



Market Research Report on Business Case for Affordable Green Housing Finance in India

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Aavas Financiers Limited (formerly known as Au Housing Finance Limited), incorporated in 2011 in Jaipur, is a retail, affordable housing finance company, primarily serving low- and middle-income self-employed customers in semi-urban and rural areas in India. The company provides affordable home loans in the un-served market and a majority of its customers have limited access to formal banking credit. Aavas uses a unique appraisal methodology to assess its customers so that individualized financial solutions can be worked out. The mission and vision of Aavas is to enrich the lives of people by enabling them to achieve their dream of owning a home.

About Aavas Foundation

Aavas Foundation is a Jaipur-based non-profit established in 2019 to fulfil the CSR commitments of Aavas Financiers Ltd. It undertakes social initiatives with a three-pronged strategy: engage, enable, enrich. It engages directly with communities through a team of trained professionals. It collaborates deeply with these communities, right from understanding their needs, planning to implementing programs and measuring the value and impact they create. Since its inception, Aavas Foundation has touched 1.6 million+ lives with initiatives in rural development, education and holistic development, and environmental sustainability.

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List of abbreviations

Aavas	Aavas Financiers Ltd
ADB	Asian Development Bank
AFD	Agence Française de Développement
AHP	Affordable Housing in Partnership
BEE	Bureau for Energy Efficiency
BLC	Beneficiary-led Construction
BMPTC	Building Materials and Technology Promotion Council
CLSS	Credit-linked Subsidy Scheme
CREDAI	Confederation of Real Estate Developers' Associations of India
CMIE	Center for Monitoring Indian Economy
DFI	Development Finance Institution
DMIC	Delhi-Mumbai Industrial Corridor
ECBC	Energy Conservation Building Code
EDGE	Excellence in Design for Greater Efficiencies
EWS	Economically Weaker Section
FAR	Floor Area Ratio
GDRC	General Development Control Regulation
GHTC-India	Global Housing Technology Challenge – India
GoI	Government of India
GRIHA	Green Rating for Integrated Habitat Assessment
IGBC	Indian Green Building Council
HIG	High Income Group
IAY	Indira Awas Yojana
IFC	International Finance Corporation
IIT	Indian Institute of Technology
IMC	Indore Municipal Corporation
INR	Indian Rupee
HFC	Housing Finance Company
HMDA	Hyderabad Metropolitan Development Authority
LED	Light Emitting Diode
LIG	Low Income Group
MIG	Middle Income Group
MNRE	Ministry of New and Renewable Energy
MoEFCC	Ministry of Environment, Forestry, and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
NBFC	Non-Banking Financial Institution
NHB	National Housing Bank
NIT	National Institute of Technology

PCMC	Pimpri Chinchwad Municipal Corporation
PMAY-U	Pradhan Mantri Awas Yojana – Urban
RAY	Rajiv Awas Yojana
RBI	Reserve Bank of India
RCC	Reinforced Cement Concrete
RERA	Real Estate Regulation and Development Act
SBI	State Bank of India
SCB	Scheduled Commercial Bank
SEZ	Special Economic Zone
SHLC	Sustainable Housing Leadership Consortium
SIDBI	Small Industries Development Bank of India
SUNREF	Sustainable Use of Natural Resources and Energy Finance
TERI	The Energy and Resources Institute
UNDP- GEF	United Nations Development Programme (UNDP)- Global Environment Facility (GEF)
USD	United States dollar
WB	World Bank

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Executive summary

India is urbanizing rapidly and, as per UN estimates, its urbanization rate is set to cross 50% by 2050, with close to 600 million Indians expected to be living in urban areas by 2030. The increased urbanization, along with rising household incomes, has led to a surge in demand for residential properties. This has been accelerated by the Government of India's (GoI's) Pradhan Mantri Awas Yojana (PMAY) initiative launched in 2015. The program seeks to overcome a housing shortage of close to 10 million units by 2022 in the urban, low-income, affordable housing category.

Since its launch in 2015, PMAY has led to a cumulative 17-18% annual growth rate of the housing finance industry, including an increasing number of housing finance companies (HFCs) in the affordable housing space. From USD 77.45 billion in 2017-18, HFCs outstanding loan portfolio increased to USD 174.99 billion as on 31.03.2021.¹ This has been used to finance developer-led and self-built housing construction, including in the low-income segment. However, self-built housing is the predominant mode of affordable housing production in India, 62% of loans provided for new housing by affordable housing finance companies is for self-construction.²

Creating housing stock for the urban influx is a challenge and would exert huge pressure on available resources, subsequently contributing towards carbon dioxide (CO₂) emissions. As per estimates from the 'Eco-cities India' program, residential housing in India already accounts for about 24% of the nation's electricity consumption, as compared to 8% by the commercial sector.

India has been progressing in its adoption of cleaner energy and moving towards achieving its climate goals. At the 26th Conference of Parties (COP-26) in Glasgow, India set the target to achieve net-zero emissions by 2070. India has also committed to reducing 1 billion tonnes of projected emissions from now till 2030 and achieving carbon intensity reduction of 45 per cent over 2005 levels by 2030.³

In a recent IFC study on India's building construction market, the residential construction market was estimated at around USD 180 billion by value and 354 million sqm by volume, in 2019. The overall penetration of green buildings in India was low in 2019, with around only 12.1 million sqm certified as green out of total new formal-sector construction of 462 million sqm. With only 5% of buildings being classified as green, the market for green building in India is currently at a nascent stage of development. However, the Indian green building market is expected to double, and reach around 10 billion sq ft by 2022, valued between USD 35 billion and USD 50 billion.⁴ IFC estimates a total green buildings/housing investment opportunity of USD 1.4 trillion in India from 2018 to 2030, with the residential sector accounting for USD 1.25 trillion (89%) of this opportunity.

Green buildings provide some of the most effective means of achieving a range of global goals, such as addressing climate change, creating sustainable and thriving communities and driving economic growth. Green buildings eliminate negative impacts on the environment, by using less water, energy, or natural resources, and have a positive impact on the environment by generating their own energy or increasing biodiversity. Economic benefits include cost savings on utility bills for tenants or households (through energy and water efficiency); increased sales for building developers; increased occupancy rates for building owners; and job creation. Apart from environmental and economic benefits, other social benefits are positive impact on the health and wellbeing of people who work in green offices or live in green homes.⁵

While India’s progress has been commendable, it is also important to tap into the potential of housing finance to achieve other development objectives such as environmental sustainability and gender equality. For instance, despite the rise in housing finance provision over the last decade, women in India continue to face barriers in accessing home loans, primarily due to insufficient income and traditional gender norms. Serving the estimated home loan demand of USD 32.3 billion among women in India will help lenders tap into a new market segment while also improving socioeconomic conditions for women.

Similarly, as housing construction continues apace to meet the large unmet demand in the country, green housing finance products have the potential to incentivize environmentally sustainable construction. In this context, IFC’s vision to develop a “scalable and replicable business case for a home loan product for construction of green homes in the affordable segment” is timely as it will – (a) spur innovation in the housing finance sector, and (b) address multiple urgent development challenges.

Study objectives and methodology

This study follows the December 2020 agreement between IFC, Aavas Financiers Ltd., and Aavas Foundation to “help improve access to affordable green housing for low-income borrowers who have little or no access to finance.”⁶ The study aims to create a demonstrable example for affordable green housing for low-income households (including women-led households). The objectives of the study include:

- (i) Identifying and assessing the potential and actual demand for green housing among lower-income groups (affordable segment).
- (ii) Assessing the complete value chain of supply of green construction materials and financial products.
- (iii) Assessing housing policy framework on green buildings and finance; and
- (iv) Formulating appropriate product(s) and strategies for penetrating the affordable green housing market and targeted customer segments.

To meet the aforementioned objectives of the study, our team has conducted secondary research as well as primary research in the cities of Jaipur (Rajasthan) and Indore (Madhya Pradesh) where Aavas has a significant presence.

Household demand for green housing

The first step in designing a green housing finance product was to understand customer demand. Therefore, the team conducted primary surveys to assess household demand in terms of awareness and willingness to pay for green building materials and features. The survey covered 551 households in the peri-urban areas of Jaipur and Indore, both markets with a high penetration of affordable housing finance. Rajasthan is one of the 8 states that have a major presence of HFCs.⁷

For this study, our definition of ‘green building’ was adopted from IFC’s green building certification program – Excellence in Design for Greater Efficiencies (EDGE).⁸ Following this approach, we first asked respondents about the measures that they have taken/are currently taking to conserve electricity, water, and embodied energy (via the use of alternate building materials). The two major objectives of the survey were as follows:

Objective 1: Understand current perceptions and attitudes

- Measures (being) taken to reduce energy and water consumption
- Awareness of incentive schemes and rebates
- Awareness around and definition of green homes
- Barriers to adoption of green building materials and features

Objective 2: Evaluate willingness to pay for green features

- Distribution of green bundles choices
- Change in choice of bundles based on savings and cost information
- Desired green home loan features and support services

Most of the surveyed households (more than 90%) were already adopting measures to reduce energy and water consumption; these included simple, inexpensive steps such as installing energy-efficient light bulbs and using low-flow faucets. For many households (roughly 50%), the impetus to install these features was a neighbor's recommendation. Star rating is not an essential criterion affecting households decision to purchase electrical appliances. The presence of advanced energy efficient features such as solar water heaters and solar power systems was almost negligible.

Similarly, the use of low-flow fittings and dual flush water closets were common measures to reduce water consumption, but the installation of large systems such as that for rainwater harvesting was significantly lower.

Awareness of government schemes and subsidies for electric appliances and water usage was low, suggesting that awareness-raising campaigns have not been effective.

Most of the respondents have employed conventional construction technologies to build their homes. The structural design is based on RCC framed construction. Consequently, cement, steel, and masonry are the principal building materials used for the building envelope. The housing typology is predominantly low-rise, with single-storey houses being the most common typology (53%).

When asked what green housing meant to them, **70% respondents indicated that building green meant a reduction in electricity usage.** This is not surprising given the high cost of electricity in these two cities. At the same time, **50% indicated cost as a barrier for the uptake of green materials.** Additionally, **38%** also indicated that the **lack of awareness of benefits was a barrier to the uptake of energy-efficient features.**

Most households expressed willingness to incorporate sustainable building materials and features in their new homes, with 28% stating that they had not considered the ecological impact of their homes. The low number is very encouraging as it shows that **a vast majority, in principle, recognizes the importance of being eco-friendly and green.** However, these numbers are on the optimistic end, as there is a high likelihood of social desirability bias.

To understand households willingness to pay for green materials and fixtures, we provided respondents with the following three bundles of green features, wherein the number of green features, costs and associated savings increased incrementally.

- **Bundle 1:** Inexpensive and simple green features that result in small monthly savings
- **Bundle 2:** Addition of green features that are slightly more expensive and result in sizable monthly savings and
- **Bundle 3:** Addition of green features that are expensive and result in large monthly savings

Of the green features provided under each of the bundles, we asked respondents about the features they are willing to incorporate in their new house. Low-flow faucets and energy-efficient bulbs and lights were chosen most often, very much in keeping with their current practices.

The overall distribution of preferred bundles is between bundles 1 and 3. The preference of most respondents is on either extreme end, where they either choose the bundle with the maximum green features or the bundle with the minimum green features.

To understand the rationale behind the choice of bundles, we examine the distribution of bundle choice by income level. **Income seems to have an impact on the choice of bundles**, particularly in that EWS households have a strong preference for bundle 1. HIG households prefer bundle 3. After savings and cost information was revealed, there was a shift among EWS respondents, indicating that they were not fully aware of the costs of green features and have opted for a higher bundle when they were able to internalise the cost. Across the sections EWS, LIG and MIG 1, we can see at least **40%** of people indicate their unwillingness to adopt the green building features, cost being a major barrier that prevents many households from adopting all the available green features.

Supply of green affordable housing

As a complement to the primary household surveys, the team also conducted interviews and reviewed publicly available information to assess the ecosystem of green affordable housing, including stakeholder partnerships, gaps, and opportunities.

On the supply side, the GoI is actively encouraging the adoption of new construction technologies to reduce costs as well as the environmental impact of affordable housing. Under the technology sub-mission of PMAY, the GoI has been identifying new environmentally sustainable materials and construction technologies and publishing a compendium annually. Moreover, the GoI is building six lighthouse projects (LHPs) in six different Indian states to showcase and build proof of concept for six green building materials and technologies. While these efforts focus primarily on large-scale developer-built housing, beneficiary-led construction constitutes the majority of housing supply in the country. Starting in 2021, the GoI has also started to identify (and publish) green building materials suitable for low-rise self-built housing.

The green building materials value chain is still nascent, and limited awareness of new materials and technologies among stakeholders is the foremost obstruction to green building construction. In self-built housing among low-income segments, the potentially higher upfront costs of green materials, coupled with limited knowledge/training on how to use those materials, hinder green housing construction practices. Therefore, as observed during the primary surveys, while households are using (and remain amenable to using) energy- and water-efficient appliances, they prefer to use conventional building materials (vis-à-vis green alternatives such as compressed stabilized earth blocks or fly ash bricks). For developers, the higher upfront costs combined with the lengthy procedures associated with green ratings systems and complexity in design and execution are key obstacles to building sustainably.

Housing finance provision has increased manifold in recent years, in response to increased housing construction, particularly in the beneficiary-led construction segment. As on June 30, 2022, the total number of registered Housing Finance Companies (HFCs) stood at 95.⁹ However, only three financial institutions (two HFCs and one bank) have announced new green home loan products. Backed by KfW, IFC, and ADB respectively, State Bank of India (SBI) Home Loans, HDFC Ltd., and IIFL Home Finance Ltd. are developing green home loan offerings to encourage both developers and beneficiaries to reduce the carbon footprint of their housing construction activities.¹⁰ The technology sub-mission of the PMAY was introduced to incorporate environmentally sustainable design and construction principles in affordable housing development. However, studies have highlighted limited awareness of green building materials and technologies among stakeholders as the foremost impediment to green building construction in India. Potentially higher upfront costs, lengthy procedures associated with green ratings systems, and complexity in design and execution are the key obstacles in developer-led green affordable housing. Moreover, in the beneficiary-led

sector, limited access, and knowledge of how to use green materials hinder scaling up of green housing construction. The increasing urgency around climate change has resulted in more focus on green building from all stakeholders in the ecosystem. However, much more needs to be done to establish meaningful partnerships, products, and processes to help scale innovations in the green building sector.

Financing and regulating green affordable housing

In response to the increased construction pace to meet the housing demand, the provision of housing finance in India has grown manifold. However, in 2019-20, 64% of the total allocation was for loans more than INR 2.5 million¹¹ (USD 33,784), whereas the affordable sector received only 37% of the total allocation. There is an urgent need to develop appropriate green housing finance products for households, developers, and other stakeholders to scale innovations in the green building sector. There are three financial institutions, backed by DFIs, which have announced new green home loan products. However, these are in the development stage, and none are currently offering it.

While there are some incentives and funding programs to incentivize green affordable housing construction, there are no specific regulations to mandate green housing finance products. At present, there is no holistic regulatory framework (for green affordable housing) at the national level, but instead consists of state and city-level regulations and incentives designed in response to those stipulated by national ministries. An enabling regulatory environment has potential to stimulate supply and demand for green housing products, thereby setting the foundation for a robust green housing ecosystem.

Key findings

The market research shows that **although the green affordable housing value chain is not yet well-established, there is momentum**, and stakeholders recognize the urgent need to adopt sustainable building practices. Most of India's population, particularly in the lower income segments, remains inadequately housed, so affordable housing development is bound to continue apace over the next several decades. At the same time, current building methods and materials are not responsive to local climatic conditions and are environmentally unsustainable. With this as the starting point, it is **imperative to bring together stakeholders to collectively design green housing products and solutions**, on the supply and finance sides.

The primary surveys demonstrate that **households are willing to pay to incorporate green materials and features in their homes**; incentives and support would help increase uptake. Although the sample size of this survey is not representative of the country (or even the states) as a whole, and more research is needed to zero-in on the nuances of household demand, the results clearly show that households are willing to pay for green housing. Driven by a desire to reduce utility bills, households are already taking steps to reduce energy and water consumption. Although these measures are small, when combined with households stated willingness to build sustainably, this **presents an opportunity to offer green housing and housing finance products to increase adoption of energy and water saving measures**.

Through GHTC-India, the GoI is leading the way as it relates to innovating green and affordable construction technologies. If successful, the lighthouse projects (LHPs) currently under construction could significantly increase developer interest in the sector. Complementary to the GoI's initiatives to encourage developers, DFIs are focusing their efforts on beneficiary-led construction, which is the predominant mode of housing production, especially for lower income segments. DFIs are investing in and providing technical assistance to HFCs that have a deep understanding of the target customer segment to drive penetration of green housing practices.

In summary, while there is much to be done to build a green affordable housing ecosystem, the success of previous initiatives and the current (global) momentum in the sector present a ripe opportunity for new products and partnerships in this sector.

Structure of this report

Subsequent chapters of this report delve into the details of the household surveys, as well as the secondary research on the green housing ecosystem. The report is structured as follows:

Chapter	Overview
1	Findings of household surveys, and assessment of the demand for green housing among target segments
2	Analysis of the supply-side value chain of green affordable housing, including a discussion on challenges and opportunities
3	Analysis of the housing finance value chain, including a discussion on challenges and opportunities
4	Analysis of the regulatory framework that guides the development of the green affordable housing sector

1. Household demand for green housing

Key takeaways

Understanding Current Perceptions and Attitudes	Takeaways
Question 1.1: What are the steps that households are currently taking to use water and energy efficiently?	75% households are only taking simple behavioural steps
Question 1.2: What are the steps that households are currently taking to reduce heat during summer?	82% households are only taking simple, inexpensive steps such as installation of blinds or external shading devices
Question 1.3: What is the current level of awareness about green homes?	While many have not heard the term ‘green home’, 87% associated it with the houses that consume less electricity
Question 1.4: What is their attitude towards the concept of green homes?	43% consider the ecological impacts/aspects of their home to a great extent and are willing to incorporate them in the new house they are building
Evaluating the Willingness to Pay for Green Features	Takeaways
Question 2.1: How is the choice of bundles (of green features) distributed?	The choice of bundles is primarily distributed between bundles 1 and 3.
Question 2.2: How is the choice of bundles affected by the provision of savings and cost information?	Cost and savings information does not have a sizable impact on the choice; it appears that most respondents do not have a proper understanding of the cost of the features.
Question 2.6: What are the key features that households think is important?	Energy efficient bulbs, ceiling fans, and low-flow faucets.

There’s no doubt that affordable housing options are the need of the hour. To combat the growing population, poverty, and other urbanization challenges, the Indian government has already launched various affordable housing schemes. But what if housing could be both affordable and environmentally friendly?

Green buildings are a growing trend because of the benefits they offer in the face of the climate crisis. For instance, as compared to conventional buildings, green buildings are designed to save energy and resources, and minimize the emission of toxic substances throughout their life cycle – during the construction as well as in operational phases. However, their association with affordable housing has long been misunderstood due to a lack of data and analysis, particularly in India.

To promote market research initiatives and enhance the understanding of the green housing market and value chain, IFC, with its real estate developers and housing finance companies, plan to integrate green lending and climate adaptation strategies in scaling up of affordable housing solutions in India. The following section presents the results of household demand assessment the team conducted to gauge the interest, capacities, and perceptions of the target segments – (i) to adopt green construction practices and buildings, and (ii) their preferences in availing green financial products.

1.1 Survey sample

Aavas Financiers Limited (Aavas) was originally incorporated as a private limited company in Jaipur, Rajasthan. Aavas is engaged in the business of providing housing loans, primarily in the un-served, unreached, and under-served markets which include the states of Rajasthan, Maharashtra, Gujarat, Madhya Pradesh, Haryana, Uttar Pradesh, Chhattisgarh, Uttarakhand, Punjab, Himachal Pradesh, Delhi, Odisha, and Karnataka. This includes the people

belonging to low-and middle-income segments in semi-urban and rural areas. The primary customers of Aavas, in terms of economic status, are those above the poverty line, lower-middle class, and middle-class people. Currently, Aavas has a customer base of 1,25,500 (2021) which has grown from 52,800 (2018) and has disbursed loans worth Rs. 137.5 billion since its inception.

The survey covered a total of 551 households, of which 352 were in Jaipur and 199 were in Indore. Survey locations were chosen in consultation with the Aavas team. Jaipur and Indore were selected due to their strategic significance. It is often challenging for survey respondents to internalize potential costs and savings in a hypothetical setting and conducting such a survey without inter-personal communication/touch would further reduce the comprehension, and therefore effectiveness of the survey. Therefore, all the surveys were conducted in person through a random selection of respondents from Aavas’ database. Efforts were made to ensure that existing clients were prioritized for the consultation. 88.9% of customers had their loans already sanctioned by Aavas and the rest were in the final stages of approval. This becomes a good indicator as it presents an estimate of the proportion of respondents whose loans can be easily converted to take up green home loans products.

The survey instrument had 5 different sections (as indicated in the table below) to collect information on household profiles and respondent preferences for green housing elements. Survey section on willingness to pay for green features, was accompanied by green bundle brochures¹² and had open-ended questions to give the respondents the freedom to answer in their own words, instead of limiting their response to a set of pre-selected choices.

Table 1: Overview of survey questionnaire

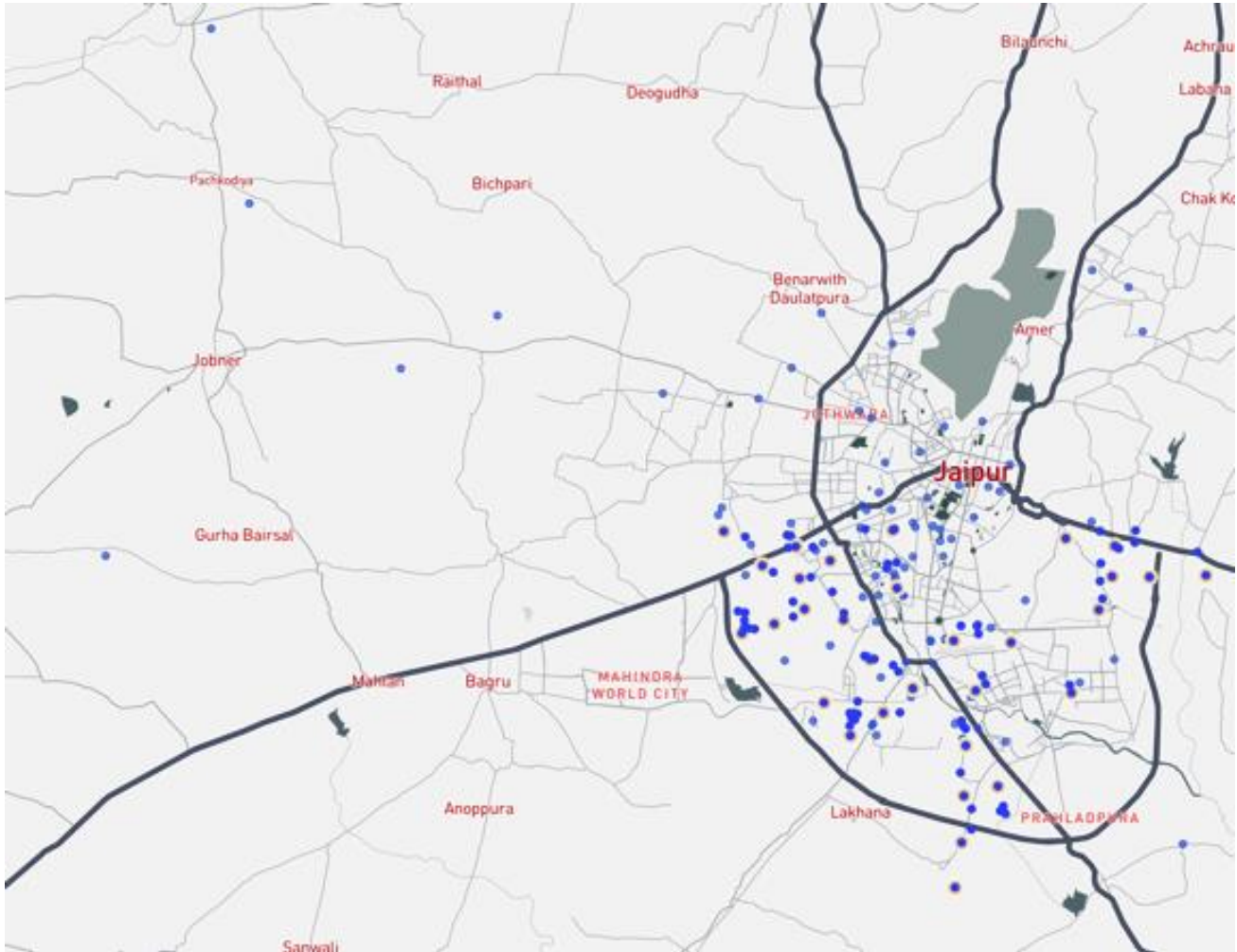
S.No	Section	Description
1	Respondent screening questions	Set of filter questions to select the correct respondent. The objective is to identify a household who is within the target income group, is in the process of taking a loan or intends to take a loan (from a formal source) and has not already completed house construction.
2	Respondent profile and household characteristics	General information on household demographics and socioeconomic characteristics.
3	Energy and water consumption patterns	Questions to assess respondent’s current energy and water consumption behavior (current and future) based on the type of appliances and materials used, and past efforts to reduce or switch to energy- or water-efficient features.
4A	Need for housing	Questions to assess current housing status (household size, tenure (rental or ownership), etc.), reasons for building a house, preferred housing size, and awareness of and attitudes towards green homes.
4B	Willingness to pay for green housing features	Questions to assess the awareness of, preference for, and the willingness to pay for green housing features.
5	Sources of finance and preferred loan features	Questions to assess loan history, propensity to take green housing loan, add-on features for green housing loan finance, desired features of a green housing loan if the respondent had the opportunity to take one, and qualitatively capture perceived impact of a green housing loan on willingness to pay.

1.2 Jaipur – City profile

Jaipur holds tremendous significance for Aavas. Home to the company’s very first office, Jaipur remains the organization’s headquarters, even though it has expanded to ten other states in the country. The survey was conducted primarily in peri-urban regions of the city and included four towns namely, Renwal, Sambhar, Phulera

and Chomu. The widespread location of the households in the urban and peri-urban regions (as shown in the Figure 1) can be attributed to the customer base that Aavas primarily targets.

Figure 1: Location of households surveyed in and around Jaipur



Map credits: Map Box

Phulera is a town in Jaipur district and part of the Delhi-Mumbai Industrial Corridor (DMIC) project. Chomu, Renewal, and Sambhar are smaller municipalities that are 45-50 km away from the city and host the prime branches on the peri-urban front. 91% of the respondents had availed the loan and the other 9% were currently in the process of availing the loan. On the basis of employment status, Aavas primarily categorizes its customers into – (i) self-employed, (ii) business, and (iii) salaried. The only difference between self-employed and business is to do with a registered business and a place of operation. Based on this categorization, the distribution in Jaipur is shown in Figure 2.

Figure 2: Distribution of Jaipur-area respondents by employment category

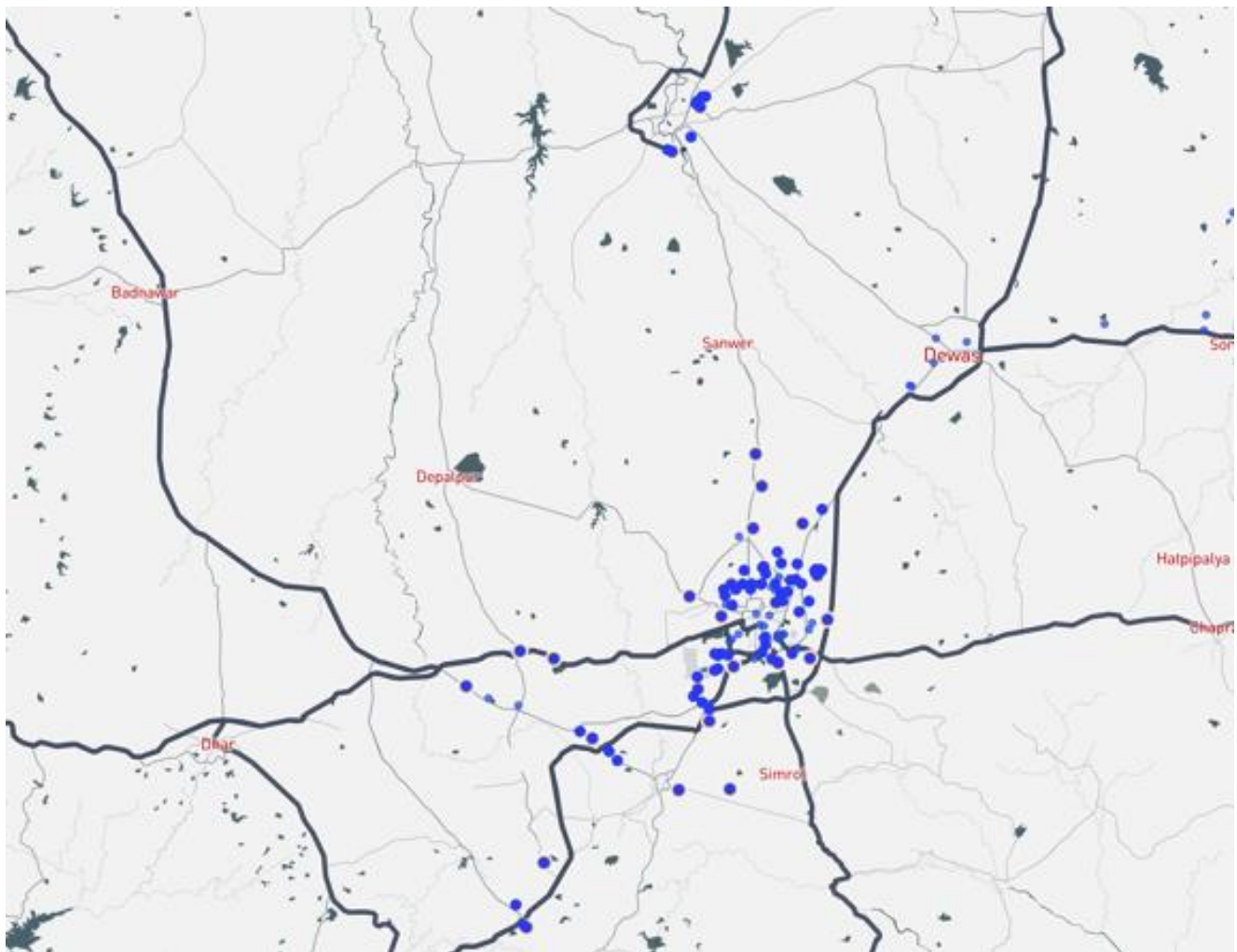


Source: Athena Infonomics

1.3 Indore – City profile

Indore has been an emerging market for Aavas. The average household size in the city is five and the houses are further spread-out as compared to Jaipur. The survey was conducted primarily in the peri-urban regions of the city and included two satellite towns namely, Dewas and Pithampura.

Figure 3: Location of households surveyed in and around Indore



Map credits: Map Box

Dewas lies northeast of Indore and southeast of Ujjain. The city has industrial units of companies like Tata Motors, Kirloskar Group, and Deere & Company that provide employment to thousands of workers. Pithampura is also an industrial town home to several large-scale industries like Torrent Pharmaceuticals and has recently been included

in the Indore Metropolitan Region. 86.9% of the respondents had availed of a loan and their distribution based on employment categories as shown in Figure 4.

Figure 4: Distribution of Indore-area respondents by employment category



Source: Athena Infonomics

1.4 Survey limitations

Female primary respondents were low (6%) – Gender perspectives become very essential in such studies. While Aavas in its policy encourages female applicants (co-applicant or main borrower), there was a low turnout for this survey.

Non-responses to qualitative questions – Data errors due to question non-responses may exist. The number of respondents who choose to respond to a survey question may be different from those who chose not to respond, thus creating bias. Alternatively, respondents may not be fully aware of their reasons for any given answer because of lack of memory on the subject, or even boredom.

Social desirability bias – Questions about preferences and perceptions are often affected by a phenomenon called ‘social desirability bias.’ Social desirability is the tendency of some respondents to report an answer in a way they deem to be more socially acceptable than would be their "true" answer. They do this to project a favorable image of themselves and to avoid receiving negative evaluations.¹³ Respondents might overstate their preference for green homes or their willingness to pay for green features, as being eco-friendly is perceived as a positive characteristic. While interpreting the results of the survey, it is crucial to note that it could potentially be an overstatement of the respondents preferences.

1.5 Respondent profiles

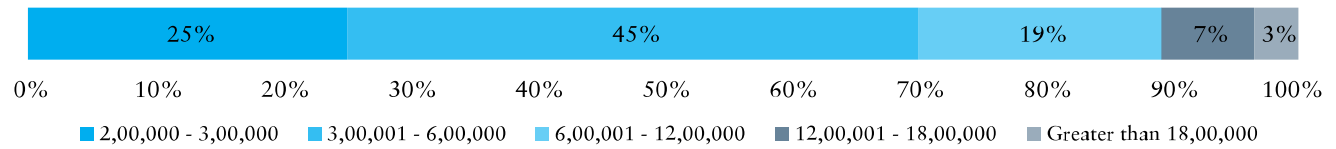
Use of a questionnaire as the survey instrument was deemed the most appropriate method of data collection for this study. By requesting uniform data from respondents, the team adopted a comparative statistical analysis methodology. The first section of the questionnaire aimed at identifying respondents demographic data to check if they satisfied all the required checklists for the research, and to establish a profile of the customers. This was done to identify the most eligible group of respondents that meet certain criteria and therefore, collect the most accurate responses and derive better insights.

1.5.1 Income, occupation, and educational profile

The research divides the households into five income groups, which is in line with the categorization by the Government of India (GoI) in its centrally sponsored housing scheme Pradhan Mantri Awas Yojana (PMAY)

- (i) **EWS** – Economically Weaker Section, with income <INR 3 lakh (USD 4,054) per annum
- (ii) **LIG** – Lower Income Group, with income between INR 3 lakh (USD 4,054) and 6 lakh (USD 8,108) per annum
- (iii) **MIG-I** – Middle Income Group, with income between INR 6 lakh (USD 8,108) and 12 lakh (USD 16,216) per annum
- (iv) **MIG-II** – Upper Middle-Income Group, with income between INR 12 lakh (USD 16,216) and 18 lakh (USD 24,324) per annum, and
- (v) **HIG** – High Income Group, with income more than INR 18 lakh (USD 24,324) per annum

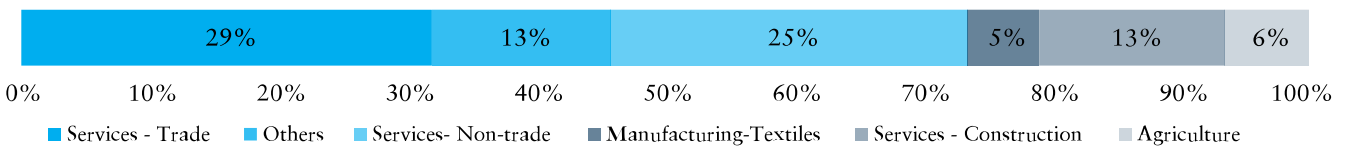
Figure 5: Distribution of surveyed households by annual income (in INR)



Source: Athena Infonomics

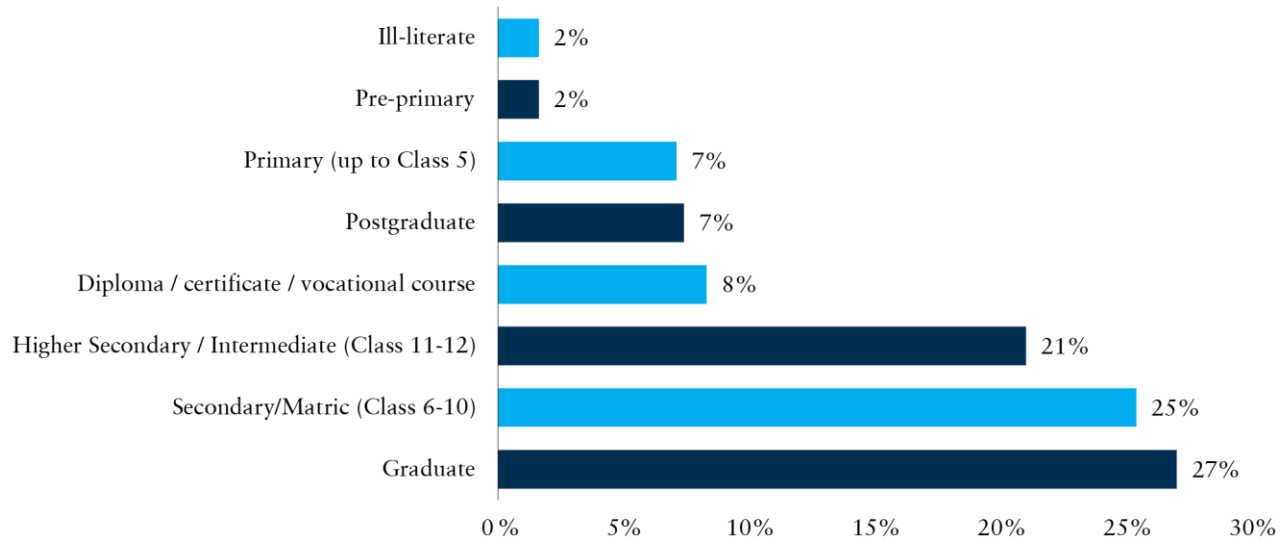
Almost 70% of the households were in the INR 2-6 lakh income slab, in which 25% fell in the EWS segment. 42.2% of households had at least two earning members, and 73% had at least one female applicant. 45% of the loan applicants were in the 35-45 years age group. 67% of the households occupation is service (Trade, non-trade and construction) as given in Table 6. In terms of education, most households (73%) had completed their secondary education, and out of which 27% of respondents had completed graduation (the detailed split is shown in figure 7).

Figure 6: Distribution of surveyed households by occupation



Source: Athena Infonomics

Figure 7: Distribution of surveyed households by educational attainment

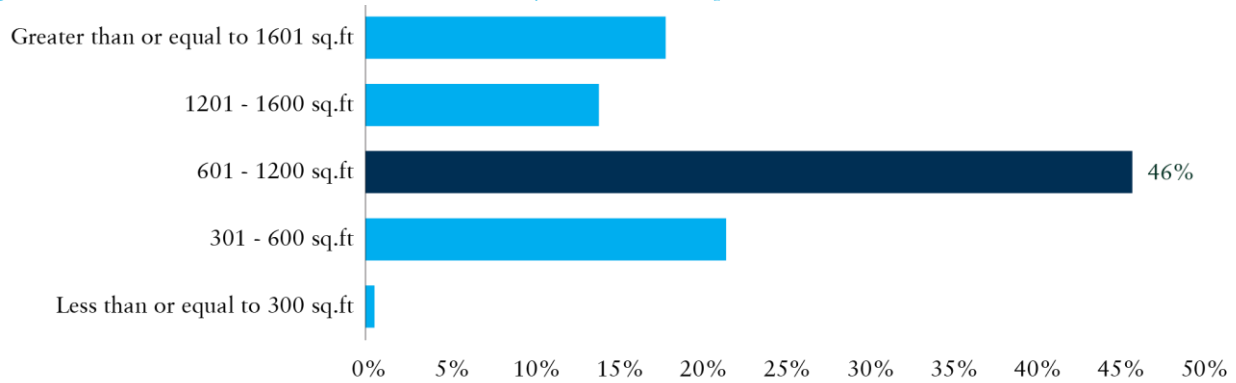


Source: Athena Infonomics

1.5.2 House construction – tenure and house size

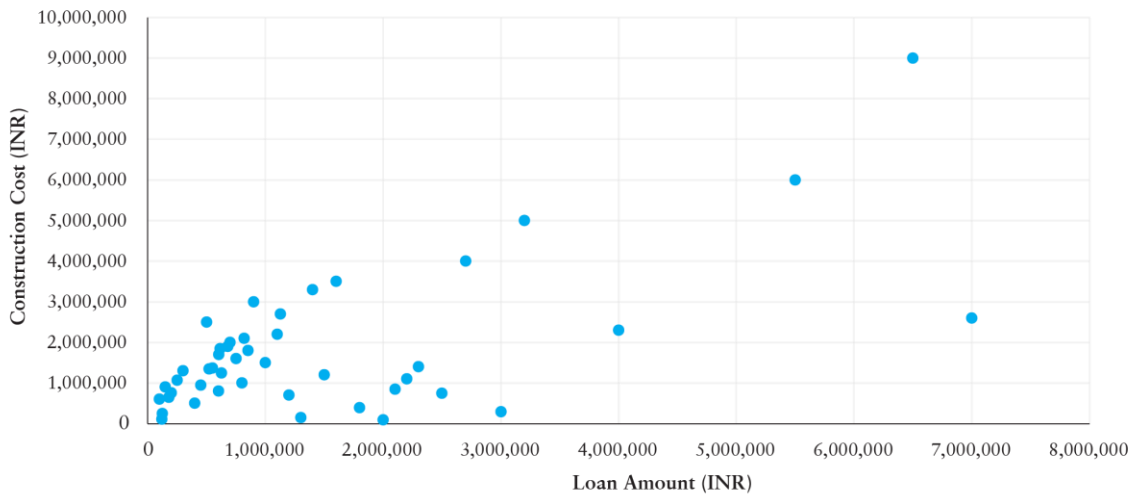
The responses indicate the ownership status of current residences to be 73% owned and 27% rented. 90% of houses being built (or planned to be built) were being built for the self and family to reside in. For this study, our team categorized built-up areas in line with PMAY CLSS criteria. Almost 46% of the houses that were being built were between 600 and 1,200 ft² and were in the advanced stages of construction. 98% of the households had access to reliable electricity and water supply within 100 meters, indicating that there was an enabling ecosystem in the locality.

Figure 8: Distribution of houses under construction, by house size (in sq.ft.)



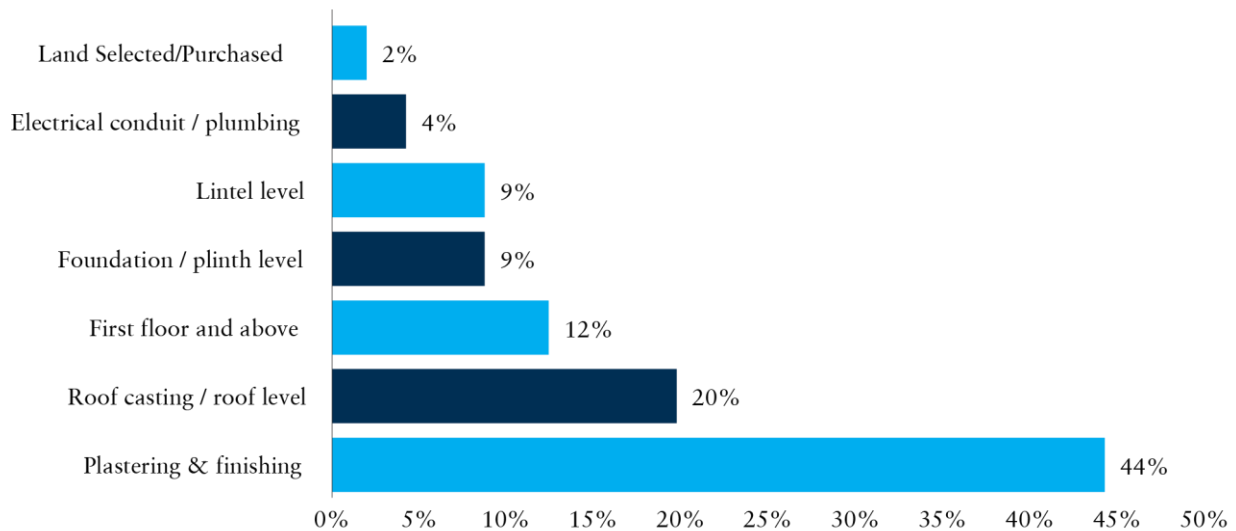
Source: Athena Infonomics

Figure 9: Construction cost vs loan amount for houses under construction



Source: Athena Infonomics

Figure 10: Stage of construction of new house

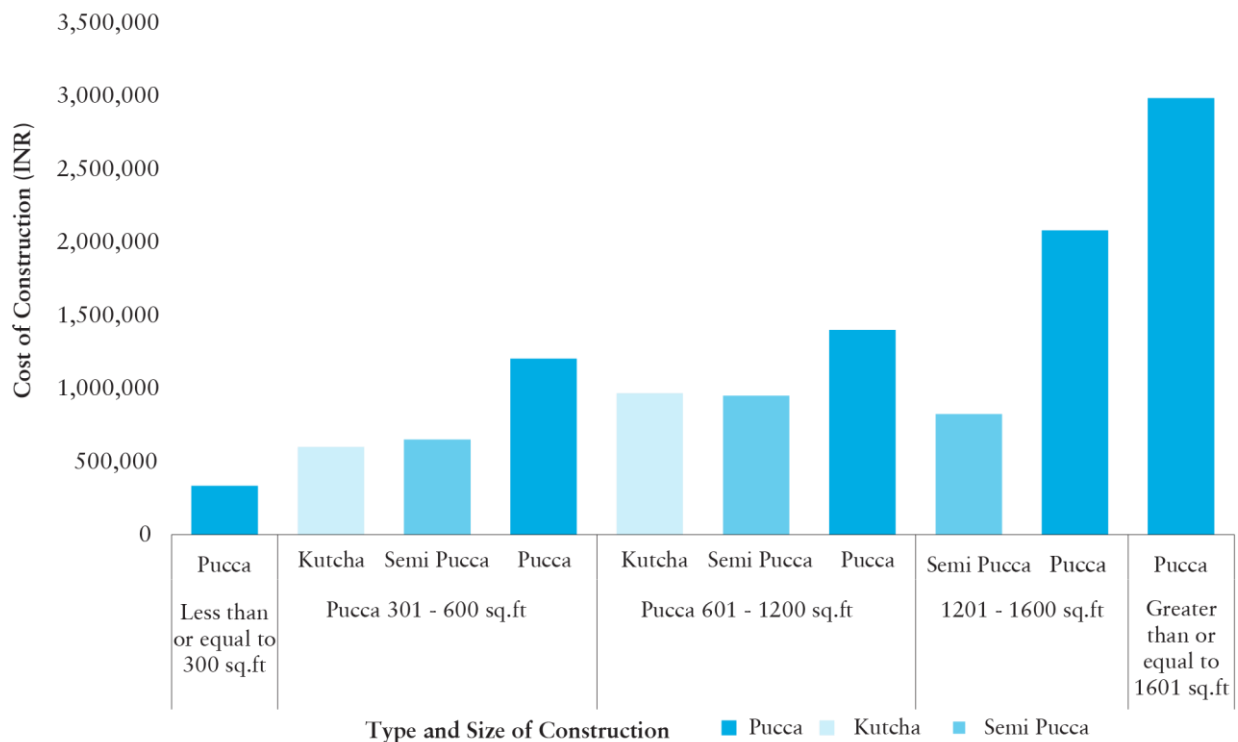


Source: Athena Infonomics

To understand the physical condition of the houses, the field team also classified them into *pucca*, *kutcha* and *semi-pucca* (permanent, temporary, and semi-permanent), respectively. The short descriptions of each of these classifications are as follows:

- *Pucca* – A house that has walls and roof made of permanent materials. For example, wall materials could be burnt bricks, stones (packed with lime or cement), or cement concrete. Permanent roof materials include tiles, galvanised corrugated iron (GCI) sheets, asbestos cement sheets, reinforced brick concrete (RBC), reinforced cement concrete (RCC), and timber.
- *Kutcha* – A house that has walls and/or roof made of materials other than those mentioned above, such as unburnt bricks, bamboos, mud, grass, reeds, thatch, loosely packed stones, etc.
- *Semi-pucca* – A house that has fixed walls made of permanent materials, but the roof is made of a material other than that used for *pucca* house.

Figure 11: Cost distribution of houses by type of construction and size



Source: Athena Infonomics

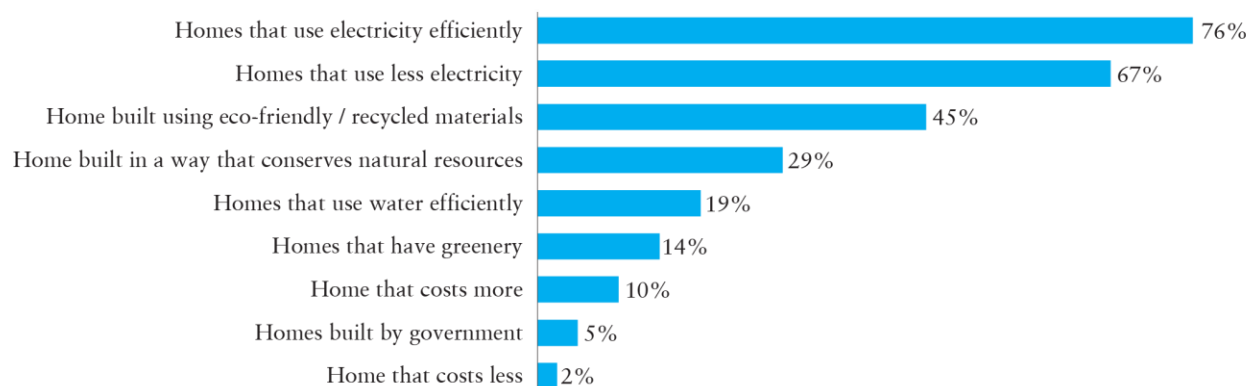
A total of 534 houses were listed as *pucca*, 12 houses as *kutcha*, and the remaining 4 as *semi-pucca*. The average cost difference between a *pucca* and *kutcha* house in the 601-1,200 ft² category stands at approximately INR 0.45 million (USD 6,085).

1.6 Understanding perceptions and attitudes towards green homes

A ‘green building’ is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment.¹⁴ However, this is not a standalone definition and there are different expressions with the same intent. Comparing different definitions is not an easy task as it results from a wide range of assessment criteria, application and building life cycles that are covered by different building assessment codes and methods.

For this study, our definition of ‘green building’ was adopted from IFC’s Green building certification program EDGE (Excellence in Design for Greater Efficiencies).¹⁵ According to EDGE’s minimum standards a building is said to be green if it can accrue savings in three critical dimensions i.e., 20% or more savings in energy, water, and embodied energy in materials compared to baseline. Following this approach, we first asked respondents about the measures that they have taken/are currently undertaking to conserve electricity, water, and embodied energy (via the use of alternate building materials). We also asked them about steps currently taken to regulate the indoor temperature of their homes. To understand the household’s awareness about green homes, we asked them if they were aware of the term ‘green home’ and what it meant to them. Two aspects were the most associated with green home – efficiency in electricity usage and use of eco-friendly/recycled materials. To evaluate household’s attitude towards reducing the ecological impact of their home, we asked them about the extent to which ecological considerations played a role in their decision making.

Figure 12: Respondents perception about 'green home'



Source: Athena Infonomics

Based on responses, we have developed energy, water and embodied energy profiles, which are described in subsequent sections.

1.7 Energy profile

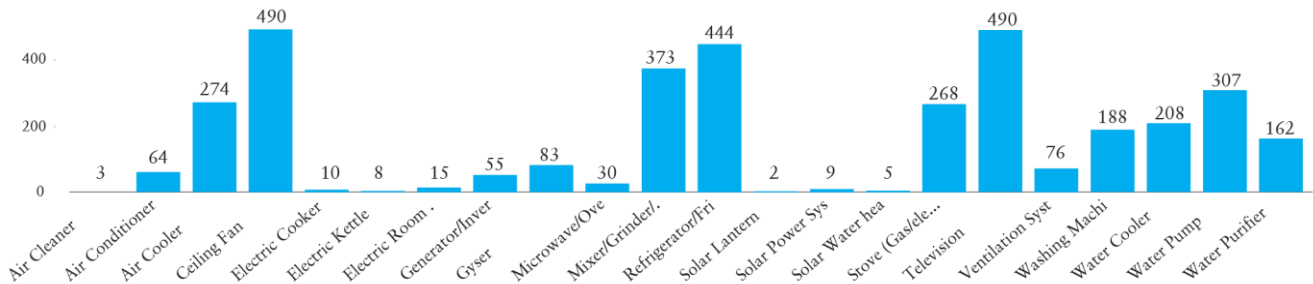
Electricity is an essential resource for a thriving life; we need it to run almost every appliance in our daily lives. With electricity rates going higher (Jaipur: INR 9/kWh (USD 0.12/kWh) | Indore: INR 5/kWh (USD 0.067/kWh)), measures to reduce electricity usage have become almost mandatory for the target households. Respondents were probed on the measures they undertook in the past to conserve electricity, and to understand the awareness of schemes, rebates, and incentives available in their locations. The top two measures revolved around using energy-efficient appliances:

- **98%** of respondents bought energy-efficient light bulbs/ tube lights
- **45%** of respondents upgraded to more efficient (star-rated) air-conditioners or refrigerators

Of those that had taken steps to reduce their electricity consumption, **40-50%** were prompted to do so because they saw it being beneficial at a neighbor’s house. While the uptake of LED bulbs was high, the awareness of the UJALA (Unnat Jyoti by Affordable LEDs for All) scheme, a LED lamp distribution project launched by the Government of India was just satisfactory. Awareness regarding rebate schemes and incentives for solar photovoltaic (PV) and solar water heater was negligible. We found that existing awareness-raising campaigns and subsidies for promoting PV technologies have not been effective. Households prefer word-of-mouth references and first-hand experience over conventional electronic and print media advertising, which are the preferred modes of information dissemination by

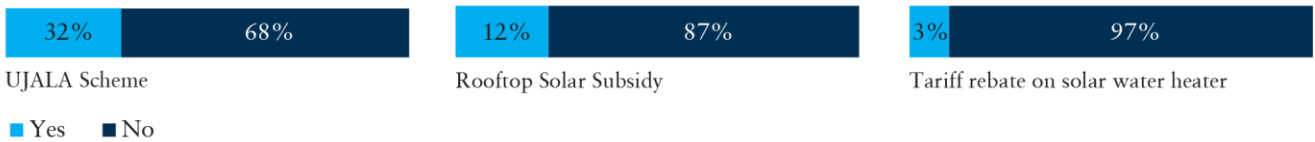
the government and private sector actors. In terms of the appliances that households own (except for washing machines, geysers, and air conditioners), star rating was not an essential buying criterion. The presence of advanced energy efficient features like solar water heaters and solar power systems were negligible and almost absent.

Figure 13: Appliance inventory in respondents homes



Source: Athena Infonomics

Figure 14: Households awareness on electricity schemes and rebates

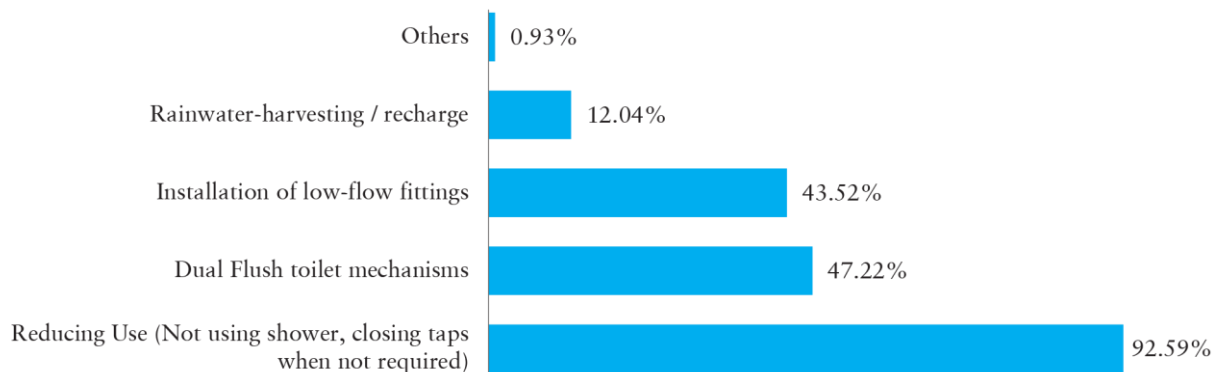


Source: Athena Infonomics

1.8 Water profile

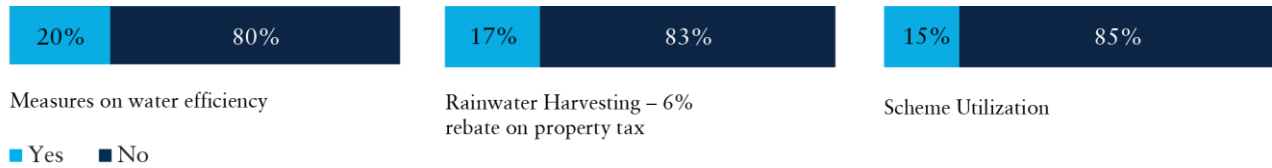
The dimensions of housing need to be viewed within the overall environment of human settlements. The physical dwelling unit is not the sole element of housing; the provision of basic services like potable water and sanitation are equally relevant. Water saving was a priority for most respondents; however, they mostly resorted to individual measures like turning off the tap when not required as compared to technological measures like rainwater harvesting and installation of low-flow fittings. **95.7%** of respondents find low flow faucets and dual flush systems beneficial, and **53%** were prompted to buy them because they saw it being beneficial at a neighbor’s house. On the contrary, only **13** respondents have taken up rainwater harvesting in their houses and indicate maintenance as a key issue for uptake in their new house. Respondents awareness of incentive schemes was better compared to solar PV schemes; however, they reported lower utilization.

Figure 15: Measures taken to reduce water consumption



Source: Athena Infonomics

Figure 16: Households awareness on water schemes and rebates



Source: Athena Infonomics

1.9 Embodied energy profile

The majority of the respondents have employed conventional construction technologies to build their homes. The structural design is based on RCC framed construction. Consequently, cement, steel, and masonry are the principal building materials used for the building envelope. The housing typology is predominantly low-rise, with single-storey houses being the most common (53%).

Most construction materials are sourced from hyper local markets. Any attempt to design a material palette or bundle must consider this factor, and its impact on material quality, price, and access/availability.

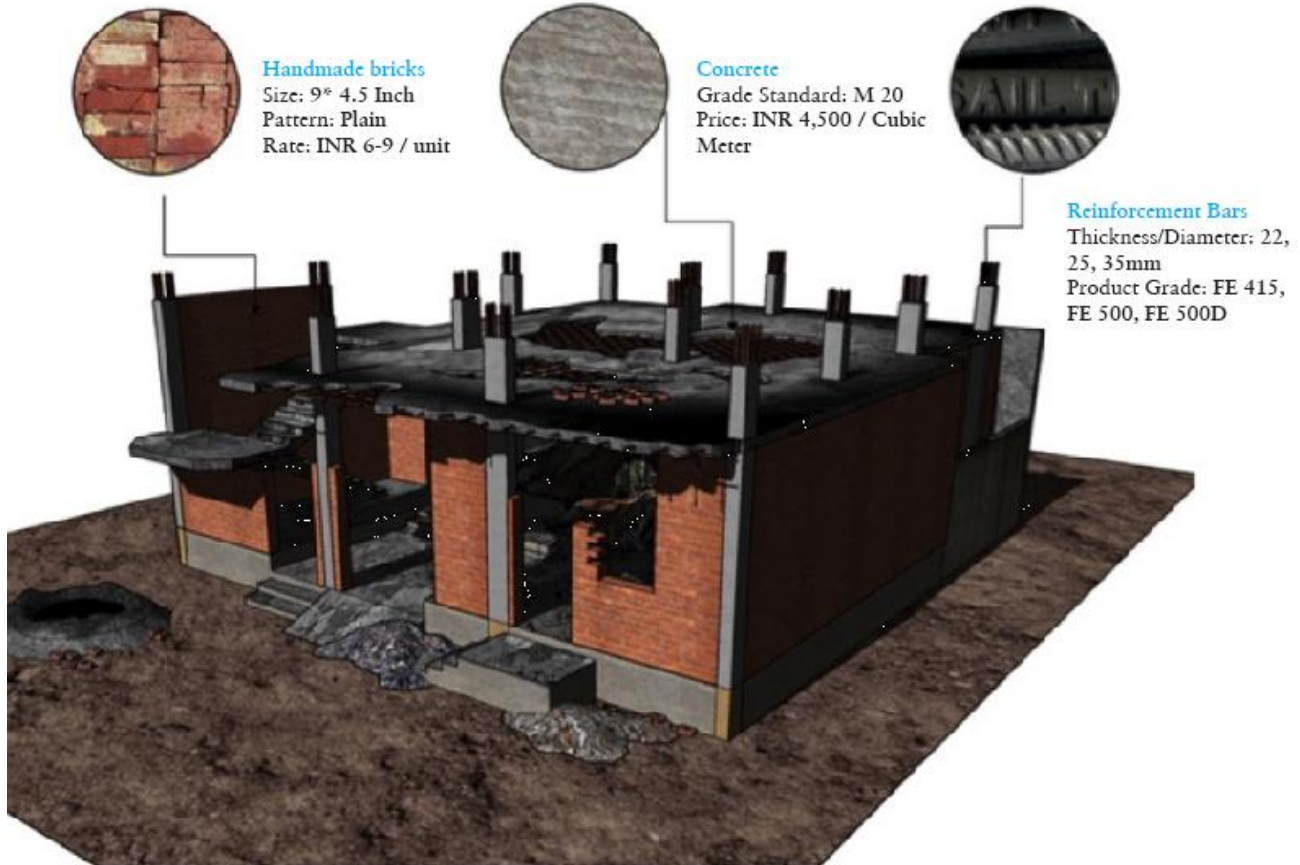
Construction cost is a significant component of the total cost of low-income housing projects, accounting for about 80% of the total project cost. With labor accounting for 20% of total costs, construction materials account for at least 40% of the project cost. In this context, the choice of (alternate) construction technologies and materials are important means to help achieve cost efficiency for the target segment. The following table shows the most common specifications of construction materials that have been used in low-income housing in Jaipur and Indore.

Table 2: Common construction materials and specifications in Jaipur and Indore

Structure	<ul style="list-style-type: none"> Most common for >more than G+1 structures: RCC framed structure as per building codes for seismic design, using M20 strength concrete
Building envelope	<ul style="list-style-type: none"> 150-200 mm thick concrete block masonry in cement mortar (1:6) Fly ash bricks have become a feasible alternative to burnt clay bricks over the last few years in government projects, wherever the project is within 100 km
Flooring	<ul style="list-style-type: none"> Ceramic/ Vitrified tiles Locally available (pre-polished) stone tiles 20-30mm thick Plain cement concrete floor
Openings	<ul style="list-style-type: none"> Stone door and window frames (125mmx65mm double rebate or 100mmx50mm single rebate) 6mm thick float glass for glazed parts; RCC sunshades for windows are completely absent or negligible
Finishes	<ul style="list-style-type: none"> Cement-sand plaster 20mm thick (external), 15mm thick (internal) White cement-based putty Cement paint (external and internal), or white wash (internal)
Fittings	<ul style="list-style-type: none"> LED bulbs, shower heads and faucets with aerators 900 mm Fans (No star rating) and fluorescent tube lights Air conditioners (star rated) and geysers

Source: Athena Infonomics

Figure 17: Typical house construction materials and specifications



Source: Athena Infonomics

The environmental impacts are dramatically high for concrete and steel however most of the respondents stated that they would consider the ecological impact/aspects of the home they are constructing. The general attitude towards green and eco-friendly homes is positive. Moreover, only 28% of the households stated that they were not at all interested in green homes and did not consider the ecological impact of their homes. The low number is very encouraging as it shows that a vast majority, in principle, recognize the importance of being eco-friendly and green. However, these numbers are on the optimistic end, as there is a high likelihood of social desirability bias. **70% indicated that building green meant a reduction in electricity usage, and 50% indicated cost as a barrier for the uptake of green materials.** Additionally, **38%** also indicated that the **lack of awareness of benefits is a barrier to the uptake of energy-efficient features.**

1.10 Green building materials and bundles

We provided respondents with three bundles of green features (see Annex 1 for details), wherein the number of green features, costs and associated savings increased incrementally across the three; bundle 1, with the fewest green features was the cheapest and led to the least savings (in terms of ongoing utility bills) while bundle 3, with the largest number of green features, was the most expensive and led to commensurately high savings. The bundles were designed based on EDGE criteria, i.e., minimum 20% savings in energy, water, and embodied energy consumption as compared to baseline. The table below presents a summary of the characteristics of each bundle and the difference in terms of cost of each bundle in the categories.

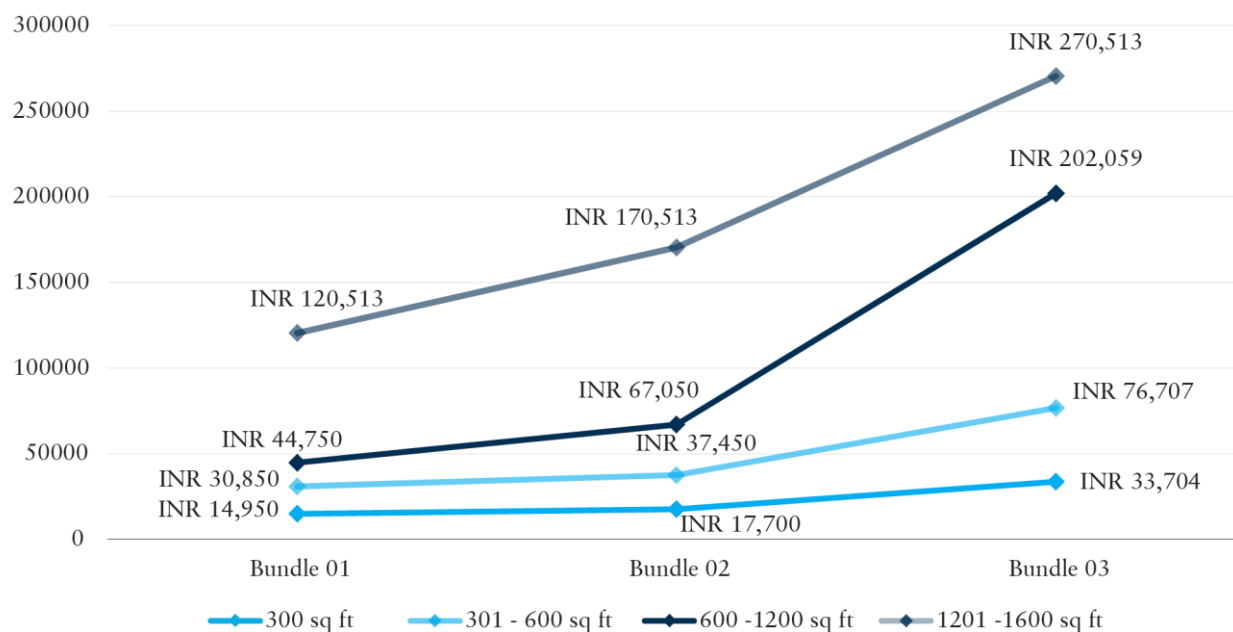
Table 3: Summary of the characteristics of green bundles

Bundle 1	Inexpensive and simple green features that result in small monthly savings
Bundle 2	Addition of green features that are slightly more expensive (1.3x bundle 1) that result in sizable monthly savings
Bundle 3	Addition of green features that are expensive (2.3x bundle 1) that result in large monthly savings

A household willingness to pay for green features is assumed to be the estimated cost of their preferred bundle choice. The rationale behind using bundles as proxies to evaluate the willingness to pay is because many of the green features (such as solar photovoltaic panels) are not products for which the respondents might have price anchors. Hence, directly asking respondents for the amount that they are willing to pay for each product might be problematic, as many would not have a proper understanding of the price (ranges) for the products.

Additionally, instead of directly asking for the preferred bundle after providing all relevant information, we iteratively asked the household for their preferred bundle choice. In the first iteration, we only provided the features that were available in each bundle and asked respondents to choose their preferred bundle. In the second iteration, we provided them with the monthly savings (in utility bills) that the bundles would result in, and again asked for the respondents for their preferred choice. Finally, in the last iteration, respondents were provided information about the costs and were asked for their choice again, based on the additional information provided.

Figure 18: Cost differentiation of the bundles for different categories based on the built-up area of the households



Source: Athena Infonomics

These costs are indicative and may undergo refinement as we progress further.

This approach enables us to understand how the following three underlying knowledge gaps influence bundle choice:

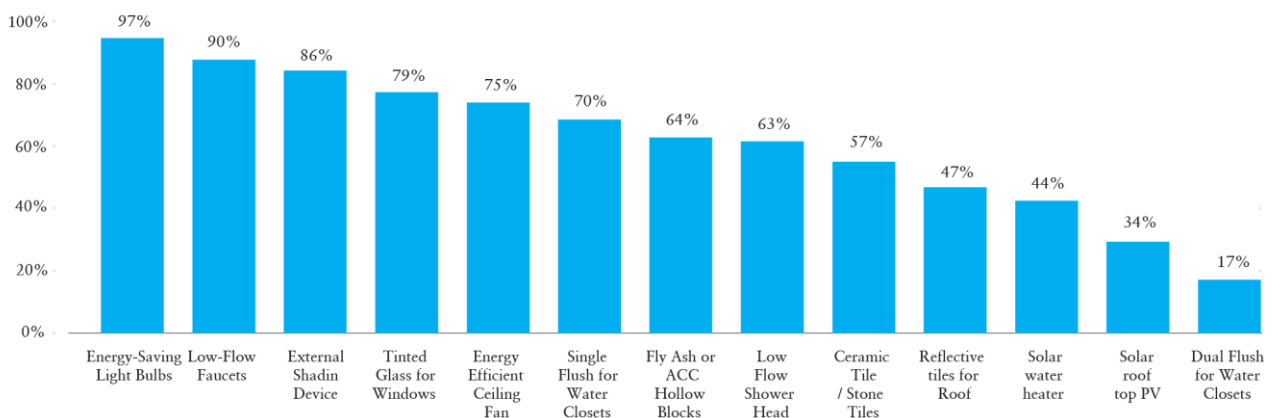
- a. **Lack of awareness:** Households might not have heard of these green features at all
- b. **Flawed knowledge about the savings that the green features would result in:** Households might think that a particular green feature (say, solar water heaters) would lead to a savings of INR 20 (USD 0.27), when the true savings would be closer to INR 10 (USD 0.14)
- c. **Flawed knowledge about the cost of incorporating green features:** Households might under- or over-estimate the cost of green features.

For example, consider a consumer who is aware of the various green features that could be incorporated in their house, but has a flawed understanding about the cost and savings associated with said green features. Hence, they may initially choose bundle 1. However, once we provide them with information about the potential savings that the three bundles would lead to, they might choose bundle 3, as the savings would be much higher than their initial estimation. In the next iteration, when we provide them with the cost information, they might move down to bundle 2, as the cost of bundle 3 might be higher than their expectation. This iterative approach therefore enables us to understand respondent’s underlying perceptions about costs and savings, while also simultaneously estimating their willingness to pay.

Of the green features provided under each of the bundles, we asked respondents about the features they are willing to incorporate in their new house. Low-flow faucets and energy-efficient bulbs and lights were chosen most often. Field observations about current practices regarding external shading devices indicate that they were purely aspirational as most of the houses in Jaipur and Indore did not have a *chajja*. Some of the respondents also indicated that they would like to use fly ash bricks as a building material; however, since most of the surveyed houses were at an advanced stage of construction, this feature would not be applicable.

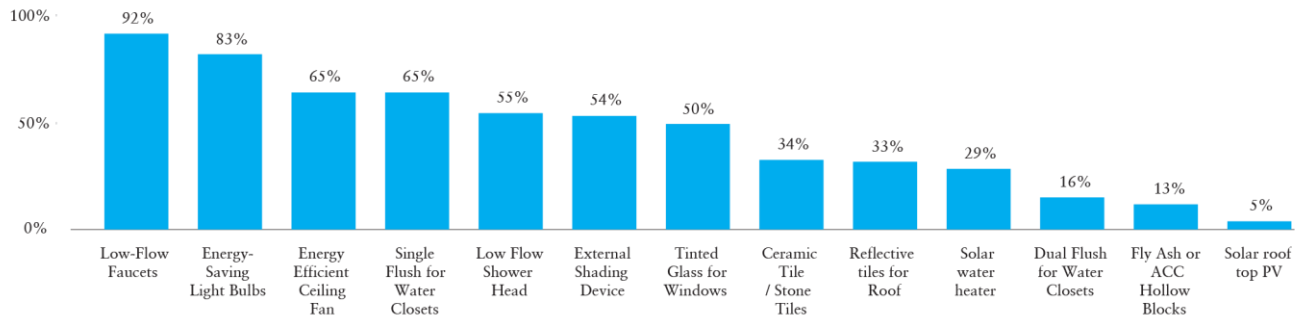
65% of respondents believe that incorporating these features will help save on monthly expenses, and 60% indicated higher upfront costs as a barrier and additionally pointed concerns on (i) awareness, (ii) credibility of savings information, and (iii) durability of available products as barriers to the uptake of green building materials.

Figure 19: Households awareness on green building materials and features



Source: Athena Infonomics

Figure 20: Green materials and features that respondents would like to incorporate in their new houses



Source: Athena Infonomics

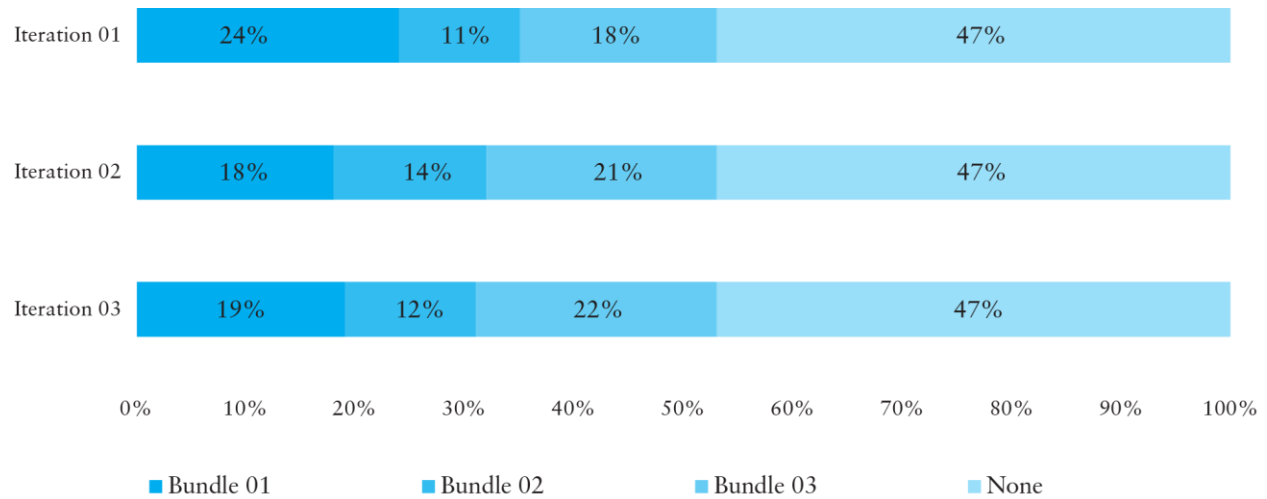
Figure 21: Few window shading devices observed during field visits



Source: Athena Infonomics

The overall distribution of preferred bundles is between bundles 1 and 3. The preference of most respondents is on either extreme end, where the respondents either choose the bundle with the maximum green features or the bundle with the minimum green features.

Figure 22: Choice of green bundles across iterations

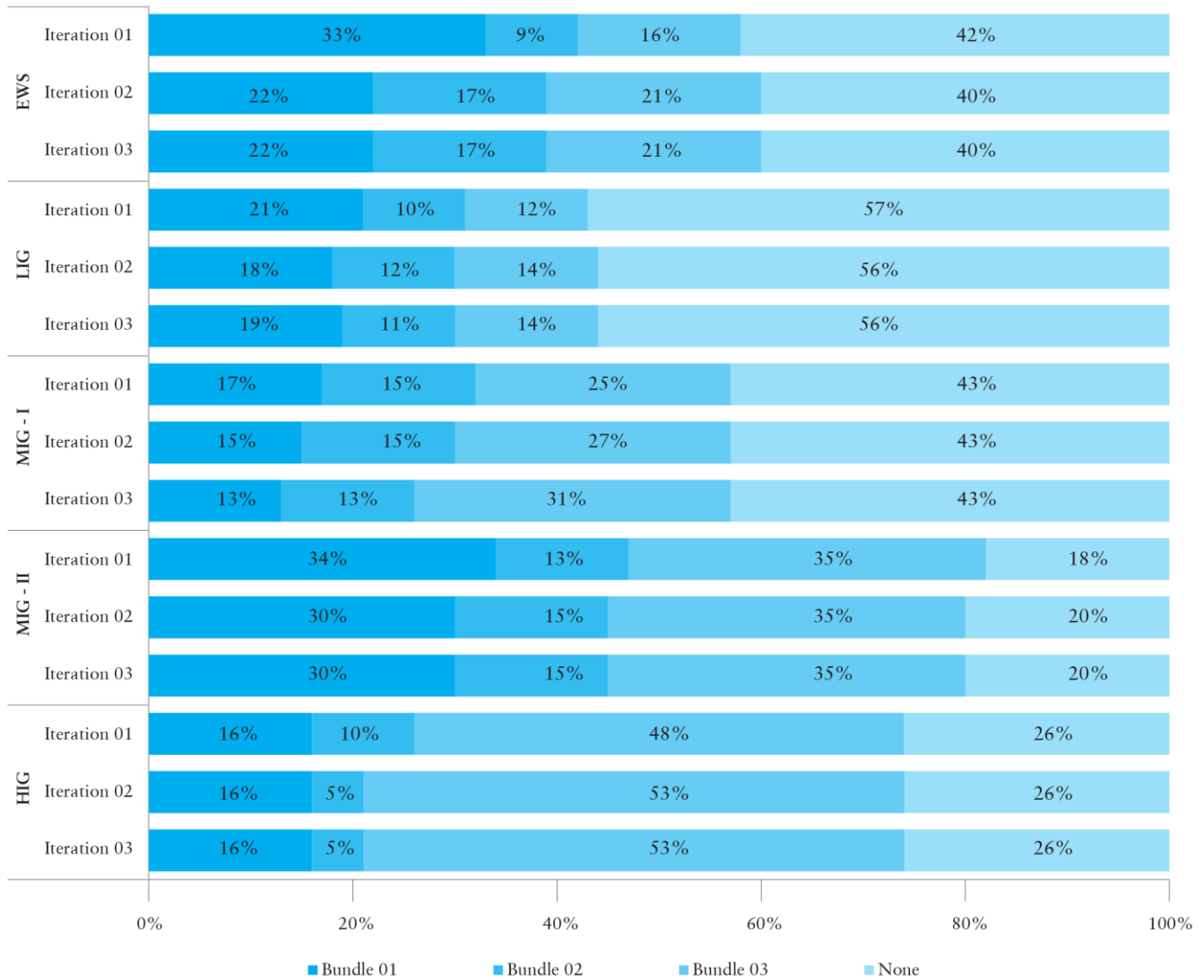


Source: Athena Infonomics

Understanding how cost and savings information influences bundle choice, provides insights into respondent’s current level of understanding/awareness and provides direction on how to design campaigns to improve uptake. Most respondents (**25%**) preferred bundle 1 prior to the provision of any savings or cost information when compared to bundle 3 (**19%**). However, bundle 3’s numbers increased marginally, to 21% when savings information was provided that indicating **savings information has a positive correlation on the choice of bundles**. After revealing cost information, this number further increased to **22%**. From these numbers, respondents **have little information/awareness about costs** as, had they known about the costs and savings, they would have accounted for it in their initial choice. Additionally, the increased shift (even though marginal) to bundle 3 after revealing costs indicates that **respondents likely did not fully internalize the information about increased costs**. **80%** of respondents did not change their choices based on cost and savings information indicating they had already factored those in before picking a preferred bundle.

To understand the rationale behind the choice of bundles, we examine the distribution of bundle choice by income level. **Income seems to have an impact on the choice of bundles**, particularly in that EWS households have a strong preference for bundle 1. **HIG** households prefer bundle 3 as seen in Figure 23. After savings and cost information was revealed, there was a shift among EWS respondents indicating that they were not fully aware of the costs of green features and have opted for a higher bundle when they were able to internalize the cost, Across the sections EWS, **LIG** and **MIG 1**, one can see at least **40%** of people indicating their unwillingness to adopt the green building features and cost is a major barrier that prevents many households from adopting all the green features.

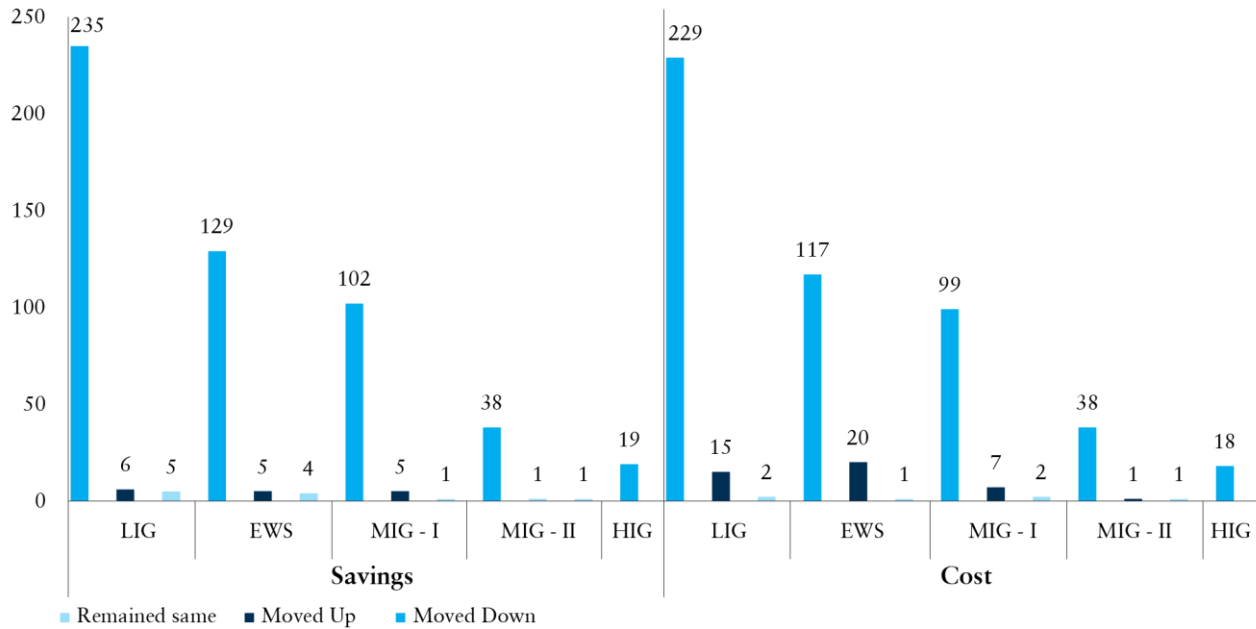
Figure 23: Choice of green bundles across iterations and income categories



Source: Athena Infonomics

Households across most of the income categories exhibited a strong preference for the green features in bundle 3 when compared to the other 2 bundles. Digging deeper into the impact of cost and savings information on preferred bundle choice, we observe that households across income categories factored this into their initial choice, and their choices have predominately remained the same through the iterations. In summary, **cost has been a major barrier that prevents households from adopting green features and households are inclined to adopting green features in their homes.**

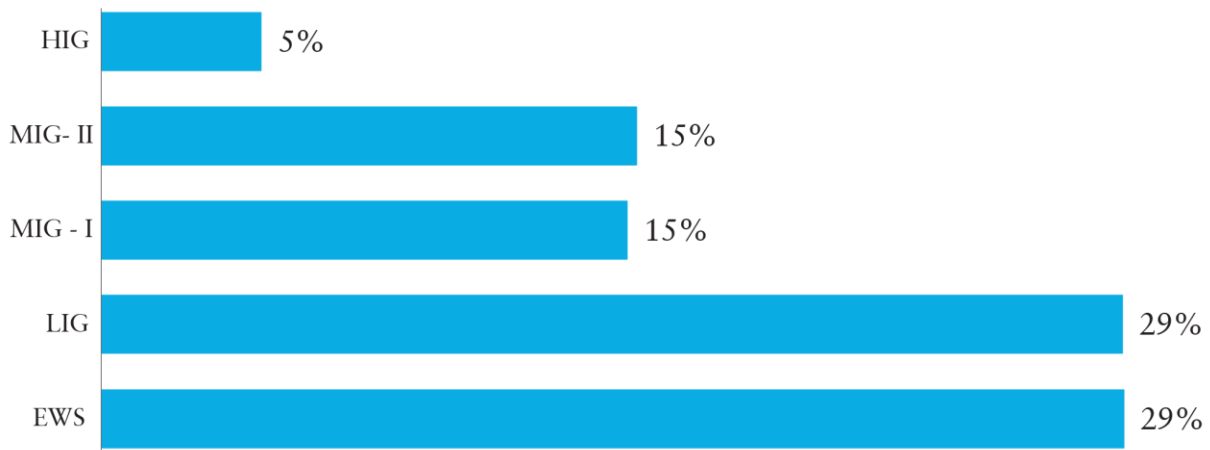
Figure 24: Change in choice of bundles on revealing savings and cost information



Source: Athena Infonomics

If the final choice was not any of the bundles, we asked respondents how much they would be willing to pay for the next in line bundle. In other cases, if the final choice was bundle 1, we asked the amount they would be willing to pay to get bundle 2. The results are presented below. **On an average, the price of the next bundle would have to be discounted by 30% to nudge consumers in the EWS and LIG categories to choose it.** If the customer is aware of the benefits of the green materials, the expected discount reduces, indicating the **need for awareness campaigns that will help improve the uptake of green materials.**

Figure 25: Willingness to pay for next bundle by income category



Source: Athena Infonomics

1.11 Green home loans: Desired features and support services

Figure 26: Awareness on green home loan products



Source: Athena Infonomics

We asked respondents if they were aware of any loan products specifically targeted at green home construction. As expected, due to the limited number of green home loan products currently available, **awareness was very low, at 7%**. Awareness was below 10% across EWS, LIG, and MIG segments, with the HIG segment having the highest awareness at 18%. However, **respondents who were aware of green home loan products could not identify any particular financial institution that offers it**. This leads us to believe that the **actual awareness might be even lower than 7%**.

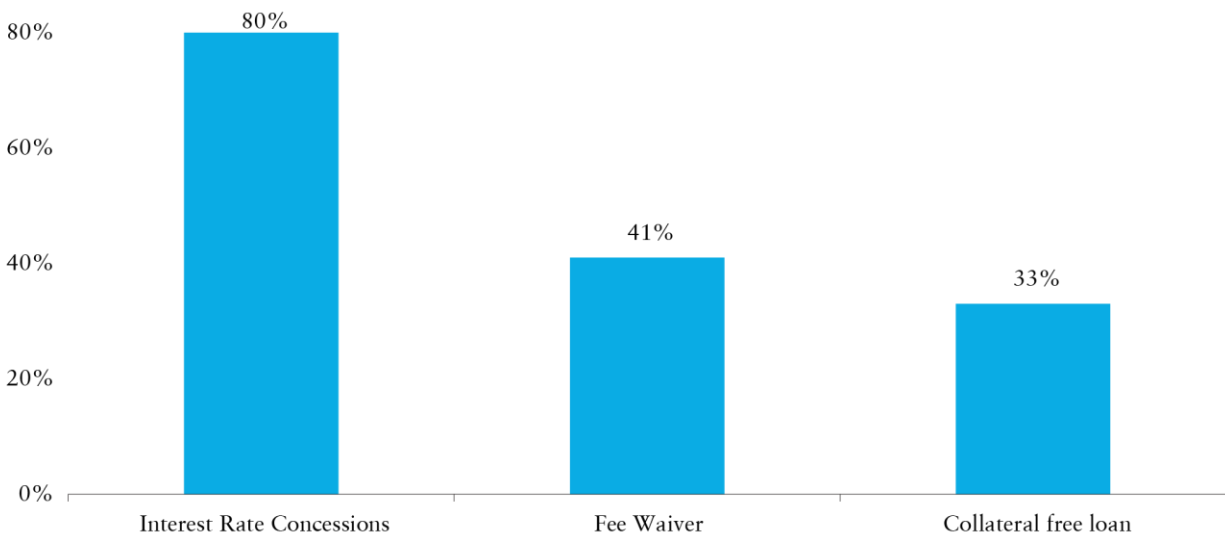
Figure 27: Demand for green home loan products



Source: Athena Infonomics

Though the awareness of green home loan products was low, respondents across all income categories were willing to take one if it translated to monthly savings in the form of lower utility bills and environmental benefits. 38% of the respondents agreed in the first instance, and 62% said they would consider taking a green home loan if it included one or more of the following incentives: interest rate concessions, fee waivers, and no collateral requirements.

Figure 28: Desired features of green home loans



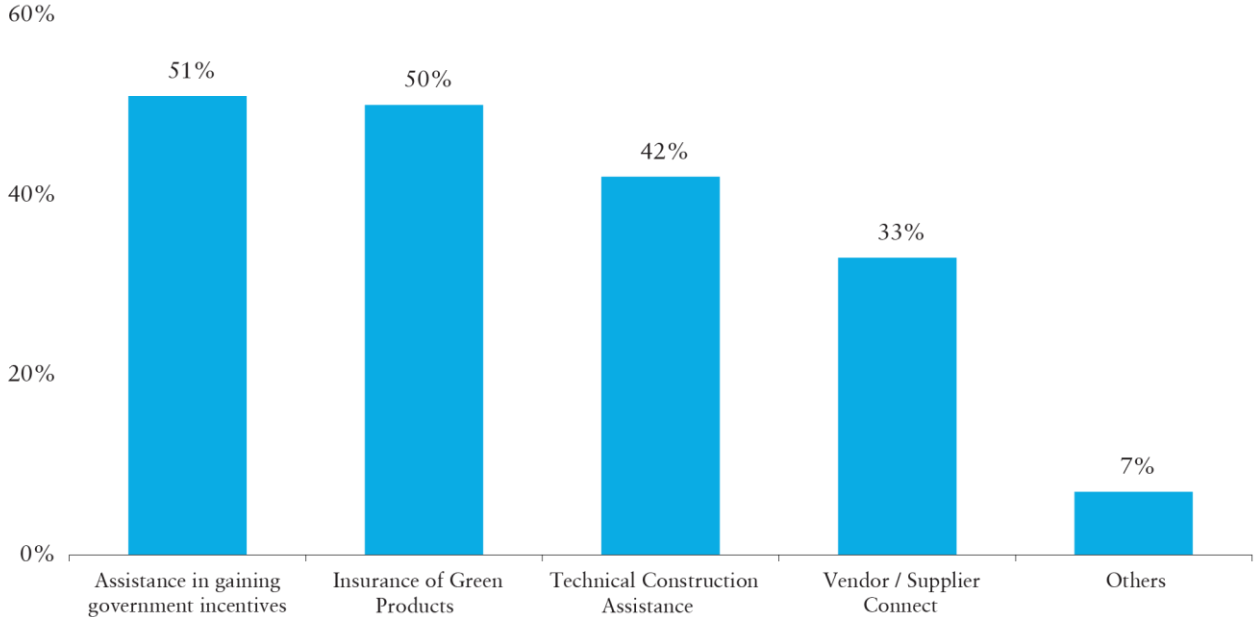
Source: Athena Infonomics

Interest rate concession was the most attractive incentive, with 80% of the respondents selecting it. This was followed by 41% selecting processing/application fee waivers; and finally, collateral free loans, lower down payments, and

faster processing were selected by approximately 33% of the respondents. Based on these responses, we infer that a new green home loan product might need to be subsidized initially to make it attractive to consumers and drive early adoption.

Apart from the incentives mentioned above, respondents identified a few support services that would ease the uptake of green home loans. These services include assistance in gaining access to subsidies, insurance of capital-heavy green features such as solar panels or rainwater harvesting systems, technical assistance in selecting the most appropriate materials, and connections with vendors of such materials.

Figure 29: Desired support services for green home loans



Source: Athena Infonomics

2. Supply of green affordable housing

Key takeaways

- The technology sub-mission of the Pradhan Mantri Awas Yojana (PMAY) was introduced to incorporate environmentally sustainable design and construction principles in affordable housing development
- Limited awareness of green building materials and technologies among stakeholders is the foremost impediment to green building construction
- Potentially higher upfront costs, lengthy procedures associated with green ratings systems, and complexity in design and execution are the key obstacles in developer-led green affordable housing
- In the beneficiary-led sector, limited access, and knowledge of how to use green materials hinder scale up of green housing construction
- The increasing urgency around climate change has resulted in more focus on green building, including funding and projects driven by DFIs

2.1 Developer-built green affordable housing

Private developers got involved in affordable housing, in a (somewhat) meaningful way, after the launch of PMAY-U in 2015. Recognizing that the scale and diversity of affordable housing challenges in the country would require the involvement of multiple stakeholders, the PMAY specifically envisioned the role of developers in building affordable housing under the ‘Affordable Housing in Partnership’ (AHP) vertical. In the years since, supporting regulations and tax reforms were passed to encourage developer-led affordable housing construction. The passage of the Real Estate Regulation and Development Act (RERA) in 2016 has improved transparency in the sector and seeks to plug the information gap between developers and buyers. In 2017, tax reforms by way of the Goods and Services Tax (GST) aimed to simplify cost structures and thereby reduce development costs. These reforms helped increase developer participation in the sector. For instance, in 2017, members of the Confederation of Real Estate Developers Association of India (CREDAI) announced the launch of 375 affordable housing projects across the country.¹⁶ However, limited availability of funds, lengthy permitting processes, and the high costs of raw materials continue to hinder tapping the full potential of the developer sector in India.¹⁷

Until the introduction of the technology sub-mission of PMAY in July 2015,¹⁸ there was little focus on incorporating environmentally sustainable design and construction principles in affordable housing projects. The sub-mission was set up to facilitate the adoption of innovative green building materials and technologies by collaborating with other government agencies to increase awareness and scale the deployment of new materials. (refer section 4.3.1) Without any comprehensive regulatory guidance or requirements, developer-led affordable housing included only green elements mandated by state regulations. For example, following the Gujarat General Development Control Regulations (GDCR) – 2017, all buildings with ground coverage more than 80 sqm. are mandated to have rainwater harvesting systems.¹⁹

With increasing awareness of the need to reduce the carbon footprint of the construction industry, the GoI introduced the technology sub-mission to work on the following aspects:

- Design and planning
- Innovative technologies and materials
- Green buildings using natural resources
- Earthquake and other disaster resistant technologies and designs²⁰

Additionally, in January 2019, the GoI launched the Global Housing Technology Challenge (GHTC–India) “to identify and mainstream a basket of innovative construction technologies from across the globe for the housing construction sector that are sustainable, eco-friendly, and disaster-resilient.”²¹ To test and demonstrate the viability of the identified construction technologies, the GoI has identified Light House Projects (LHPs) in six cities across the country, one in each of the six climatic zones. Each of the projects has roughly 1,000 units. Two LHPs at Chennai and Rajkot have been completed and handed over to the beneficiaries. Remaining are at the advanced stage of construction and will be completed by 2023. These projects are intended to serve as live laboratories to demonstrate the suitability of new sustainable construction technologies and to encourage their subsequent widespread uptake.

Table 4: Light House Projects (LHPs) and the associated construction technologies

S.No	Project location	Selected construction technology	No. of units
1	Indore, Madhya Pradesh	Prefabricated sandwich panel system	1,024
2	Rajkot, Gujarat	Monolithic concrete construction using tunnel formwork	1,144
3	Chennai, Tamil Nadu	Precast concrete construction system – precast components assembled at site	1,152
4	Ranchi, Jharkhand	Precast concrete construction system – 3D volumetric	1,008
5	Agartala, Tripura	Light gauge steel structural system & pre-engineered steel structural system	1,000
6	Lucknow, Uttar Pradesh	PVC stay-in-place formwork system	1,040

Source: <https://ghtc-india.gov.in/Content/LHP.html>

Figure 30: Progress of LHP in Indore using prefabricated sandwich panel system



Source: *Light House Project E-Newsletter Volume XII*. https://ghtc-india.gov.in/Content/pdf/newsletter/LHP_E-Newsletter-XII.pdf

In addition to projects built under GHTC-India, there has also been support from DFIs to encourage developers to build green – e.g.: IFC and Agence Française de Développement (AFD). In 2016, IFC convened the Sustainable Housing Leadership Consortium (SHLC), a voluntary private sector consortium comprised of developers and

financial institutions. SHLC’s goal was “to support the sustainable development of cities with a focus on climate change mitigation, adaptation, and energy efficiency.” SHLC’s founding members included Godrej Properties, Mahindra Lifespace Developers, Shapoorji Pallonji Real Estate, Tata Housing Development Company, VBHC Value Homes, HDFC Bank, and PNB Housing Finance Corporation.²² In 2017, under the Sustainable Use of Natural Resources and Energy Finance (SUNREF) program, AFD provided a loan of EUR 100 million (USD 115 million) to NHB “to refinance home buyers and developers of eligible green building projects certified by local labels.”²³ The program also includes a technical assistance component that aims to enhance the knowledge and capacities of private and public stakeholders.

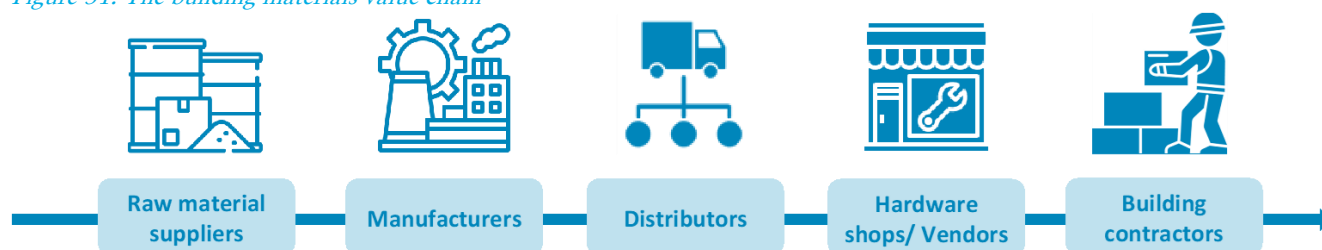
Although these efforts have helped increase developer involvement in the affordable housing sector, much more needs to be done to mainstream green building. Lack of awareness, potentially higher upfront costs, lengthy procedures, and paperwork associated with green ratings systems, and complexity in design and execution are some of the obstacles facing developers. With regards to green ratings, few residential projects are certified, and even fewer are in the affordable segment. As of 2019, only 2.62% of newly built area in India was certified green. Of this, 89% was commercial and only 11% residential.^{24,25} That said, the market has been growing – the 2.62% certified green building (by area) in 2019 was three times more than the 0.85% certified green building (by area) in 2015. These numbers show that there is growing interest in building sustainably, but the time-consuming processes and documentation to get green building certifications pose a barrier.

Another hurdle that developers face is the high cost of green building materials. At present, the technology submission under PMAY and GHTC–India are the largest programs innovating to make affordable housing development sustainable and disaster-resilient, while keeping development costs low. However, to achieve the GoI’s goal of reducing industry-level emissions, it is important to scale these green building technologies – including raising awareness and availability – to make it conducive for not only developers but also individual households to build green.

2.2 Green building materials

The **building materials value chain** extends from raw materials suppliers to manufacturers to distributors to hardware shops and finally to general contractors and households themselves. In addition to construction materials, the term also refers to building systems, construction technologies, building components, appliances, and fixtures. The goal of greening building materials is to reduce resource consumption throughout the value chain, right from the sourcing of raw materials to the construction process and throughout the building lifecycle.

Figure 31: The building materials value chain



The Building Materials and Technology Promotion Council (BMTPC)²⁶ is a (central) government body that “has been working towards operationalizing a comprehensive and integrated approach for the promotion of cost-effective, environment-friendly, and energy-efficient innovative building materials and construction technologies for housing in urban and rural areas.”²⁷ Since the launch of PMAY-U in 2015, the BMPTC has been identifying,

evaluating and certifying new technologies, published annually in a ‘Compendium of Prospective Emerging Technologies for Mass Housing.’ BMTPC has identified fifty-four new construction systems as of 2021.²⁸ These are grouped into six categories, namely:

- (i) 3D precast volumetric concrete construction
- (ii) Precast concrete construction with precast building components
- (iii) Light gauge steel structural system and pre-engineered steel structural system
- (iv) Prefabricated sandwich panel systems
- (v) Formwork systems
- (vi) Stay-in-place formwork systems

Figure 32: Monolithic concrete construction using aluminum formwork



Source: *Compendium of Prospective Emerging Technologies for Mass Housing*, available at:
https://www.bmtpc.org/DataFiles/CMS/file/PDF_Files/BMTPC_CBRI_Compndium_Building_Technology_2021S.pdf

In addition to BMTPC’s publications, the Green Rating for Integrated Habitat Assessments (GRIHA) Council has published a product catalogue that meets pre-determined technical criteria for environmentally sustainable construction.²⁹ BMTPC and GRIHA’s catalogues are intended to guide developers and other stakeholders as they look for alternate products to help reduce the carbon footprint of their projects.

The emerging technologies listed in BMTPC’s compendium are primarily suited for large-scale high-rise building structures but are not so for the more than 60% of houses being built by households themselves under PMAY-U. Recognizing that small-scale self-built housing construction requires different building materials and technologies, the Ministry of Housing and Urban Affairs (MoHUA) organized the Indian Housing Technology Mela (IHTM) in October 2021. IHTM provided a platform for established manufacturers and upcoming entrepreneurs alike to showcase innovative building materials and technologies specifically suited for low- and medium-rise housing construction. The eighty-four technologies and systems presented at IHTM have been grouped into four categories and published in the ‘Compendium of Indigenous Innovative Building Materials and Construction Technologies.’³⁰ It includes materials such as compressed stabilized earth blocks (CSEB) and fly-ash bricks, as well as 3D printed technology and terracotta blocks.

Table 5: Building materials and technologies suitable for low-rise housing construction

S.No	Category	Product examples
1	Building systems/products for construction of low-rise houses (up to G+3)	<ul style="list-style-type: none"> Compressed stabilized earth blocks (CSEB) KonCrete – Konark aerated concrete reinforced panel Cost-effective technology like ferrocement walling and roofing panels
2	Products/Technologies primarily from recycling of industrial/agricultural waste	<ul style="list-style-type: none"> Agrocrete solid and hollow concrete blocks Bio-bricks from agricultural waste Fly-ash bricks and interlocking blocks
3	Materials and components (doors, windows, construction chemicals, insulation, plumbing, plastering, machinery)	<ul style="list-style-type: none"> Wooden doors and panels Cement-bonded particle board Pre-painted galvanized iron windows Polyurethane-based water-proofing coatings
4	Technologies already shortlisted under GHTC-India and suitable for low-rise housing	<ul style="list-style-type: none"> Stay-in-place insulated concrete formwork Prefabricated sandwich panel system 3D printed housing technology Terracotta blocks

Source: Compendium of Indigenous Innovative Building Materials and Construction Technologies

Figure 33: Composition of Compressed Stabilized Earth Blocks (CSEB)



Source: Compendium of Indigenous Innovative Building Materials and Construction Technologies

These initiatives have helped build momentum in developing new green building materials, as witnessed by the continued emergence of new entrants and technologies in recent years. However, the use of these green materials can only be scaled up by simultaneously addressing two key concerns: (i) availability and access; and (ii) knowledge and skills regarding use and maintenance. Innovations in green building materials are still at a nascent stage and scale up has been hindered due to limited awareness, access, and skills to use the materials.

Although stakeholders agree on the need to use green materials and technologies (in place of traditional building materials), contractors and masons often do not have the technical know-how to use/ install them, and users have little knowledge of how to maintain them. As a result, there is widespread adoption of some easy-to-use (and install) features, such as LED bulbs, and star-rated electrical appliances. However, this has not yet extended to the use of

sustainable building materials (for instance, fly ash bricks instead of conventional burnt clay bricks) or large-scale systems (such as solar PV or rainwater-harvesting). Consequently, in the absence of customer demand, local hardware stores do not carry a wide range of green materials and appliances, especially in peri-urban and rural locations.

For Housing Finance Companies (HFCs) or other stakeholders venturing into the green housing space, it is therefore important to evaluate the local building materials value chain, including the availability and cost of materials, customer preferences, and local contractor skills and willingness to work with new materials.

2.3 Self-built green affordable housing

Most of the housing in the EWS and LIG segments is self-built, often incrementally over an extended period of time. Like developer-built affordable housing, this segment received an impetus via the launch of the PMAY program in 2015, particularly through the two verticals of ‘Beneficiary-led construction (BLC)’ and ‘Credit Linked Subsidy Scheme (CLSS).’ Unlike developer-built housing (AHP vertical), there has been a significant amount of house building activity under these two PMAY verticals since 2015. Data from MoHUA suggests that more than 60% of the homes constructed under PMAY-U are self-built.³¹

At the same time, there has been little focus, if any, on greening this stock of self-built housing. The launch of the technology sub-mission and GHTC-India (both under PMAY-U) focus primarily on sustainable building materials and technologies for large-scale developer-built housing. Initiatives for sustainable development of self-built/beneficiary-led housing remain few and disparate and include those by different levels of government (more details in Chapter 4). Recognizing this gap, MoHUA published its first ‘Compendium of Indigenous Innovative Building Materials and Construction Technologies’ specifically for self-built construction in 2021 (refer to section 2.2 for details).

However, in the absence of any coherent GoI vision or policy, beneficiary-led construction, especially among EWS and LIG segments, is primarily guided by socio-cultural preferences, availability of local materials, and cost imperatives. With limited financial mobility and limited knowledge (or availability) of new materials, households are reliant on locally available and easily accessible materials. Further, since socio-cultural preferences and the availability of materials differ widely across the country, so do design and construction practices in different locations. For instance, while our team observed high penetration of solar panels and solar water heaters in Jaipur and surrounds, it was much less so in Indore where the emphasis is on recycling and reuse. Even in Jaipur and its neighboring towns, households prefer to use roof areas to host festivals or other events, and solar panels on the roof would obstruct this practice. Although solar panels and water heaters are not widespread in Indore, discussions with three distributors revealed that there is growing interest in these technologies.

Figure 34: Solar panels are a common sighting in Jaipur and surrounds



Source: Athena Infonomics

Figure 35: Energy efficient appliances available in hardware stores in Jaipur and Indore (water heaters, ceiling fans, and light bulbs)



Source: Athena Infonomics

During our team’s field visits in Jaipur and Indore, it was observed that households generally use red bricks for home construction and are reluctant to experiment with new materials. Low levels of awareness, among households and contractors alike, are a key contributor to the continued use of traditional building materials.³² In Indore, fly ash bricks have different material compositions, depending on the manufacturer, and are not strength tested. Moreover, customers refer to these as ‘black bricks’, a reference to the misconception that fly ash bricks are made from construction waste. Due to this stigma, households do not use fly ash bricks, and prefer conventional red bricks instead. Fly ash bricks are being used in institutional buildings in and near Indore, but not for residential buildings.

Figure 36: Red brick construction is the norm in Jaipur (left) and Indore (right)



Source: Athena Infonomics

In recent years, seeing the increase in beneficiary-led housing construction, DFIs have begun to promote green building practices via investments and technical assistance to financial institutions and other stakeholders. For example, Asian Development Bank (ADB) is working with IIFL Home Finance Limited, a leading HFC in India, to facilitate access to green affordable housing for women. The technical assistance component includes raising awareness among stakeholders as well as integrating climate adaptation strategies in the context of affordable housing (finance).³³ However, these efforts are in their initial days, and there remains a long way to go to institutionalize these initiatives.

The table below lists some commonly available building materials based on the team’s visits to hardware shops in Jaipur and Indore.

Table 6: Commonly available green building materials and appliances in Jaipur and Indore

S. No	Materials and appliances
1	Fly-ash stabilized blocks
2	Energy efficient ceiling fans
3	Solar water heaters
4	Smart energy meters
5	Energy-efficient refrigerator
6	Energy-efficient light bulbs
7	High thermal performance glass
8	Low-E coated glass
9	Rainwater harvesting system
10	Reflective roof paint
11	Reflective wall paint
12	Reflective roof tiles
13	Low-flow showerheads
14	Low-flow faucets

S. No	Materials and appliances
15	Dual flush water closets (WCs)
16	Solar photovoltaic panels (PVs)

2.4 Challenges and barriers

While there has been some progress on greening the supply of affordable housing, and stakeholders continue to make efforts in that direction, there are some key barriers along the value chain that must be addressed. These are discussed in brief below:

- Under-developed building materials value chain, particularly for beneficiary-led housing development:** In the last few years, there has been significant GoI involvement in exploring alternative building materials to green affordable housing supply. However, the focus has been primarily on innovating for large-scale developer-built affordable housing. Although entrepreneurs are developing new materials targeted at EWS and LIG households that self-build their homes, reaching the end user/customer is a difficult task (refer to section 2.3 for details). Moreover, the hyper-local nature³⁴ of beneficiary-led construction means that unless these new materials are made available at local stores, it is difficult to scale adoption. In such a scenario, the bulk of affordable housing development in the country – which is self-built – continues to use traditional, easily available building materials that are often not sustainable.
- Unskilled construction workforce:** The majority of India’s construction labor force does not receive professional training or certification, but instead learns the required skills on the job. According to the 11th Five Year Plan of the Planning Commission, 82% of the construction sector workforce is unskilled.³⁵ With limited exposure to formal skills training, there is a severe lack of technical capacity in using new materials and construction practices. The limited technical know-how hinders the scaling of green materials and new construction technologies (to the extent that they are available). Furthermore, the migratory nature of the construction workforce prevents developers from providing training.
- Limited awareness and demand:** Given that the green affordable housing sector is in the early stages of development, it is not surprising that there is limited awareness of its benefits, costs, and availability among stakeholders. As it relates to consumers, this limited information prevents them from making well-informed investment decisions and leads to a lack of trust in the durability/performance of materials (or projects). Furthermore, there is limited awareness among developers and contractors on building codes, green building guidelines, and certification programs (which are often not aligned with one another).

2.5 Opportunities

Despite the challenges, there are several efforts afoot that aim to reduce the barriers to green affordable housing development. To green developer-built affordable housing stock, GHTC–India is building six large-scale projects in six different cities across the country using discrete alternative construction technologies (refer section 2.1). These have been vetted for environmental sustainability as well as disaster-resilience while also being cost effective and reducing construction duration. Should these (or any subset of these) technologies be successful, they have the potential of significantly scaling up developer involvement in the green affordable housing sector.

Simultaneously, the Building Materials and Technology Promotion Council’s (BMTPC’s) ‘Compendium of Prospective Emerging Technologies for Massing,’ published annually, continues to explore new materials and technologies, and disseminate information to the sector.

Self-built affordable housing construction is receiving support from DFIs such as ADB and IFC. Given the proximity and role of HFCs in scaling up beneficiary-led housing construction over the last six years, both DFIs are providing assistance (investment and technical support) to HFCs to affect change in this sector. In addition to developing new green home loan products, the approach includes simultaneously raising awareness among stakeholders, and integrating the two value chains of green building and affordable housing finance.

Finally, entrepreneurs are developing new building materials targeted at EWS and LIG segments that build their own homes. For instance, ModRoof has designed a low-cost modular roofing system made from packaging and industrial waste. The system is modular, and therefore, easy to ship, install, and replace.³⁶ Tvasta Construction is “building concrete 3D printing technology for the construction industry” on the principles of reducing build-time, zero-waste construction, and optimized production.³⁷

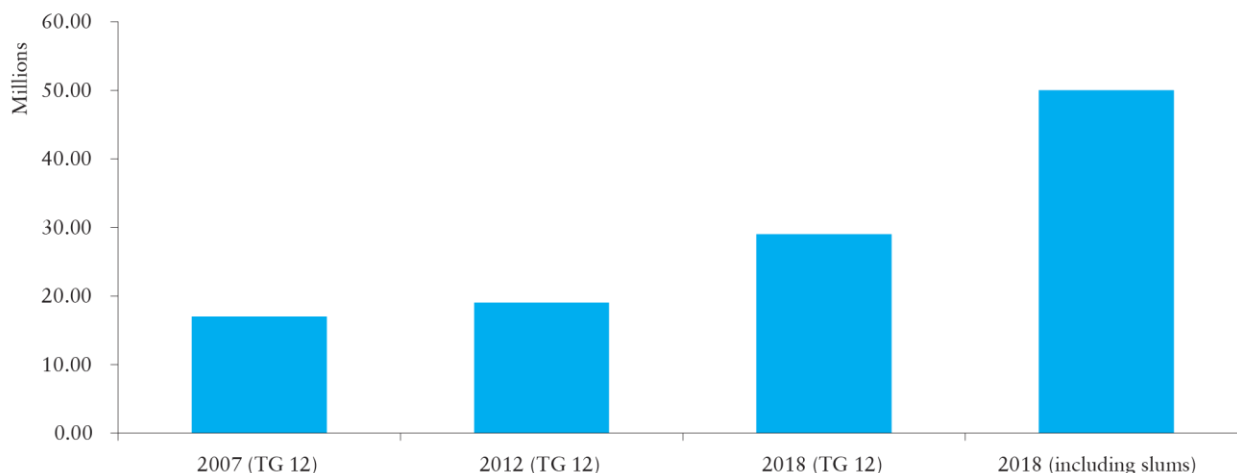
3. Financing green affordable housing

Key takeaways

- The provision of housing finance in India has grown manifold in response to the increased construction pace to meet housing demand. However, in 2019-20, 64% of the total allocation was for loans more than INR 2.5 million (USD 33,784), whereas the affordable sector received only 37% of the total allocation.
- Three financial institutions, backed by DFIs, have announced new green home loan products. However, these are in the development stage, and neither are currently offering these.
- There is an urgent need to develop appropriate green housing finance products for households, developers, and other stakeholders to scale innovations in the green building sector.
- Financiers and primary lending institutions (PLIs) face challenges to venture into green housing projects due to lack of innovative finance tools such as credit enhancement facilities, blended finance, social outcome bonds, etc.

3.1 Trends in affordable housing finance in India

Figure 37: The urban housing shortage in India, 2007 – 2018

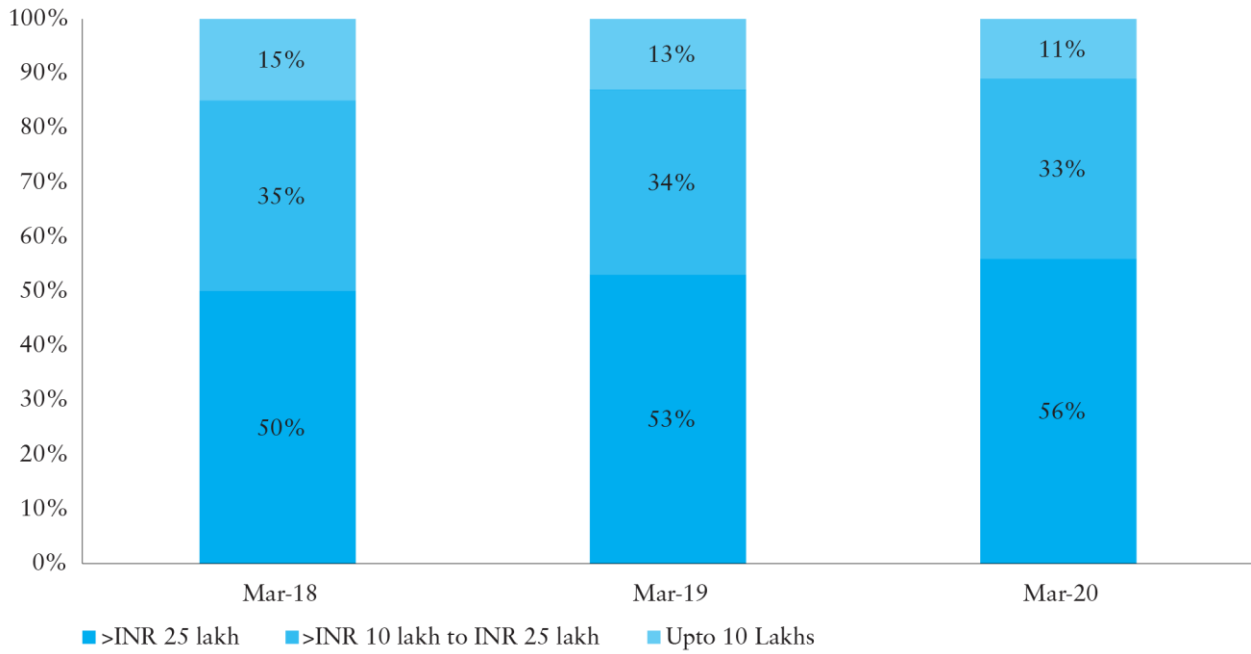


Source: 'Housing for India's Low-Income Urban Households: A Demand Perspective,' Working paper by the Indian Council for Research on International Economic Relations (ICRIER)

According to a study by RICS and Knight Frank, the current estimate of urban housing shortage in India is 10 million and it is estimated the urbanization will create demand for an additional 25 million units by 2040.³⁸ The magnitude of this shortage clearly demonstrates the funding required for the affordable housing sector.

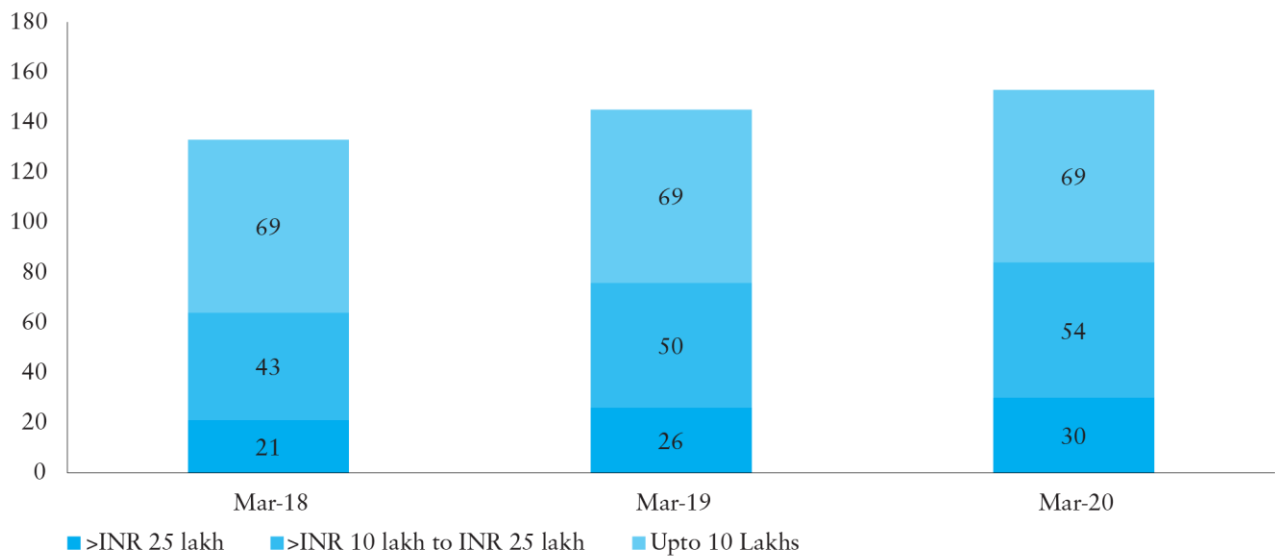
Between 2018 and 2020, there was a 6% increase (from 50% to 56%) in loans above INR 2.5 million (USD 33,784), which usually cater to middle- and high-income categories. These loans have financed only 3 million housing units. On the contrary, EWS and LIG borrowers (combined) have received only 44% of the loans in 2020, financing the construction of 12.3 million housing units. This is a 6% decrease from the allocation of 50% in 2018.

Figure 38: Trends in individual housing loans of HFCs and SCBs, categorized by loan size



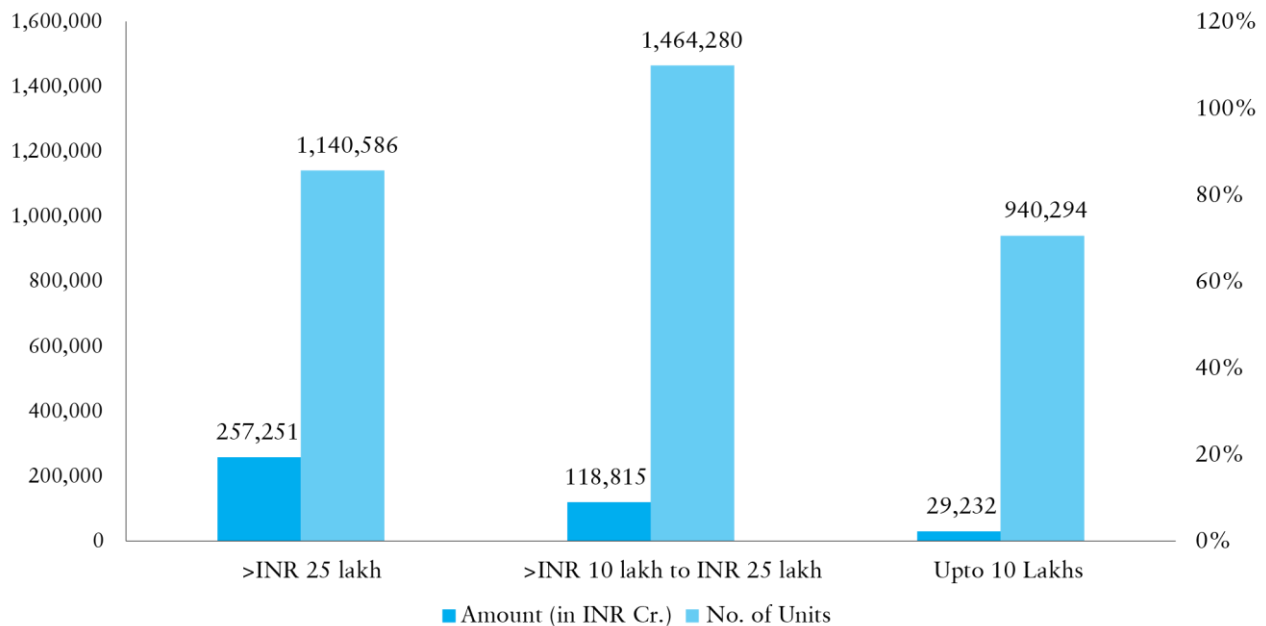
Source: National Housing Bank, Progress Report (2020)

Figure 39: Trends in number of units financed through individual housing loans



Source: National Housing Bank, Progress Report (2020)

Figure 40: Slab-wise disbursement of individual housing loans during 2019-20



Source: National Housing Bank, Annual Report 2019-20

A closer look at the disbursement by HFCs and PSBs in 2019-20 also shows a distorted proportion of the disbursements, with INR 2,572.5 billion (USD 34.8 billion) being disbursed for loans more than INR 2.5 million (USD 33,784), constituting 64% of the total allocation. This amount only financed the construction of 32% of the housing units, i.e., 1.14 million units. The affordable housing sector, which constituted 68% of the total units, was allocated only 37%, i.e., INR 1,480.5 billion (USD 20 billion) of the funds. This shows a clear mismatch between the need/demand for housing finance and the allocation/supply financing for it.

3.2 Financial products for green housing in India

As can be seen from the chart above, the loans outstanding in the affordable sector, i.e., loans up to INR 2.5 million (USD 33,784), have financed an increasing number of units, from 11.2 million units in 2018 to 12.3 million units in 2020. Though tremendous progress has been made in financing affordable housing, there has been little progress in developing sustainable building practices in this segment. Green housing would help provide benefits such as reduced energy and utility expenditures, improved health and hygiene, and better sanitation, all of which translates to increased monthly savings. Currently, banks and HFCs provide a limited number of products to encourage green housing development in India.

Green Refinance products: AFD has signed an agreement with NHB to implement ‘Sustainable Use of Natural Resources and Energy Finance (SUNREF)³⁹ Housing in India’ through two schemes:

- Under **Promoting Green Housing Refinance Scheme – 1**, NHB will make refinance available up to 100% of housing loans sanctioned and disbursed by PLIs for acquisition/construction of green dwelling units by EWS, LIG, and MIG households.⁴⁰ Eligible houses should have received the pre-certification of either 4- or 5-star rating by GRIHA, or Gold or Platinum rating by IGBC.

- Under **Promoting Green Housing Refinance Scheme – 2**, NHB will make refinance available for construction finance extended by PLIs to residential projects located in urban areas. Residential projects should have received the pre-certification of either 4- or 5-star rating by GRIHA, or Gold or Platinum rating by IGBC.
- The National Housing Bank (NHB) extends refinance to primary lending institutions (PLIs) through a ‘regular window’ at market interest rate and through ‘concessional window’ at a lesser interest rate for specific norms or criteria of PLIs. To implement the project **SUNREF** promoting green housing in India, NHB has negotiated a line of credit from Agence Française de Développement (AFD), France in 2017 for availing a credit facility of EUR 100 million to provide refinance to eligible PLIs. Further, an investment grant of Euro 9 million to reduce the cost of eligible loans has been sanctioned from the European Union to support private and public stakeholders in implementing projects of green housing in India. As per the agreement signed between NHB and AFD, Promoting Green Housing Refinance Scheme (PGHRS) is active from 2021 to December 2025.⁴¹

Green bonds: In 2016, IFC invested USD 75 million in a green bond issued by Punjab National Bank Housing Finance Ltd. (PNBHFL), to finance residential projects based on recognized green building standards including EDGE. India has become the second-largest market globally for green bonds with USD 10.3 billion worth of transactions in the first half of 2019, as issuers and investors continued to adopt policies and strategies linked to sustainable development goals, according to the Economic Survey 2019-20.⁴² However, not much progress has been seen in terms of housing as use of funds since the IFC issuance. An RBI study on green bonds show that the cost of raising green bonds have remained higher than other bonds; and green bonds constituted only 0.7 per cent of the bonds issued in India since 2016. Clearly there is a long way to go for the Green Bond market, although over subscription of the offerings that have happened seem to indicate that significant appetite exists in the market. The size and the penetration of the Green Bond market can go up with the encouragement of more robust foreign exchange risk management mechanisms. This will make Indian green bonds more attractive. Further, there is a need for mechanisms for a rupee denominated bond market which can be accessed by international investors. And there is a need to create tools and certification methods for green tagging sustainable projects on the books of financial institutions and governments and building project pipelines that can underlie future green bond issuances.⁴³

Green Home loans: At present, three financial institutions in India have announced green home loan products, each at different stages of development and backed by DFIs. However, none of these products are currently available to borrowers, and the terms/incentives are unknown.

- Under its ‘Green Banking Policy’,⁴⁴ **State Bank of India (SBI) Home Loans** has identified green home loans as a product to help reduce carbon emissions and promote renewable energy. In December 2019, KfW extended a USD 277 million line of credit to SBI Home Loans to build its green home loan portfolio and a EUR 1.5 million grant for technical assistance. The goal of the program is to achieve 25% energy savings compared to the base case scenario.⁴⁵ However, the project has been stalled since the onset of the COVID-19 pandemic, and there are no recent updates.
- In July 2021, IFC provided a loan of USD 250 million to **HDFC Ltd.** to grow its affordable housing portfolio. The fund specifically aims to improve access to finance for low- and middle-income households while supporting the GoI’s climate goals. 25% of the financing is earmarked for green affordable housing.⁴⁶
- In 2018, **IIFL Home Finance Limited (IIFL)** launched ‘Kutumb’, a platform where industry experts and housing developers came together to build awareness, educate stakeholders, and encourage green housing development.⁴⁷ With partners such as NHB, CDC, IFC, GiZ, ADB, EESL, IGBC, and EDGE, the program

helped form strong collaborations among industry stakeholders. Building on the success of Kutumb, IIFL received USD 68 million in funding from ADB to expand its affordable and green affordable housing portfolio. 85% of the fund is “earmarked for women borrowers and for mortgages on green certified affordable housing” while the rest is to finance developers building green certified affordable housing.⁴⁸

3.3 Challenges and barriers

The Covid-19 pandemic has had devastating effects on the housing sector. Comparing disbursement of individual housing loans during Q1 and Q2 FY 2020-21 and Q1 and Q2 FY 2019-20, there was a sharp decrease of 45% and 48% respectively.⁴⁹ The nascent green housing finance sector has been hit hard too, with many initiatives (by DFIs and other financial institutions) coming to a halt. The following are some challenges that might further slowdown the adoption of green financing products:

- Unemployment numbers have increased drastically. According to the Centre for Monitoring Indian Economy (CMIE), the number of employed fell from 399.38 million in July to 397.78 million in August 2021,⁵⁰ as the unemployment rate rose across the country. This employment loss has disproportionately affected LIG and MIG segments and therefore might affect the uptake of green affordable housing.
- Lack of innovative finance tools such as credit enhancement facilities, blended finance, social outcome bonds, etc. have prevented primary lending institutions (PLIs) from venturing into green housing projects.

3.4 Opportunities

(1) **Regulatory push:** RBI’s efforts in promoting the affordable housing sector have led to both banks and HFCs increasing their allocation in the segment India. Following are a few key steps taken by RBI:⁵¹

- In July 2014, RBI classified affordable housing loans as eligible under priority sector lending (PSL). For metropolitan areas, loan limits have been raised from INR 2.8 million (USD 37,838) to INR 3.5 million (USD 47,297), and for other areas, it has been increased from INR 2 million (USD 27,027) to INR 2.5 million (USD 33,784), provided the overall cost of the home does not exceed INR 4.5 million (USD 60,811) and INR 3 million (USD 40,541) respectively.⁵²
- Banks were allowed to raise long-term bonds (minimum seven years maturity) to raise capital for affordable housing loans.
- Loan-to-Value (LTV) ratio of 90% could be provided to houses that cost up to INR 3 million (USD 40,541)
- In 2019, RBI declared that henceforth, HFCs will be treated as NBFCs and will be regulated by RBI. NHB will continue to supervise the HFCs.
- In November 2020, RBI issued guidelines for a “Co-Lending Model” (CLM) to help HFCs and banks lend jointly. This would benefit the sharing of risk in lending to underserved sectors such as green housing finance.
- The Weighted Average Lending Rate (WALR) at which HFCs are providing fresh individual housing loans has been falling from 9.58% in June 2019 to 8.51% in June 2020. This can tremendously increase the borrowing potential for green housing finance.

All the above given measures led to a sharp decline in the cost of funds, lowered interest rates for borrowers, and eventually, the optimization of property prices that helped improve affordability.

(2) **Environment, Social and Governance (ESG) pull:** Emphasis on stricter ESG compliance laws and the rise of socially conscious investors has drawn the focus of financial institutions, both globally and in India. Many banks are already moving down the path towards greener finance. Goldman Sachs, for example, announced they would spend USD 750 billion on sustainable finance over the next decade. According to McKinsey, there are five

essential ways in which ESG can create value for a company. This is also true for banks and HFCs funding green housing:

- **Top-line growth:** Green affordable housing is a niche that has not yet received its due importance. Bringing in green finance products can help financial institutions gain a first-mover advantage opening tremendous prospects.
- **Cost reduction:** By having a strong green housing portfolio, HFCs and banks gain access to funding, especially facilities made available by DFIs with ESG and impact goals. Financial institutions, through these funds, then have access to long-term debt at subsidized interest rates thereby reducing their cost of borrowing.
- **Regulatory and legal interventions:** Government subsidies and incentives, such as subsidized funds and refinancing facilities, help reduce the risk of the overall portfolio. Similarly, in India, RBI has mandated PSL for banks, which, if not fulfilled, can lead to imposition of penalties and enforcement actions.
- **Productivity uplift:** ESG compliance can attract and retain talent that is socially conscious and motivated. It creates an added sense of satisfaction for the employees and pride in the work that they do.
- **Investment and asset optimization:** Financing green housing projects helps financial institutions allocate funds towards more promising and sustainable opportunities. These opportunities would help banks steer away from investing in projects in polluting industries that would lead to strict regulatory responses down the road. For example, bans or limitations on single-use plastics and restrictions on diesel-fueled cars present warning signs of how regulations will impose new constraints on multiple businesses and eventually a high NPA for banks financing them.

(3) **Global green finance products:** Though nascent in India, green housing finance has been prevalent in other countries with varied levels of success. Financial institutions in India can learn from these products and adapt them to the Indian context. Following are a few distinct examples:⁵³

- **Green mortgage:** In a green mortgage, a bank or mortgage lender offers a homebuyer preferential term if they can demonstrate that the property meets certain environmental standards. This could be a new build home with an existing sustainability rating, or a case where the borrower will commit to invest in renovations to improve its environmental performance. In Europe alone, more than 20 banks and financial institutions are providing green mortgages.
 - **Infonavit green mortgage:** A Mexican social financial institution that serves low-income workers, Infonavit's green mortgage program provided an additional amount of credit for workers to acquire homes with environmental technologies to help reduce their energy expenses and water consumption while also reducing carbon dioxide emissions.⁵⁴ Infonavit worked closely with vendors and materials suppliers who had inventory of environmental technologies, and contracted them via early direct payment to distribute and install at both national and regional levels.
- **Green home loans:** In Australia, Bendigo Bank offers a Generation Green™ Home Loan with a 0.5% annual reduction on the prevailing residential variable rate and no monthly service fees. This preferential rate, combined with no fees, leads to significant savings for loan recipients by implementing simple green measures.
- **Green bonds:**⁵⁵ IFC has worked with Bancolombia and Davivienda, the largest commercial banks in Colombia, to issue USD 260 billion in green bonds to support climate projects, including green buildings. The funds raised aim to green building construction in the residential as well as office sectors.
- **Premium refunds:** Canada Mortgage and Housing Corporation (CMHC) offers a 10% premium refund on its mortgage loan insurance and extended amortization for purchase of energy efficient homes.
- **Technology leasing:** European banks, in collaboration with governments, provide environmentally friendly technologies to customers at subsidized rates, accelerated depreciation, and tax exemptions. In USA, New

Resource Bank (NRB) offers residential solar power installations for a 25-year loan term, which is equivalent to its warranty. Solar financing provided solar power to a home for as little as USD 100 per month. This cost was lowered even further with tax deductions on interest.

4. Regulating green affordable housing

Key takeaways

- At present, there is no holistic regulatory framework (for green affordable housing) at the national level, and state- and city-level regulations and incentives are designed in response to those stipulated by national ministries.
- While there are some incentives and funding programs to incentivize green affordable housing construction, there are no specific regulations to mandate green housing finance products. An enabling regulatory environment can help stimulate supply and demand for green housing products, thereby setting the foundation for a robust green housing ecosystem.
- Technology sub-mission under the PMAY-U program, Global Housing Technology Challenge (GHTC-India) and Rooftop Solar (RTS) program are some of the key initiatives undertaken by the Government of India to encourage developers and building material manufacturers to integrate green construction technologies into affordable housing development.

The regulatory analysis starts with a description of government policies and initiatives that encourage green affordable housing development. This is followed by an analysis of the systems that help measure and quantify the greening of building stock – i.e., green rating and certification systems and building codes. This chapter also explores the financial products, incentives and stakeholders that help promote green affordable housing development.

4.1 The need and opportunity for green housing in India

The evolution and expansion of India's building stock has a critical role to play in its battle against climate change. Accounting for more than 40% of the country's total energy consumption, energy use from buildings is increasing at 8% annually.⁵⁶ If conventional inefficient building practices continue, buildings will account for over 70% of emissions by 2050, thus posing a major threat to India's green ambitions.

According to IFC, 70% of the buildings required by 2030 are yet to be constructed in India.⁵⁷ If India were to embrace the concept of green buildings to meet this demand, it will be a win-win for the environment and the economy. The green building market in India is currently at a nascent stage of development, with only 5% buildings being classified as green. While this might come across as a challenge at the outset, it opens a wide array of opportunities for the development of green buildings within which affordable housing could be a cost-effective leverage point for achieving India's environmental and poverty reduction objectives. Until recently, environmental sustainability and affordable housing for the urban poor had been two separate policy objectives. There has been increasing integration of these two fields in the policy sphere in the last few years.

4.2 Government of India's housing program(s)

The (GoI) and its competent ministries design and monitor the implementation of affordable housing programs for the urban poor. As per the Indian Constitution, housing is a state responsibility. The role of the central government is thus limited to financial assistance and provision of guidelines for state- and city-level implementing agencies.

Erstwhile schemes such as the Indira Awas Yojana (IAY) and Rajiv Awas Yojana (RAY) were launched to address the housing needs in rural and urban areas, respectively. However, these were restructured in 2015 and were rolled out as PMAY-G (Pradhan Mantri Awas Yojana-Grameen) and PMAY-U (Pradhan Mantri Awas Yojana-Urban) respectively. The mission launched by the GoI aims to construct 11.2 million houses in urban areas and 29.5 million houses in rural areas by 2030.

4.2.1 Pradhan Mantri Awas Yojana – Urban (PMAY-U)

PMAY-U was launched on June 25, 2015, with the objective to provide central assistance to States and Union Territories (UTs) for providing houses to all eligible beneficiaries by 2022. To achieve its objective, the program has four verticals:

- i. In-situ Slum Redevelopment (ISSR)
- ii. Credit Linked Subsidy Scheme (CLSS)
- iii. Affordable Housing in Partnership (AHP)
- iv. Beneficiary-led Construction (BLC) New / Enhancement (BLE)

The program is being implemented as a Centrally Sponsored Scheme (CSS) except for the CLSS vertical that is being implemented as a Central Sector Scheme. To be eligible for central assistance under the program, the beneficiary family should not own a *pucca* (permanent) house either in his/her name or in the name of any family member in any part of India. A beneficiary family shall comprise husband, wife, unmarried sons, and/or unmarried daughters. A beneficiary of the scheme is eligible under only one component based on household income and other eligibility criteria. EWS beneficiaries are eligible for all four program verticals while LIG and MIG beneficiaries are eligible for benefits under the CLSS vertical. Houses are to be allotted in the name of an adult female member or in joint name, and all houses must have a toilet facility, drinking water, and power supply.

As of August 2021, of the 11.3 million houses sanctioned, over 5 million houses have been delivered to beneficiaries with over INR 1000 billion (USD 13.5 billion) released under various components.⁵⁸ The table below summarizes the financial support provided to beneficiaries under the PMAY-U program:

Table 7: Summary of financial support provided under PMAY-U

S.No	Vertical	Beneficiary category	Financial support
1	Beneficiary-led house construction/enhancement	EWS	Central assistance of INR 0.15 million (USD 2,027) for construction of new houses or enhancement of existing houses
2	Affordable Housing in Partnership (AHP)	EWS	Central assistance of INR 0.15 million (USD 2,027) in all eligible PPP housing projects
3	Credit Linked Subsidy Scheme (CLSS)	EWS, LIG, MIG-I, MIG-II	EWS/LIG, MIG-I, and MIG-II beneficiaries seeking housing construction or acquisition loans from primary lending institutions (PLIs) ⁵⁹ are eligible for an interest subsidy at the rate of 6.5%, 4% and 3% respectively for a tenure of 20 years or during tenure of loan, whichever is lower CLSS subsidy is available only for loan amounts up to INR 0.6 million (USD 8,108) for EWS/LIG, INR 0.9 million (USD 12,162) for MIG-I, and INR 1.2 million (USD 16,216) for MIG-II

S.No	Vertical	Beneficiary category	Financial support
4	In-situ Slum Redevelopment	Eligible slum dwellers	“In-situ” slum rehabilitation using land as a resource with private participation to provide houses to eligible slum dwellers

Source: PMAY-U, HFA – Scheme guidelines available at: <https://pmayurban.gov.in/uploads/guidelines/60180813309f2-Updated%20guidelines%20of%20PMAY-U.pdf>

Annex 1 describes some of the salient features of each of these verticals, as well as the Affordable Rental Housing Complex (ARHC) vertical that was added in the wake of the COVID-19 pandemic.

4.2.2 AMRUT Atal Mission for Rejuvenation and Urban Transformation

AMRUT was launched as the first water focused Mission in 2015, with a total Mission outlay of INR 1000 billion (USD 13.51 billion). The Mission caters to 500 major cities covering 60% of the urban population.⁶⁰ The purpose of the mission is to

1. Ensure that every household has access to a tap with the assured supply of water and a sewer connection.
2. Increase the amenity value of cities by developing greenery and well-maintained open spaces (e.g., parks) and
3. Reduce pollution by switching to public transport or constructing facilities for non-motorized transport (e.g., walking and cycling). All these outcomes are valued by citizens, particularly women. Indicators and standards have been prescribed by the Ministry of Housing and Urban Affairs in the form of Service Level Benchmarks (SLBs).

To build upon the progress of AMRUT, AMRUT 2.0 was launched in October 2021 with an aim to create water secure cities providing universal coverage of water in all statutory towns and 100% coverage of sewerage management in 500 AMRUT cities.⁶¹ This will be achieved through circular economy of water by effecting water source conservation, rejuvenation of water bodies and wells, recycle/ reuse of treated used water, and rainwater harvesting by involving community at large.

4.3 Greening affordable housing under PMAY-U

While PMAY-U mentions adopting green practices for faster construction,⁶² initially, there was a disconnect between urban housing policies and the GoI’s environmental commitments. Affordable housing targets were not integrated with the government’s climate change and urban development agendas. This was due to the lack of awareness and understanding of the social, economic, cultural, and environmental components of sustainability in housing development.

However, given the increasing awareness on the need for sustainable development, the GoI introduced the technology sub-mission under the PMAY-U program to encourage developers and building materials manufacturers to integrate green construction technologies in affordable housing development.

4.3.1 Technology sub-mission under PMAY-U

The technology sub-mission has been set up under PMAY-U to facilitate – (i) the adoption of modern, innovative, and green technologies and building materials, and (ii) faster construction of affordable housing. The sub-mission is also intended to facilitate the preparation and adoption of designs and building plans tailored to the different geo-

climatic zones in the country. Finally, the sub-mission aims to assist states and cities in deploying disaster-resistant and environmentally friendly technologies.

The sub-mission coordinates with multiple regulatory bodies and private sector companies to mainstream and scale the deployment of modern construction technologies and materials in place of conventional construction. The technology sub-mission covers the following aspects:

- Design and planning
- Innovative technologies and materials
- Green buildings using natural resources
- Earthquake and other disaster resistant technologies and designs

Central and state government agencies partner with Indian Institutes of Technology (IITs), National Institutes of Technology (NITs), and planning and architecture institutes to develop technical solutions and build capacity. A technical cell has been set up in the BMTPC to support the sub-mission. BMTPC has identified and is promoting fifty-four emerging technologies, using which 1.2 million houses are being constructed across the country.⁶³

4.3.2 Global Housing Technology Challenge (GHTC-India)

The Ministry of Housing and Urban Affairs (MoHUA) has also initiated a Global Housing Technology Challenge-India (GHTC-India) to shortlist alternative innovative technologies through a challenge process. The challenge has three components viz.

- Conducting a biennial grand expo-cum-conference called Construction Technology India (CTI)
- Identifying proven demonstrable technologies from across the globe to construct lighthouse projects
- Promoting potential technologies (domestic) through the establishment of Affordable Sustainable Housing Accelerators-India (ASHA-I) that provide incubation and accelerator support.

GHTC-India aims to transform the housing construction ecosystem through lighthouse projects built using advanced proven technologies. It will foster the development of domestic technological research and building platforms for knowledge sharing and networking across the sector (refer section 2.2).

4.4 Other GoI green building programs/incentives

In addition to its sustainable construction initiatives under PMAY-U, the GoI⁶⁴ has two other programs to increase adoption of specific green features in new and existing homes. Summarized in the table below, these programs aim to popularize the use of energy efficient appliances, and solar heating and lighting systems by offering incentives in the form of capital subsidies for purchase and installation.

Table 8: GoI programs to encourage adoption of specific energy-efficient features

S.No	Scheme	Beneficiary category	Financial support/ incentive
1	Rooftop Solar (RTS) program ⁶⁵	Residential, institutional, and social sectors	Central Finance Assistance (CFA) of 40% for up to 3KW capacity and 20% for 3-10 KW capacity for setting up rooftop solar photovoltaic systems in residential buildings

S.No	Scheme	Beneficiary category	Financial support/ incentive
2	Unnat Jyoti by Affordable LEDs for All (UJALA) ⁶⁶	Domestic households	LED bulbs, LED tube lights and energy-efficient fans at subsidized prices

4.5 Green building rating and certification systems

Energy codes for new buildings are an important regulatory measure for ushering energy efficiency in the building sector. They are particularly relevant for countries like India where the building stock is growing rapidly. The Energy Conservation Building Code (ECBC) has been designed to improve energy efficiency in commercial buildings. Given the rapid growth in the residential building stock across India, and the consequent opportunities and necessity for energy conservation in this sector, the Ministry of Power established an Energy Conservation Building Code for residential buildings, called ECBC-R.

ECBC-R (Part I: Building Envelope) sets minimum building envelope performance standards to limit heat gains (for cooling dominated climates) and to limit heat loss (for heating dominated climates), as well as to ensure adequate natural ventilation and lighting potential. The code provides design flexibility to innovate and vary important envelope components such as wall type, window size, type of glazing, and external shading to windows to comply with the code.

Apart from the ECBC codes, ratings and certification systems also include standards and guidelines to encourage energy efficient and sustainable construction. Some of these systems are:

- Green Rating for Integrated Habitat Assessment (GRIHA) by The Energy and Resources Institute (TERI)
- Leadership in Energy and Environmental Design (LEED) Green Building Standard by Indian Green Building Council (IGBC)
- Excellence in Design for Greater Efficiencies (EDGE) by IFC
- Energy Conservation – New Indian Way for Affordable and Sustainable Homes (ECO–NIWAS)
- Energy Efficiency Label for Residential Buildings – Star rating of Homes by Bureau of Energy Efficiency (BEE)

4.5.1 Green Rating for Integrated Habitat Assessment (GRIHA)

GRIHA evaluates the environmental performance of a building holistically over its entire life cycle. Based on accepted energy and environmental principles, it seeks to strike a balance between established practices and emerging concepts, both national and international. It covers commercial, institutional, and residential new builds, and, in the case of schools, existing buildings. Projects can be registered under GRIHA, GRIHA-LD, SVA-GRIHA or GRIHA-Prakriti depending on the building use and scale. SVAGRIHA (Small Versatile Affordable GRIHA) is applicable only for projects that are less than 2,500 m² of built-up area, and applies to all building uses, except industrial buildings.

In India, GRIHA is increasingly linked to state and municipal governments' promotional policies for green buildings: five state governments offer increased Floor Area Ratio (FAR) for GRIHA *registered* projects, while four municipal governments have similarly followed the Ministry of Urban Development's notification to the same effect.⁶⁷ In addition:

- The Ministry of Environment and Forestry (MoEF) promotes fast-track project approval for GRIHA *registered* or *pre-certified* projects.

- At present, Small Industries Development Bank of India (SIDBI) is offering concessional rate (50 basis points) of interest to green buildings certified by accredited rating agencies including GRIHA.
- Pimpri Chinchwad Municipal Corporation (PCMC) has announced incentives for developers and owners who voluntarily comply with GRIHA.
- The MNRE granted the following incentives to various stakeholders under its 'Energy-efficient solar/green buildings' scheme to GRIHA-NRS projects for implementation during 2013-14 under the 11th Five Year Plan and the remainder of the 12th Five Year Plan.

4.5.2 The Indian Green Building Council (IGBC)

The Indian Green Building Council (IGBC) was formed in 2001 with the vision “to enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025.” IGBC has licensed the LEED Green Building Standard from the USGBC and adapted it to local conditions.

IGBC works at a national level with a whole-building approach to sustainability by recognizing performance in the seven key areas and covers homes (through the separate IGBC Green Homes system), townships, Special Economic Zones (SEZs), green factory buildings, and green landscapes. The rating is a point-based system that certifies buildings as silver, gold, or platinum. IGBC is working with multiple city and state governments to develop incentives, which can take different forms. For example:

- In the state of Maharashtra, the Environment Department is developing green building guidelines along with the IGBC.
- The Noida Development Authority – the urban local body responsible for providing building permission in the city grants an additional 5% FSI to projects with plot sizes above 5,000 m² that achieve a minimum IGBC gold rating or commit to achieving IGBC gold rating.⁶⁸
- The Hyderabad Metropolitan Development Authority's (HMDA) 'green channel' initiative provides faster clearances for IGBC compliant residential, commercial, and industrial buildings, and a 50% reduction of the approval fee.

4.5.3 Excellence in Design for Greater Efficiencies (EDGE)

EDGE, a green building certification system for emerging markets created by IFC, is a measurable way for builders to optimize their designs, leading to a more investment-worthy and marketable product (for developer- and self-built construction alike). By keeping certification fast and inexpensive, EDGE keeps pace with the momentum that developers need to stay ahead of green building practices. Projects must achieve the EDGE standard of a 20% improvement in energy, water, and materials as measured against the base case. When achieved, the project is registered for certification. During the certification process, documentation is submitted by the client and reviewed by EDGE-trained auditors at the design and construction stages, including a site audit. Projects that meet the EDGE standard receive a certificate confirming predicted performance.

4.5.4 Energy Conservation – New Indian Way for Affordable & Sustainable Homes (ECO NIWAS) by Ministry of Power and BEE

ECO NIWAS aims to promote energy efficiency in residential buildings by sharing insightful information covered under IGEN-EERB about policies and programs at national and state levels. The website (developed under the Indo-German Energy program) contains information about the policies, tools for evaluating the energy performance of residential buildings, events, news, publications, and other resources related to the program. Tools that have been developed for building performance evaluation have a user-friendly and interactive interface to – (i) raise awareness and sensitize people to adopting energy efficiency measures in buildings, and (ii) educate users regarding energy saving potential, cost savings, and CO₂ emissions reduction.

ECO NIWAS offers users (individuals as well as building professionals) three tools with different specifications to help them customize multiple energy efficiency options, including analyzing the compliance status of the building design as per BEE regulations. It is a web-based compliance tool, made available to users on the internet with minimal software requirements and building science or simulation expertise.

The ECO NIWAS simulation tool virtually assists decision making while altering certain parameters like window-to-wall ratio, U-values, and vertical and horizontal shading to minimize the energy requirements to make a building more energy efficient. The tool compares baseline parameters from ECBC prescriptive requirements and the proposed design to compute the Energy Performance Intensity (EPI).

4.5.5 Energy Efficiency Label for Residential Buildings – Star Rating for Homes by BEE

BEE launched the ‘Energy Efficiency Label for Residential Buildings’ in February 2019 with the key objective of making the energy performance of a home a key comparative variable in deciding home prices in the future. It also aims to provide a benchmark to compare houses based on energy efficiency to create a consumer-driven market transformation solution in the housing sector.

This program is another step towards realizing the vision of an energy surplus India with 24 x 7 power to all. The proposed labeling program will include all types of residential buildings in India. The envisaged objectives can be achieved by mandating the proposed labeling in any real estate transaction.

4.6 Limitations of rating and certification systems

The MoEFCC notification on green buildings provides faster environmental clearances to projects applying for IGBC or GRIHA certification. However, as the Centre for Science and Environment (CSE) rightly points out, MoEFCC is offering these incentives “with the faith that the green rating agencies have carried out the due diligence of these project designs and will be accountable for the environmental performance of such projects. However, pre-certification is only a pledge and there is no legal provision for requiring the project proponents to achieve the level of rating promised in the pre-certification application.”

Furthermore, some building assessment and benchmarking tools have attracted scrutiny for several reasons, including:

- (1) Lack of adaptability to local climate, culture, and resources
- (2) Lack of life-cycle inventory databases that make it difficult to ascertain the life-cycle impact of materials and therefore, render the results unreliable
- (3) Focus on the operational phase of building and insufficient attention to the life-cycle energy requirements of adjoining infrastructure, occupants transportation requirements, and process-based vs. input- and outcome-based calculation of embodied energy of material
- (4) Relative subjectivity of weightage of indicators
- (5) Discrepancy between projected and actual performance of buildings, mainly due to the user of the building as the unknown variable.

In segments like affordable housing, sustainability concerns take second place behind affordability concerns, limiting the demand for green building certification (since fees increase costs). However, the institutionalization of GRIHA demonstrates the potential of building assessment and benchmarking as a requirement for building permits, fiscal incentives as well as educational tools that utilize a common sustainability language. However, it should be highlighted again that there does not seem to be consistency as to which green building rating system, i.e., GRIHA,

IGBC, EDGE, or the ECBC, receives support from which national, regional, or local authority, and whether registration for certification is a sufficient condition to qualify for government support, as opposed to certification itself. The already fragmented green building certification ‘market’ could limit the overall impact of these initiatives. A more unified approach, as in Singapore (Green Mark scheme), may be more effective⁶⁹ for steering the Indian housing sector towards greater sustainability.

4.7 Role of states and Urban Local Bodies (ULBs) in the green housing ecosystem

In India, buildings are a state subject, and laws and regulations that govern building construction are under the ambit of state Urban Development Departments (UDDs) that are guided by MoHUA at the central level. For instance, the BEE⁷⁰ has developed the ECBC, but it is BEE’s state-level counterparts – State Development Agencies (SDAs) – that provide implementation support to cities. While local governments, primarily ULBs, have the authority to implement and enforce policies, their approach is heavily influenced and guided by national and state governments. Globally, local governments have assumed three types of roles in implementing policy actions depending on their capacity and implementation powers. Local governments and ULBs in India play the following key roles:

- **Regulator:** Participating in code adoption and enforcement process by:
 1. Empaneling third-party assessors for ECBC compliance
 2. Integrating ECBC into building approvals systems
 3. Developing a monitoring mechanism to ensure code compliance
 4. Incentivizing compliance or penalizing non-compliance

- **Convener/facilitator:**
 1. Organizing capacity-building programs for ULB officials
 2. Raising awareness regarding code processes amongst builders, developers, and other private sector stakeholders
 3. Engaging with consumers, building occupants, and tenants through public platforms and workshops

ULBs in India can also influence building efficiency policies as investors or owners based on their ownership of buildings. For example, ULBs can lead by example by taking steps to improve the energy efficiency of buildings directly under their control. A high-level structure and the relationships between different government departments at national, state, and local levels are illustrated below:

Figure 41: Institutional structure at different levels of government



Source: Athena Infonomics

Code adoption, implementation, and enforcement involve multiple stakeholders; and amongst them, the role of state and local government is the most pivotal of all. The involvement of multiple government departments, with their overlapping roles and responsibilities, can aggravate issues related to streamlined implementation. This is especially true for building energy efficiency codes and standards as the technical capacity and subject expertise within the sub-national government is limited.

States like Andhra Pradesh, Telangana, Karnataka, Punjab, and Kerala are leading by example by – (i) making strong commitments, (ii) trying to create awareness amongst government officials and other stakeholders, (iii) further amending their byelaws and revising Public Works Department (PWD) Schedule of Rates (SoRs), (iv) building capacity, and (v) constituting ECBC cells. While the leading states are even developing online tools, to take advantage of technology platforms and capture advanced knowledge for efficient implementation, there are states where the code implementation has not moved post notification. The implementation status of various states is further elaborated in the attached matrix below.

Figure 42: Implementation status in various states (UNDP-GEF-BEE, 2020)

State/UT	Andhra Pradesh	Arunachal Pradesh	Assam	Bihar	Chandigarh UT	Chhattisgarh	NCT of Delhi	Goa	Gujarat	Haryana	Himachal Pradesh	Jammu and Kashmir	Jharkhand	Karnataka	Kerala	Madhya Pradesh	Maharashtra	Manipur	Meghalaya	Mizoram	Nagaland	Odisha	Puducherry UT	Punjab	Rajasthan	Sikkim	Tamil Nadu	Telangana	Tripura	Uttar Pradesh	Uttarakhand	West Bengal
ECBC Amendment	✓	✓	✓	✓		✓	✓		✓	✓	✓			✓	✓	✓	✓					✓	✓	✓	✓		✓	✓		✓	✓	✓
ECBC Notification	✓									✓				✓	✓							✓	✓	✓	✓			✓			✓	✓
Notification in state bye-laws	✓									✓																		✓				
Notification at Municipalities	✓																										✓					
Enforcement	✓																										✓					
Schedule of Rates -PWD														✓																		
ECBC Cell	✓			✓		✓	✓			✓	✓			✓	✓	✓	✓					✓		✓				✓		✓		
Training & Capacity Development	✓	✓				✓								✓	✓		✓							✓				✓				
Energy Simulation Software						✓				✓				✓					✓				✓						✓			

Source: <https://beeindia.gov.in/content/gef-unido-bee-project>

The roles and responsibilities of state departments like UDD, TCP, and PWD differ among states, where some may follow a typical hierarchy as represented above.⁷¹ For instance, the PWD department follows the code compliance, if mandated by the state; however, they are not dependent on the state to amend their design and construction specifications and can set standards by implementing ECBC in the buildings that are designed and constructed by them.

Similarly, under the 74th amendment to the constitution, ULBs have powers to amend bylaws to incorporate energy code and can also enhance its stringency level, even if not directed by state’s UDD. **There is an urgent need to clarify the roles and responsibilities at different levels and improve coordination between key ministries.** For example, the formation of a high-powered committee chaired by a senior bureaucrat such as a state’s Chief Secretary/Principal Secretary of Power/Urban Development, and with members from all relevant departments will improve coordination through delegation of implementation tasks.

States such as Madhya Pradesh and Rajasthan have incorporated ECBC in their building byelaws, but implementation at city level still needs support. In Indore, buildings that are compliant with IGBC guidelines receive 5% additional FAR, an incentive granted by the Indore Municipal Corporation (IMC). In Jaipur, the city provides 7.5% additional FAR to developers that construct green buildings. Further, the Jaipur city government is currently planning to grant additional FAR – between 7.5 and 15% – based on the category of certification (Silver, Gold, Platinum etc.).⁷²

The table below provides a snapshot of the current progress of ECBC implementation and the incentive structure for green buildings in Rajasthan and Madhya Pradesh, comparing them with Andhra Pradesh that has been a frontrunner in this regard.

Table 9: State of progress of ECBC implementation in three Indian states

Tasks related to mainstreaming ECBC	States		
	Andhra Pradesh	Rajasthan	Madhya Pradesh
Status of code	Andhra Pradesh Energy Conservation Building Code (APECBC), 2014	Energy Conservation Building (ECB) directives, 2011	Madhya Pradesh ECBC (MPECBC), 2017
Adoption and notification	Adopted and amended. It was notified in 2016	Adopted in March 2011, notified in March 2011 and mandated in September, 2011	Adopted and amended. Not yet notified
Technical committee/ECBC cell	No separate cell established. NRDC and ASCI are providing technical support to AP	Established in 2018	Supported by EU and PwC with MPUVNL
Revision of bylaws and inclusion at state level	AP building rules 2017 states compliance APECBC mandate	Unified Building bylaws 2017 includes ECBC mandate	Not yet included
Incentives	20% reduction of permit fees. If the property is sold within three years, one-time reduction of 20% on duty on Transfer of Property on the submission of Occupancy Certificate	7.5% extra FAR will be provided to green buildings	5% extra FAR, shall be given as an incentive
Status of implementation	No example of implementation	Pilot project in Prabha Bhawan, MNIT, Jaipur	No example of implementation
Support institutions in the state	ASCI, NRDC, IIIT and GKSPCL	GKSPL, EDS, MNIT Jaipur, AVVNL and RUIDP	MPUVNL, CEPT and PwC
Inclusion in building bylaws/ approval system	To be included in online building approval system	Included in local building bylaws	To be included in online building approval system
Adoption of ECBC at the ULB level	Not yet adopted locally	Mandated in unified building bylaws 2017 of Rajasthan and cities had to abide by the notification	Not yet adopted locally

Source: Athena Infonomics

4.8 Incentives to financial institutions for affordable and green housing

To truly scale green affordable housing, construction innovations and supply-side incentives must be complemented by targeted and concessional lending by financial institutions. With the higher risk profile and mismatch between tenure and demand, the GoI is undertaking measures to – (i) mitigate the risks for financial institutions, and (ii) allocate funds towards affordable and green housing.

National Housing Bank (NHB):⁷³ NHB, the apex institute for housing finance in India, has been at the forefront of advancing housing finance and refinance assistance. NHB runs a dedicated Affordable Housing Fund (AHF) for refinancing individual affordable housing loans, with total disbursements of INR 298.59 billion (USD 4.03 billion) AHF till June 30, 2022 to 351,000 dwelling units. NHB's Liquidity Infusion Facility (LIF) for refinancing HFCs addressing affordable housing sector disbursed INR 92.4 billion (USD 1.25 billion) to 36 HFCs during 2019-20.

A subsidy of INR 88.9 billion (USD 1.20 billion) benefitting 361,000 households was disbursed during 2021-22 under PMAY-CLSS with cumulative disbursement of INR 388.57 billion (USD 5.25 billion) benefitting 1.68 million households till June 30, 2022.

NHB also has a mandate of catalyzing green and energy efficient housing. Under the NHB AFD PGHRS scheme (refer section 3.2), an amount of INR 3 billion (USD 40.5 million) was disbursed.

NHB in association with various multilateral agencies has launched many programmes/schemes for promotion, development and finance of green affordable housing sector in India. The schemes and programmes are as under:

- NHB, in partnership with KfW, Germany, started promoting energy efficiency in housing sector. The Bank, in 2010-11, launched the Energy Efficient Housing Refinance Scheme, aimed at encouraging energy efficiency in the residential sector. These funds were used for 2000 housing loans extended by various Primary Lending Institutions for energy efficient units aggregating to INR 3.8 billion (USD 51.35 million).
- NHB and Department for International Development (DFID) under UK DFID Technical Assistance programme have signed a Memorandum of Understanding with Building Materials & Technology Promotion Council in 2015 for the implementation of "Demonstration Housing Project with Emerging & Green Technology" for the Housing Project at Bhubaneswar (Odisha), Bihar Sharif (Bihar) and Lucknow (Uttar Pradesh). All these projects have been completed and handed over to state government authorities.
- NHB in partnership with Agence Française de Development, France and with the support of the European Union launched SUNREF Green Housing India Programme in August 2017. Under this programme, Banks and Housing Finance Companies will have access to competitive funding opportunities to finance green and affordable housing projects and thereby, funding needs of home buyers and housing developers will be fulfilled. The programme will also capacitate stakeholders on technical aspects related to sustainable and affordable housing. Bank has disbursed refinance of approximately INR 8.71 billion (USD 117.70 million) under the SUNREF Green Housing Programme. The SUNREF Affordable Housing Programme plans to demonstrate the possibility of low-income households accessing green housing at affordable price through technical assistance and limited subsidy. The Bank also conducted Affordable Green Housing Programmes as a part of SUNREF India Housing Program initiative across the geographies.⁷⁴

Table 10: NHB programs to fund affordable and green housing

S.No	Funds/ Programs	Beneficiary category	Financial support
1	Affordable Housing Fund (AHF)	EWS, LIG, MIG-I, MIG-II	Refinancing individuals on their affordable housing loans
2	Liquidity Infusion Facility (LIFT)	Primary Lending Institutions (PLIs)	Refinancing HFCs addressing affordable housing
3	Sustainable Use of Natural Resources and Energy Finance (SUNREF) – Promoting Green Housing Refinance Scheme (PGHRS)	EWS, LIG, MIG-I, MIG-II	Refinance homes with either 4- or 5-star rating by GRIHA or Gold/Platinum rating by IGBC
4	Energy Efficient New Residential Housing	Individual buyer with green building certification	New residential buildings with passive energy efficiency measures will have their buyer’s loan refinanced

Reserve Bank of India (RBI): In February 2021, RBI issued a master circular bringing HFCs under its direct purview. The framework prescribed under the circular strengthens the regulatory oversight over HFCs in terms of loan requirements, capital adequacy requirements, and risk management of assets, thereby setting up higher governance standards and prudential functioning of these companies. Such norms are welcomed as they help build overall confidence in the housing finance sector, especially for the affordable segment. For example, to improve access to finance for EWS and LIG borrowers, in cases where the cost of the house does not exceed INR 1 million (USD 13,514), HFCs may add stamp duty, registration and other documentation charges to the cost of the house for the purpose of computing Loan-to-Value (LTV) ratio.⁷⁵

Budgetary support: The Union Budget 2021 announced the continuation of additional tax exemption of INR 0.15 million (USD 2,027) on interest of home loan paid on purchase of affordable housing up to INR 4.5 million (USD 60,811). This benefit is in addition to the existing benefit of INR 0.2 million (USD 2,700). This provides a much-needed shot in the arm to the Covid-19 pandemic-hit affordable housing sector. The budget also provided a tax holiday for affordable housing and affordable rental housing projects, thereby providing relief to HFCs.⁷⁶

4.9 Challenges and barriers

Although the GoI has instituted several programs and policies over time to encourage green affordable housing development, several key challenges remain that hinder the growth of the sector.

- **The lack of a common definition of ‘green housing’** has led to ambiguity and prevented the establishment of standardized benchmarks against which to quantify the environmental or monetary benefits of green housing construction. This also contributes to a multitude of building codes and certification systems, some of which are not necessarily responsive to local climate, building practices, and resources.

In this vein, RBI has acknowledged the challenges in developing green finance, such as “greenwashing” or false claims of environmental compliance, plurality of definitions, maturity mismatches between long-term

green investment and short-term interests of investors. It further notes the need for policy action to establish a framework that promotes the green finance ecosystem in India by fostering awareness through coordinated efforts.⁷⁷

- **Inadequate institutional structure and capacities** have limited the effectiveness of established policies and programs. Due to differing capacities and resources of implementing agencies (at state- and city-levels), well-intentioned policies are often not implemented or monitored appropriately. Additionally, weak inter-departmental and inter-agency coordination (at multiple levels of government) lead to a disconnect between policy goals and initiatives.
- **Limited awareness poses a barrier to the uptake of green building practices.** Although there are some state- and national-level incentives to encourage green housing construction (self- and developer-built), information about these is not properly or adequately disseminated. In an environment where there is limited awareness of the benefits of building green, this improper dissemination of existing capital subsidies and monetary benefits has hindered the uptake of green building, especially among low-income households. Furthermore, several of these incentives are targeted at developer-built housing (such as increased FAR), which is not useful for the vast majority of low-income households that build their homes themselves.
- **Low demand and scarce number of green products** can impede the development of laws and regulations for green housing finance. To develop credible regulation, the challenge is to establish capital adequacy and liquidity requirements keeping in mind the risk associated with green finance assets.

4.10 Opportunities

The coming together of major global and Indian financial institutions and becoming signatories to landmark programs (such as Principles for Responsible Investment (PRI), Equator Principles (EP) for financial institutions and UNEP Statement of Commitment by Financial Institutions on Sustainable Development)⁷⁸ are welcome steps towards finding collaborative ways of formulating standards, innovative financing products, and reducing the risk associated with green investments.

As part of the global push toward Sustainable Development Goal (SDG) 11 of making ‘cities and human settlements inclusive, safe, resilient and sustainable,’ affordable green housing has gained significance. Initiatives towards financing the SDGs, such as the Green Climate Fund (GCF), provide a combination of grants, concessional debt, guarantees or equity instruments to leverage blended finance and crowd-in private investments.⁷⁹

In India, collaboration between Development Finance Institutions (DFIs) and Primary Lending Institutions (PLIs) are helping to mainstream green housing finance, especially in the affordable housing segment (IFC’s present engagement with Aavas Financiers Ltd.,⁸⁰ as well as its recent investments in HFDC Ltd.,⁸¹ PNB Housing Finance Ltd., etc.⁸²). This study is significant in that it is the first of its kind for its focus on “affordable individual housing.” ADB’s project on providing ‘Inclusive, Resilient, and Sustainable Housing for Urban Poor Sector’ in Tamil Nadu,⁸³ and KfW’s loan to SBI⁸⁴ are a testament to the trust and potential that Indian housing sector holds in promoting green housing finance.

According to IFC’s estimates,⁸⁵ India alone has a potential investment opportunity worth USD 1.4 trillion in green buildings, arising from rapid urbanization and policy impetus. With 70% of the buildings needed by 2030 yet to be built, the affordable green housing finance sector needs immediate attention from all levels of government.




Conclusion

Although the green housing value chain is at a nascent stage, there is increasing momentum from all quarters and recognition for the urgent need to adopt sustainable building practices. At the regulatory level, the GoI's flagship housing program PMAY has recently started focusing on green housing. This has spurred materials providers and entrepreneurs to provide solutions and products that will help improve the uptake of green building. Driven by a desire to reduce utility bills, households are already adopting energy- and water-saving measures and have expressed an interest in paying more for green building materials and technologies for longer-term benefit. This presents an opportunity to provide green housing and housing finance products to increase adoption of energy and water saving measures.

Combined with the innovations on the supply side, tailored green housing finance products will help grow a complete ecosystem thereby potentially scaling up adoption of green building overall. Although there are only three retail green housing finance products soon to be offered, the market research shows that these are much-needed products to complement and encourage green housing construction. When designing such a product, it is important to keep in mind the following key points:

- (i) **Products tailored to customer needs and local contexts:** Given the diversity of India's geography and climatic zones, a one-size-fits-all product is unlikely to meet customer demand. Furthermore, incentives by implementing agencies vary across states and cities; therefore, green housing finance products should be aligned with existing government incentives to help broaden the reach and increase efficacy.
- (ii) **Ongoing awareness-raising and knowledge dissemination campaigns:** In a sector as nascent, fragmented, and fast-evolving as green housing, it is hard for stakeholders to keep abreast with new developments. Preventing gaps in information is important to ensure that stakeholders are aligned, and the sector keeps growing steadily. Therefore, stakeholders especially government agencies must disseminate information regularly to ensure consumer buy-in and satisfaction.
- (iii) **Feedback loop to improve the regulatory environment:** While there are several innovations spearheaded by private sector stakeholders, progress can be accelerated or impeded by the regulatory ecosystem. The private sector must work closely with government agencies to improve and update regulations that create an enabling environment for the uptake of green housing.

Annex 1: Green bundles

 1 Green Bundles Built-up Area 300 sq. ft.		Bundle 1	Bundle 2	Bundle 3
	Fly Ash / AAC Hollow Blocks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Low Flow Faucets	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Single Flush for Water Closets (Low Flow)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Energy Efficient Ceiling Fans	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	External Shading Devices	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Reflective Tiles / Cool Roof	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Low Flow Shower Head	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Energy-Saving Light Bulbs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	Stone Tiles / Ceramic Tiles	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Tinted Glazing for Windows	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
	Solar Water Heater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Solar Roof Top PV	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Green Bundles

Built-up Area 300 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Water Heater



Solar Roof Top PV



Total Monthly Savings in Utility Bills(%)

20%

25%

30%



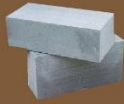
Green Bundles

Built-up Area 300 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Water Heater



Solar Roof Top PV



Total Incremental Cost

₹ 14,950

₹ 17,700

₹ 33,704



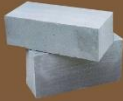
Green Bundles

Built-up Area 600 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Water Heater



Solar Roof Top PV





Green Bundles

Built-up Area 600 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



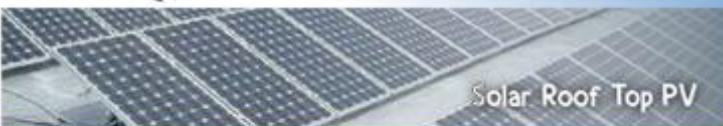
Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Water Heater



Solar Roof Top PV



Total Monthly Savings in Utility Bills(%)

30%

35%

40%



Green Bundles

Built-up Area 600 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Water Heater



Solar Roof Top PV



Total Incremental Cost

₹ 30,850

₹ 37,450

₹ 74,207



3 Green Bundles

Built-up Area 1200 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Solar Water Heater



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Roof Top PV





3 Green Bundles

Built-up Area 1200 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



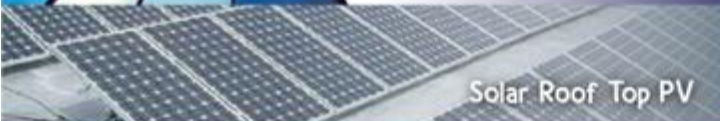
Solar Water Heater



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Roof Top PV



Total Monthly Savings in Utility Bills(%)

30%

40%

70%



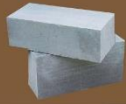
3 Green Bundles

Built-up Area 1200 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Single Flush for Water Closets (Low Flow)



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Solar Water Heater



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows



Solar Roof Top PV



Total Incremental Cost

₹ 44,750

₹ 64,550

₹ 199,559



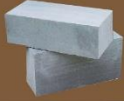
4 Green Bundles

Built-up Area 1600 sq. ft.

Bundle
1

Bundle
2

Bundle
3



Fly Ash / AAC Hollow Blocks



Low Flow Faucets



Dual Flush for Water Closets



Energy Efficient Ceiling Fans



External Shading Devices



Reflective Tiles / Cool Roof



Low Flow Shower Head



Energy-Saving Light Bulbs



Solar Water Heater



Stone Tiles / Ceramic Tiles



Tinted Glazing for Windows












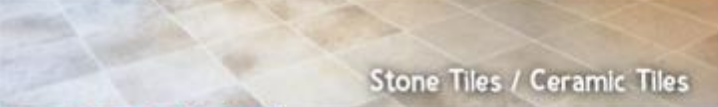


Solar Roof Top PV





4 Green Bundles













Built-up Area 1600 sq. ft.

	Bundle 1	Bundle 2	Bundle 3
 Fly Ash / AAC Hollow Blocks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Low Flow Faucets	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Dual Flush for Water Closets	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Energy Efficient Ceiling Fans	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 External Shading Devices	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Reflective Tiles / Cool Roof	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Low Flow Shower Head	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Energy-Saving Light Bulbs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Solar Water Heater	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Stone Tiles / Ceramic Tiles	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
 Tinted Glazing for Windows	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
 Solar Roof Top PV	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Total Monthly Savings in Utility Bills(%)	30%	40%	70%



4 Green Bundles

Built-up Area 1600 sq. ft.

	Bundle 1	Bundle 2	Bundle 3
 Fly Ash / AAC Hollow Blocks	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Low Flow Faucets	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Dual Flush for Water Closets	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Energy Efficient Ceiling Fans	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 External Shading Devices	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Reflective Tiles / Cool Roof	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Low Flow Shower Head	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Energy-Saving Light Bulbs	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Solar Water Heater	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
 Stone Tiles / Ceramic Tiles	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
 Tinted Glazing for Windows	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
 Solar Roof Top PV	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Total Incremental Cost	₹ 63,000	₹ 132,050	₹ 283,563

Annex 2: Salient features of PMAY-U verticals

In-Situ Slum Redevelopment (ISSR)

Slum redevelopment grant of INR 0.1 million (USD 1,351) per house is admissible for all houses built for eligible slum dwellers under the component of In-situ Slum Redevelopment (ISSR) using land as Resource with participation of private developers. Slums, whether on Central Government land/State Government land/ULB land or Private Land, are taken up for “in-situ” redevelopment. Private partner for Slum Redevelopment to be selected through open bidding process. State Governments, if required, provide additional Floor Area Ratio (FAR)/Floor Space Index (FSI)/Transferable Development Rights (TDR) for making slum redevelopment projects financially viable. States/UTs have the flexibility to deploy the central grant for other slums being redeveloped for providing houses to eligible slum dwellers with private participation, except slums on private land.

“In-situ” redevelopment of slums on private owned lands for providing houses to eligible slum dwellers can be incentivized by State Governments/UTs or ULBs by giving additional FSI/FAR or TDR to landowner as per its policy. Central assistance cannot be used in such cases.

Credit Linked Subsidy Scheme (CLSS)

Beneficiaries of Economically Weaker Section (EWS)/Low Income Group (LIG), Middle Income Group (MIG)-I and Middle-Income Group (MIG)-II seeking housing loans from Banks, Housing Finance Companies and other such institutions for acquiring/constructing houses are eligible under the scheme.

The National Housing Bank (NHB), Housing and Urban Development Corporation (HUDCO) and State Bank of India (SBI) for their own branches (from November 1, 2019), have been designated as the Central Nodal Agencies (CNAs) to channelize this subsidy to the lending institutions and for monitoring the progress of this component. As on 31st March 2023, 12 million houses have been approved, of which 10.9 million are grounded and nearly 7.2 million are completed⁸⁶. The beneficiary category wise subsidy assistance under the Scheme is summarized below:

Figure 43: CLSS beneficiary categories

Particulars	EWS	LIG	MIG I	MIG II
Household Income (INR)	Upto INR 3 lakh (USD 4,054) per annum	INR 3 lakh (USD 4,054) and 6 lakh (USD 8,108)	INR 6 lakh (USD 8,108) and 12 lakh (USD 16,216)	INR 12 lakh (USD 16,216) and 18 lakh (USD 24,324)
Carpet Area in sqm	30	60	160	200
Interest Subsidy (% p.a.)	6.5%		4.0%	3.0%
Maximum Loan Tenure	20 Years			
Eligible Loan Amount (INR)	6,00,000/-		9,00,000/-	12,00,000/-
Discounted NPV Rate	9%			
Upfront amount for Subsidy (INR) for a 20 Year Loan	2,67,280/-		2,35,068/-	2,30,156/-
Approx. monthly savings @ Loan Interest of 10%	2,500/-		2,250/-	2,200/-

Source: MoHUA

Note: CLSS for Middle Income Group (MIG) has been discontinued since 31st March 2021.

Figure 44: State-wise subsidy disbursement under PMAY-CLSS for EWS and LIG as of June 30, 2019



Source: National Housing Bank (NHB), India

Affordable Housing in Partnership (AHP)

The Scheme provides financial assistance to EWS houses being built in various partnership models by States/UTs/Cities through its agencies or in partnership with private sector including industries. Central assistance of INR 0.15 million (USD 2,027) per EWS house is provided under AHP. Projects under AHP should have a minimum of 250 houses with at least 35% houses of EWS category. Preference is given to physically handicapped persons, senior citizens, SC/ ST/ OBCs, minorities, single women, transgender and other weaker and vulnerable sections of the society.

Beneficiary-led Construction (BLC) New/Enhancement (BLE)

Assistance under this component is provided to individual eligible families belonging to EWS categories to either construct new house or to enhance existing houses on their own. Central assistance up to INR 0.15 million (USD 2,027) per house is provided under the scheme. Enhancement shall mean addition of minimum carpet area of 9.0 sq. mtr. into the existing house with pucca construction of at least one habitable room or room with kitchen and/or bathroom and/or toilet conforming to NBC norms. The total carpet area after enhancement must not be less than 21 sq. mtr. and must not be more than 30 sq. mtr.

Affordable Rental Housing Complexes (ARHC)

COVID-19 pandemic has resulted in reverse migration of urban migrants/ poor in the country. Urban migrants stay in slums/ informal settlements/ unauthorized colonies/ peri-urban areas to save cost on housing. They need decent rental housing at affordable rate at their work sites.

To address this need, Ministry of Housing & Urban Affairs has initiated Affordable Rental Housing Complexes (ARHCs), a sub-scheme under Pradhan Mantri AWAS Yojana- Urban (PMAY-U). This will provide ease of living to urban migrants/ poor in Industrial Sector as well as in non-formal urban economy to get access to dignified affordable rental housing close to their workplace.

The ARHC scheme will be implemented through two models:

- Utilizing existing Government funded vacant houses to convert into ARHCs through Public Private Partnership or by Public Agencies
- Construction, Operation and Maintenance of ARHCs by Public/ Private Entities on their own vacant land

Beneficiaries for ARHCs are urban migrants/ poor from EWS/ LIG categories. ARHCs will be a mix of single/double bedroom Dwelling Units and Dormitory of 4/6 beds including all common facilities which will be exclusively used for rental housing for a minimum period of 25 years. These complexes will ensure a dignified living environment for urban migrants/poor close to their workplaces at affordable rates. This will unlock existing vacant housing stock and make them available in urban space. It will propel new investment opportunities and promote entrepreneurship in rental housing sector by encouraging Private/Public Entities to efficiently utilize their vacant land available for developing ARHC.

Appendix 3: Global incentives for green housing finance

Governments, both in developed and developing countries, are taking various capacity building measure by all relevant stakeholder in order to target and build their green housing finance sector:

- **Bank Indonesia (BI):**⁸⁷ Indonesia’s central bank, Bank Indonesia has come up with a policy to adjust Loan-to-value by 5% for residential properties that have green certification, such as EDGE, LEED, GreenMark, etc., or fall under green belt. This helps individuals building green homes borrow a higher amount on the same property value compared to conventional homes.
- **Japan Housing Finance Agency (JHF):**⁸⁸ JHF, a Japanese government owned financial institution, under an initiative called “Flat 35S” purchases 35-year fixed rate housing loans from private institutions. The houses under “Flat 35S” should have superior energy efficiency features such as Thermal insulation and Double-glazed window, thereby increasing insulation capacity of the houses and reducing the consumption of electricity and fossil fuels for heating and cooling. It also requires the houses to have more durable material use in construction thereby helping environmental conservation.
- **Property Assessed Clean Energy (PACE) Programme:**⁸⁹ The Office of Energy Efficiency and Renewable Energy of the Government of United States runs a Residential PACE (R-PACE) programme whereby the owner of the property can make energy efficiency and renewable energy related improvements to their house. The financing of these improvements is then linked to their property tax and is spread over a 5–25-year period. These programmes are implemented by municipalities and financing is taken care by private source of capital.
- **Institute of the National Workers' Housing Fund (INFONAVIT):**⁹⁰ Infonavit is a social financial Institution with the double mandate of administrating the resources of the Housing National Fund and operating a financing system which allows the workers to satisfy their housing need. Under their Green Mortgage program, Infonavit provides financing for adopting environmental technologies to help reduce electricity, water and gas consumption to these low-income worker households.
- **Fiscal Incentives by Governments:** Apart from various programmes run by government agencies to help the uptake of green housing by providing incentives on financing, there are many national and sub-national governments that are also providing fiscal incentives to help the segment:⁹¹
 - Government of Argentina provides 10% VAT exclusion if green features such as insulation class B, solar water collectors and LED lighting are installed in residential buildings.
 - In Brazilian city of Salvador, discounts on property taxes are provided in the range of 5-10%, based on green certification of the residences.
 - National Mining and Energy Planning Unit in Colombia gives 19% VAT exclusion and 25% income tax deduction for using insulation and energy efficient air conditioning in residential buildings.
 - Kenya is providing 100% tax exemption on interest income for bonds and securities used to raise funds for green residential building projects as defined under green bond standards, issued by financial institutions.

- City of Mandaluyong, in Philippines, provides 50% discount on 'Real' Property Tax if green features, as prescribed by the green building regulation, related to energy efficiency, water efficiency, waste management, indoor air quality and site sustainability are installed.⁹²
- In developed countries such as Spain, 314 out of 7587 municipalities provide property tax reductions on green residential buildings. Similarly, in USA, 32 out of the 50 states provide tax assessment incentives for green residential properties.⁹³

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