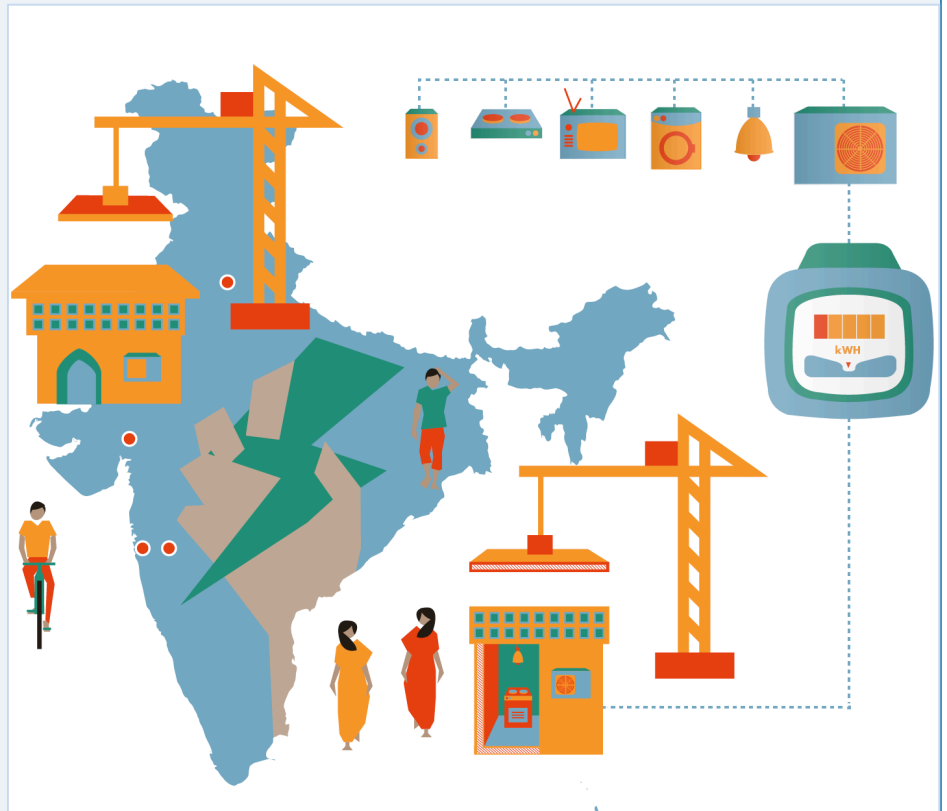


RESIDENTIAL BUILDINGS IN INDIA: ENERGY USE PROJECTIONS AND SAVINGS POTENTIALS

September 2014



REPRODUCTION AND USE:

Published in September 2014 by Global Buildings Performance Network (GBPN).

This report is made available to any and all audiences via the Creative Commons by License, and this material can be freely used provided the source is acknowledged as follows: "Source, *Residential Buildings in India: Energy Use Projections and Savings Potentials*, GBPN, 2014". This document is available for download from the GBPN website: www.gbpn.org.

DISCLAIMER:

This GBPN publication has been developed with the Centre for Environmental Planning and Technology' (CEPT) University. Survey, data collection and analysis performed by the Centre for Advanced Research in Building Science & Energy (CARBSE) at the (CEPT) University.



CEPT University focuses on understanding, designing, planning, constructing and managing human habitats. Its teaching programs build thoughtful professionals and its research programs deepen understanding of human settlements. CEPT University also undertakes advocacy and advisory projects to further the goal of making habitats more liveable.

CEPT University

Kasturbhai Lalbhai Campus
University Road, Navrangpura
Ahmedabad-380009 - Gujarat India

ACKNOWLEDGEMENTS

The GBPN would like to thank the principal authors, reviewers and editors of this report:

Authors

Rajan Rawal, CEPT University

Yash Shukla, CEPT University

Research Team: Srijan Didwania, Mohini Singh, Vivek Mewada

Graphics: Mona Galsar

Project Manager

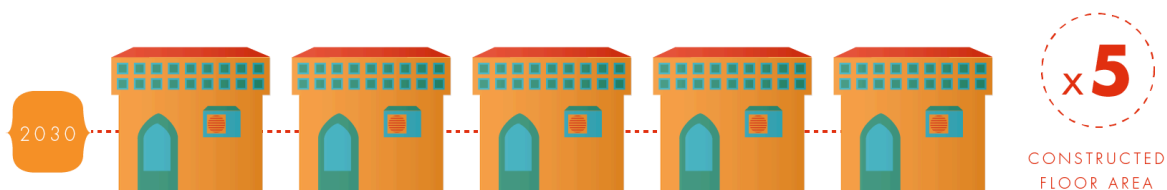
Sophie Shnapp (GBPN)

Expert Inputs

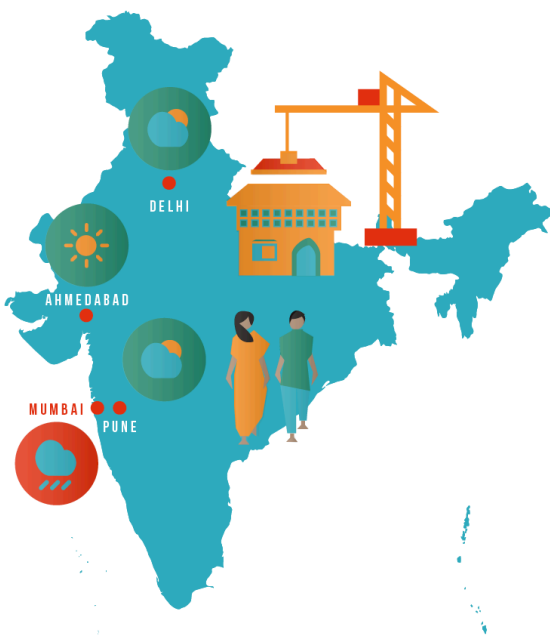
Smita Chandiwala (Shakti Sustainable Energy Foundation) / Marc LaFrance (International Energy Agency) / Jens Laustsen (GBPN) / Christopher Moore (Wuppertal Institute) / Sophie Shnapp (GBPN) / Melissa Smith (BandukSmith Studio) / Prasad Vaidya (Independent Consultant)

EXECUTIVE SUMMARY

India's domestic energy consumption has increased from 80 TWh in 2000 to 186 TWh in 2012, and constitutes 22% of total current electrical consumption (Central Electricity Authority, 2013). An increase of 400% in the aggregate floor area of buildings and 20 billion m² of new building floor area is expected by 2030 (Dr Satish Kumar, USAID ECO - III Project, 2011). Furthermore, due to the constant increase of Indian GDP, consumer purchasing power is predicted to grow leading to greater use of domestic appliances. Consequently, household electrical demand is expected to rise sharply in the coming decade. This growth of residential floor space, combined with expectations of improved domestic comfort, will require an increase in electricity production, leading to a significant escalation in damaging emissions.



As energy consumption from residential buildings is predicted to rise by more than eight times by 2050 under the business as usual scenario, it is of vital importance for India to develop energy-efficiency strategies focused on the residential sector to limit the current trend of unsustainable escalating energy demand. This study investigates methods of restraining growth in energy consumption in the Indian residential sector and documents energy saving potentials that can be achieved with focused policy and market efforts.

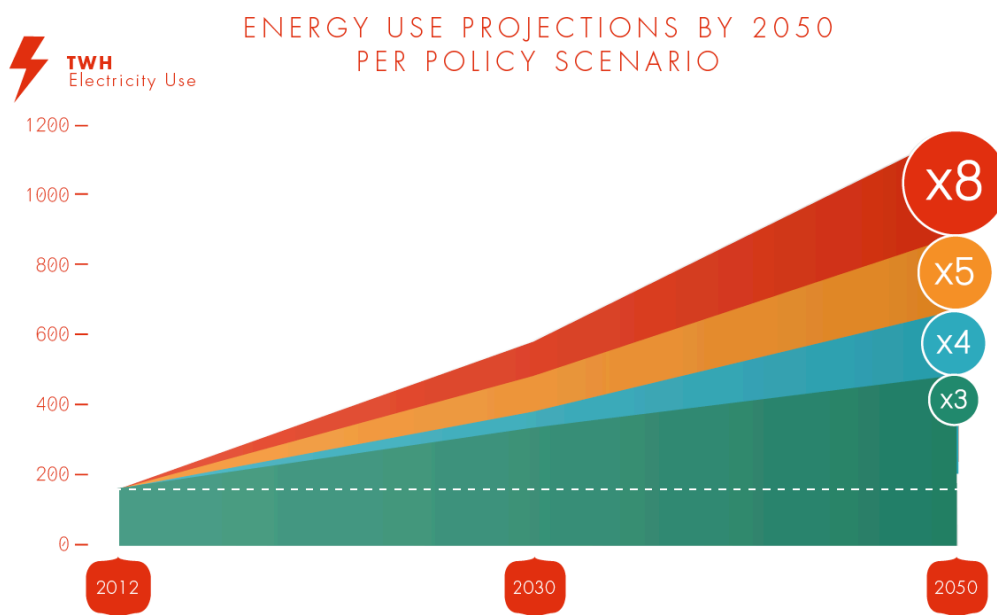


The study conducted a survey of 800 households in four climate zones of India, to map the current penetration rate of appliances and electricity consumption patterns. Key information, including residential unit areas, monthly energy consumption, connected loads and numbers of appliances, together with their power ratings and operational patterns, has been gathered in the survey. The information collected has been analysed to understand current energy consumption patterns for different sizes of residential units with varying occupancy rates, appliances and climate zones.

Building energy modelling has been deployed to quantify comfort benefits and the energy savings potentials of better-performing building envelopes. Energy conservation building code (ECBC) envelope characteristics have been used to determine the features of effective building envelopes. While ECBC is primarily focused on air-conditioned commercial buildings, the specified envelope characteristics in the code provide a benchmark for assessing savings potentials by building envelopes. Building energy modelling has also been used to predict energy consumption increases for higher comfort expectations and appliance usage.

The trends observed in the survey and the building energy modelling analysis, along with information from past studies, have been used to establish residential electricity consumption projections up to 2050. The projections have been partitioned into three end uses (air conditioning, envelope, and equipment) for urban and rural residential sectors. To further identify savings potentials in the residential sector, four projection scenarios have been developed for India: business-as-usual, moderate, aggressive and very aggressive.

Projection scenarios indicate that electricity consumption is predicted to rise by more than eight times under the business-as-usual scenario. Using focused policy and market efforts, moderate, aggressive and very aggressive strategies can limit the consumption increases to five times, four times and three times the current energy usage, respectively. Under the business-as-usual scenario, the annual electricity use per household is predicted to increase from 650 kWh in 2012 to 2750 kWh by 2050. Using a very aggressive policy strategy, the increase in household electricity consumption could be cut to 1170 kWh per household in 2050.



This report demonstrates that a very aggressive building energy efficiency policy and market driven scenario can substantially reduce future energy demand in the residential sector and help India address current challenges posed by the population growth, higher comfort expectations and the increased use of appliances.

To achieve the potentials, the report identifies the following recommendations for action:



Better Data: Introduction of a residential baseline energy data programme using a large survey to provide a detailed picture of current residential energy consumption patterns;



Policy Roadmaps: Elaboration of policy roadmaps that can support the implementation of energy efficiency measures for residential buildings;



Residential Building Energy Code: Development of a specific code focussing on residential building envelope efficiency adapted to the different climate zones to realise the saving potentials of all building envelope components to address the rising demand for thermal comfort.

GBPN

Global Buildings Performance Network

51 rue Sainte-Anne
75002 Paris
France

+33 (0)1 76 21 81 00
info@gbpn.org



www.gbpn.org
[@GBPNetwork](https://twitter.com/GBPNetwork)

About GBPN The Global Buildings Performance Network (GBPN) is a globally organised and regionally focused network whose mission is to advance best practice policies that can significantly reduce energy consumption and associated CO₂ emissions from buildings.