

APPROACH PAPER

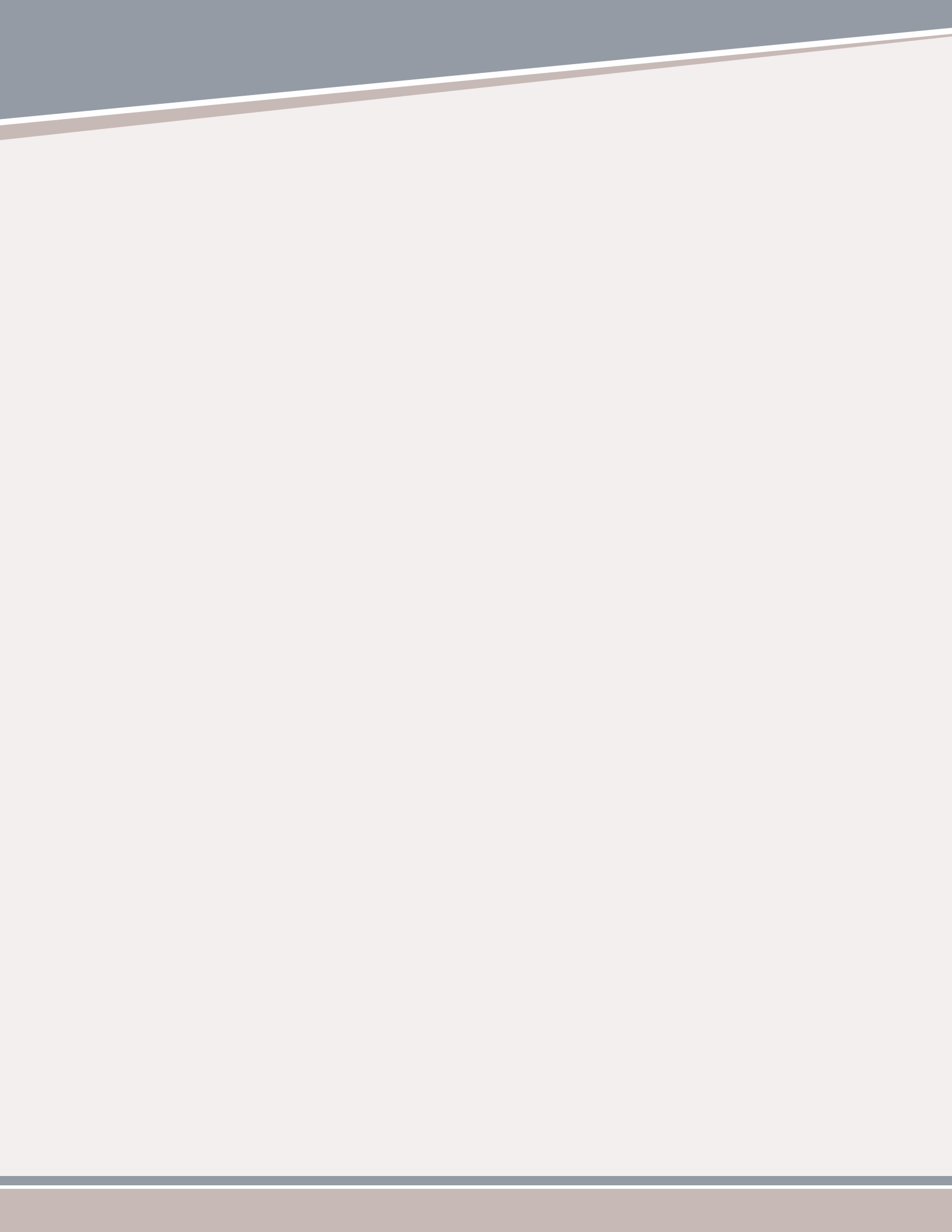


INDIA GHG PROGRAM

Promoting profitable, sustainable
and competitive businesses.



GREENHOUSE GAS ACCOUNTING FOR BUILDING SECTOR, INDIA



INTRODUCTION

As per IPCC 4th Assessment Report (2007), in 2004, global emissions from the buildings sector (including electricity) were about 8.6 GtCO₂, 0.1 GtCO₂- eq N₂O, 0.4 GtCO₂-eq CH₄ and 1.5 GtCO₂- eq halocarbons (including CFCs and HCFCs). Using an accounting system that attributes CO₂ emissions to electricity supply rather than buildings end-uses, the direct energy-related carbon dioxide emissions from building sector is approx. 3 Gt/yr.

UNEP SBCI (2014) suggest that buildings use about 40% of global energy, 25% of global water, 40% of global resources, and they emit approximately 1/3 of total GHG emissions. The building sector is estimated to be worth 10% of global GDP (USD7.5 trillion) and employs 111 million people¹.

IPCC 4th assessment report has also provided projections from building sector upto year 2030. In IPCC 4th assessment report - baseline was derived for this sector based on the literature, resulting in emissions between the B2 and A1B SRES (Special Report on Emission Scenario) with 11.1 Gt of emissions of CO₂ in 2020 and 14.3 GtCO₂ in 2030 (including electricity emissions but omitting halocarbons, which could conceivably be substantially phased out by 2030).

GHG emission from building sector in India is of specific importance because India is fast developing economy and infrastructure development is happening at very fast pace. McKinsey report in year 2010 estimated that rapid urbanization in the country will require the construction of 700 to 900 million square meters of commercial and residential space, or "a new Chicago every year².

Implementation of 'Greenhouse gas accounting and management in building sector' is a new subject for India and still need awareness and implementation to assess the emissions from this sector. Different approaches being followed, on the basis of availability of data or on the basis of use phase of the building.

AIM

The aim of approach paper is to suggest possible 'strategies and approaches to develop emission calculation tool for building sector in India'.

METHODOLOGY

To prepare this approach paper, formal invites and ToR were sent to experts to attend working group (WG) meetings. In addition, one to one meeting with various experts was conducted to have their opinion and views.

Approach paper is an outcome of two working group meetings and interaction / discussions with various stakeholders from building sector in India.

SUGGESTED STRATEGIES FOR GHG ACCOUNTING -BUILDING SECTOR

Building has various stages:

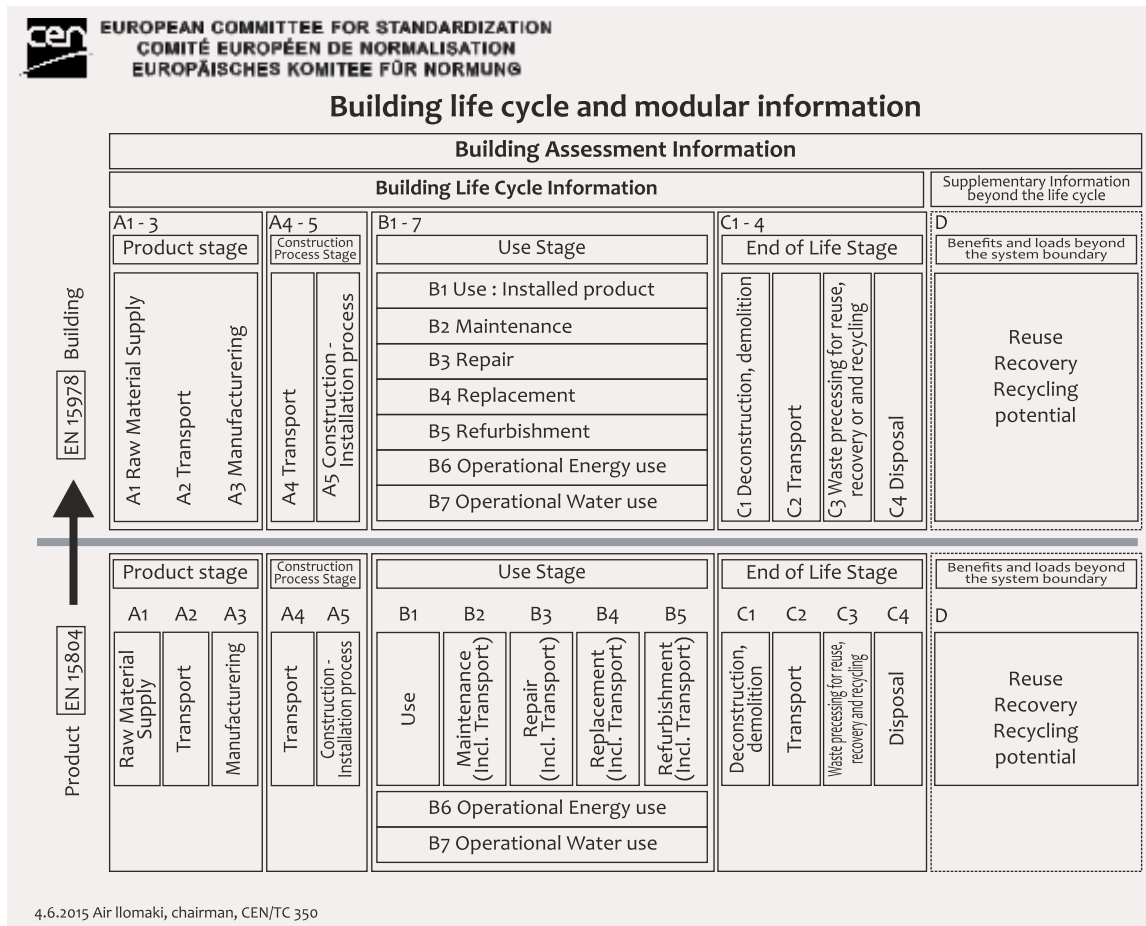
1. Construction material production, for eg. Bricks, pre-fabricated walls/roof/sheets/ glass, aluminum, iron, wood/MDF/HDF etc.
2. Construction of building, which include transportation of material to the site and energy used for construction
3. User phase of building/ Operations in Building: This phase may entirely change the face of buildings. It may be categorized as:

- a. Use of building for domestic purpose
- b. Use of building for commercial purpose.

Two different type of uses demand different amount of fuel, interiors, and amenities etc., which change the emission levels drastically.

4. End of the life of building, which may need transportation, recycling/ disposal of construction material, not very common though.

Following 'building life-cycle and modular information by European Committee for Standardization (CEN) can be useful to synthesize the strategy for GHG accounting – building sector.



SUGGESTED APPROACHES TO DEVELOP GHG ACCOUNTING TOOL FOR BUILDING SECTOR

A. Phase-wise Approach

1. **Construction Phase:** Develop emission calculation tool for material consumed and energy used to construct the particular building upto the stage of possession. GHG emission tool for this phase will be useful for construction companies only and it can be used by builders and developers.

Demolition and Re-Development Phase: Emission calculation tool at the end of life to disposal. This may be a hypothetical estimate to assess the emissions. Moreover, it is related to the construction material used. Embedded energy, metal, glass and other material used need to be disposed as per the rules/ reused and such considerations need to be made for estimation.

Demolition and Re-development phase can be considered together with construction phase because builder/ developer if considering the demolition for re-development then all emissions due to demolition are into the account of construction of building.

A directory of emissions (max and min levels) from production of construction material can be prepared. This directory can be ready to use data sets /reference guide for users willing to calculate GHG emission from construction phase of building. Such directory can be used by builders/ developers to choose the building material which is most energy efficient + durable + suitable for climatic conditions of host building. To prepare such directory, existing tool can be used for GHG accounting of construction material (by manufacturing companies). Further, the emissions from all construction materials, to the extent of its use in construction of particular building, can be added to arrive to consolidated GHG emissions from particular building. This emission calculation tool can be used upto the construction phase of building. Emissions of use phase of building cannot be estimated with this approach.

2. **Use Phase:** Emission calculation tool from stage of occupancy to the end of life of the building. The emissions from this phase can be calculated using existing GHG protocol. Benchmark for various categories of the buildings can be established for reference at later stages.

GHG emission tool for use phase will be useful users of the building. It can be used by the occupier / user of the buildings for the purpose it is used.

B. Building Category Approach

1. Residential Building
 - a. Independent Home
 - b. Apartments (multi-level residential buildings /High Rise Buildings)
2. Commercial Building

a. Service	e. Hospitals
b. Retail	f. Hotels
c. Engineering / Manufacturing	g. Airport
d. Warehouse	h. IT Companies/ IT companies with data centers

GHG emission accounting may be common for all category buildings. Benchmarking is different for different buildings. Under 'building category approach' GHG emissions for only use phase of the building can be accounted, as it focus on the purpose & use of building. Development of GHG intensity benchmarks for all categories of the building is also possible.

C. Life Cycle Assessment (LCA) Approach

This approach will focus on accounting of emissions since its inception to the end of life of building. This includes emissions happened during production of construction material, transportation, energy used for construction of building, use phase emissions/ building's life-time emissions, disposal phase emissions. It can be done on existing LCA softwares but datasets for India are yet to be developed.

CHALLENGES

1. Each phase have its own set of emissions, which can vary according to the site, type of material used for construction, occupants of building and coordinating all these parameters together is a challenge.
2. Size and Purpose of the building play an important role to assess the emissions. This need to be decided beforehand.
3. Lack of standardization of construction material /land size etc. is a challenge.
4. Variation in climatic conditions, technology availability, material of construction, transportation of material, proximity & availability material plays a bigger role in deciding the emissions from buildings.
5. Responsibility of Emissions: Responsibility of emissions and emission reduction lies with all who are involved with building (at construction phase, occupants, disposal phase) at other phases during its lifetime.
6. Life span of the building is not standardized.
7. Inclusion of interiors in buildings to estimate GHG emissions is a challenge. Eg. machineries, aesthetics, decors etc.

Keeping in view, the strategies and challenges, following approaches may be worked upon, to develop emission calculation tool for building sector.

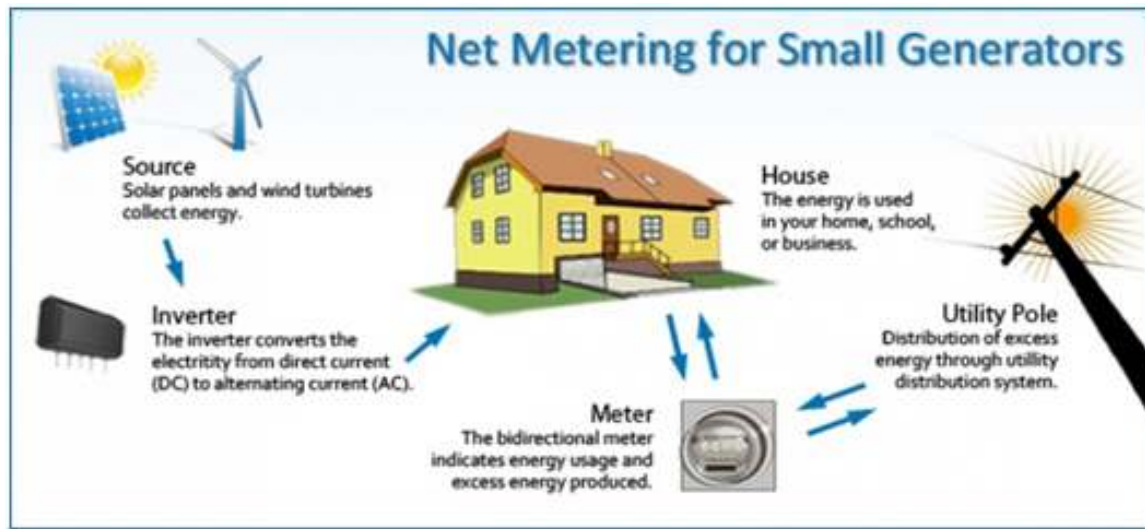
CURRENT STATUS AND WAY FORWARD

Several voluntary programmes for construction of Green Buildings are available in India. The voluntary programme which caught more attention was '**Green Building Certification**' by **Indian Green Building Council (IGBC)**. Standard for various type of green buildings viz. Commercial buildings, Residential buildings, Factories etc. are available. Various cities for eg. Kolkata, Pune, Noida Jaipur etc. announced the 'policy incentive' to support the uptake of Green Building Standards, IGBC.

Another approach, Energy Conservation Building Code (ECBC), Beureau of Energy Efficiency (BEE), Government of India (Gol), is also available for use by the builders. The Energy Conservation Building Code (ECBC) was developed by the Government of India on 27 May 2007. ECBC sets minimum energy standards for commercial buildings having a connected load of 100kW or contract demand of 120 kVA and above³. ECBC provide norms for Building envelope, including thermal performance requirements for walls, roofs, and windows; Lighting system, including daylighting, and lamps and luminaire performance requirements; HVAC system, including energy performance of chillers and air distribution systems; Electrical system and Water heating and pumping systems, including requirements for solar hot-water systems for energy conservation.

'**Star Labelling**', Standard and Labelling programme by BEE, Gol of appliances is another approach to reduce emission thru energy conservation. Appliance are given 3, 4 or 5 star rating, which standardize the energy consumption. Star rated appliances are commonly used on residential buildings. Star rated appliances contribute to GHG emissions reduction thru energy conservation during use phase of the building.

Net metering allows consumers to use the electricity anytime, which they generate on their own. Net-metering is now becoming a popular concept in India. This reduces GHG emissions through use of renewable energy and need to be specifically accounted during GHG inventORIZATION. Currently, there are four 'net-zero for energy' buildings in India viz. Indira Paryavaran Bhavan, Delhi; Bayer Eco-Commercial, Noida; Gujarat Pollution Control Board Annex, Gandhinagar; Sun Omega, Bhopal. Image below provide further clarity on net metering process:



Carbon Neutral Buildings is an upcoming concept in building sector. It is being promoted and some builders/ developers are willing to take it further. A popular approach for designing a carbon neutral building is as follows⁵.

1. Integrating passive design strategies
2. Designing a high performance building envelope
1. Specifying energy efficient HVAC systems, lighting and appliances
2. Installing on-site renewable energy
5. Offsetting

As there are diverse views from building sector in India, capacity building and awareness on GHG Accounting, is required among this sector. Awareness on benefits of 'GHG Management' in building sector can reap long term benefits for this dynamic and fast-growing sector. Further, India specific GHG emission inventory standard for construction phase and tool for GHG emission inventorization need to be built up and disseminated among construction and building sector.

REFERENCES

1. <http://www.unep.org/sbci/AboutSBCI/Background.asp>
2. <http://www.theatlantic.com/international/archive/2014/06/70-percent-of-india-has-yet-to-be-built/373656/>
3. <https://beeindia.gov.in/content/ecbc>
4. https://en.wikipedia.org/wiki/Net_metering
5. Helen Carruthers, BSc, LEED AP and Tracy Casavant, MES, P.Eng. Light House Sustainable Building Centre Society, Vancouver.

ABOUT INDIA GREENHOUSE GAS PROGRAM

The India GHG Program acts as a 'Center of Excellence' by disseminating regional, sectoral and global best practices to create a culture of inventorisation and benchmarking of GHG emissions in India. To accomplish this, the primary objective of the India GHG Program will be to build institutional capabilities in Indian businesses and organizations.

The program offers a unique threefold proposition – expertise and recognition from three renowned organisations - WRI India, TERI and CII.

The programme builds comprehensive measurement and management strategies to reduce emissions and drive more profitable, competitive and sustainable businesses and organisations in India. The India GHG Program offers businesses public visibility and specialised incentives through improved efficiency and profitability. The

India GHG Program also offers businesses opportunities to engage with industry, sectoral and regional peers on a single platform and access to policy makers and civil society to initiate dialog on actions businesses take and challenges they face in reducing GHG emissions. Thus, India GHG Program address the needs to mitigate economic, social and environmental risks while helping businesses remain profitable, competitive and sustainable.

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The India GHG Program aims to promote profitable, sustainable and competitive businesses environment in India by mainstreaming measurement and management of greenhouse gas emissions... The program is actively promoted by:



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