **Component 4:** Production and dissemination of knowledge products

BEEP FOLLOW-UP PHASE (2018-2021)

After the successful implementation of BEEP Phase I activities, the governments of India and Switzerland have decided upon instituting a follow-up phase. The extended memorandum of understanding was exchanged between the two governments on 28 November 2016 during the BEEP International Conference in New Delhi in the presence of Mr Piyush Goyal, the Minister of State (IC) for Power, Coal, New and Renewable Energy, Mines, Government of India.

While the initial phase was about development, pilot testing and demonstration of tools, methodologies and technical solutions; the follow-up phase II will be aimed at outreach and mainstreaming the outputs of the previous phase to achieve a larger impact on the reduction of energy consumption in buildings. Some of the activities planned in BEEP Phase II are listed below.

- Provide assistance in the development of a building energy conservation code for residential buildings.
- Catalyze mass adoption of energy efficient envelope and natural ventilation concepts.
- Work intensively with builders to mainstream energy efficient building design.
- Develop curricula and academic programmes for architecture and engineering institutions.
- Institute national awards on energy efficient building design.

Indo-Swiss Building Energy Efficiency Project | www.beepindia.org
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