



**A POLICY STRATEGY FOR
DECARBONISING
THE BUILDING
SECTOR**

**FACILITATING
ECO-NIWAS
SAMHITA
IMPLEMENTATION
IN AFFORDABLE
HOUSING**

A Policy Strategy for Decarbonising the Building Sector: Facilitating Eco-Niwas Samhita Implementation in Affordable Housing

Anukriti Pathak, Tarun Garg and Dr. Satish Kumar

Phase 1 Report
October 2020

ABOUT AEEE

Alliance for an Energy Efficient Economy (AEEE) is a policy advocacy and energy efficiency market enabler with a not-for-profit motive.

ABOUT GBPN

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

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Suggested Citation

Pathak, A., Garg, T., Kumar, S. (2020). A Policy Strategy for Decarbonising the Building Sector: Facilitating ENS Implementation in Affordable Housing. AEEE, CRDF, GBPN.

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LIST OF ACRONYMS

AAC	Autoclaved Aerated Concrete
ADA	Area Development Authority
AEEE	Alliance for An Energy Efficient Economy
AHM	Affordable Housing Mission
AHP	Affordable Housing in Partnership
AIP	Annual Implementation Plan
AMC	Amdavad Municipal Corporation
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
AUDA	Ahmedabad Urban Development Authority
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
BLC	Beneficiary-Led Construction
BMTPC	Building Materials and Technology Promotion Council
BPSO	Building Plan Scrutiny Pool Office
CAA	Constitutional Amendment Act
CAGR	Compound Annual Growth Rate
CEEW	Council on Energy, Environment and Water
CNA	Central Nodal Agency
CGEWHO	Central Government Employees Welfare Housing Organisation
CLASP	Collaborative Labelling and Appliance Standards Programme
CLC	Cellular Lightweight Concrete
CLSS	Credit Linked Subsidy Scheme
CPR	Centre for Policy Research
CPWD	Central Public Works Department
CSMC	Central Sanctioning and Monitoring Committee
DDA	Delhi Development Authority
DISCOM	Electricity Distribution Company
DPR	Detailed Project Report
DU	Dwelling Unit
EC	Energy Conservation
ECBC	Energy Conservation Building Code
ECBC- R	Energy Conservation Building Code – Residential (now known as Eco-Niwas Samhita 2018)
EMI	Equated Monthly Installment
ENS	Eco-Niwas Samhita
EWS	Economically Weaker Sections
FAR	Floor Area Ratio
FSI	Floor Space Index

GBPN	Global Buildings Performance Network
GDCR	General Development Controls and Regulation
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoI	Government of India
GRIHA	Green Rating for Integrated Habitat Assessment
GST	Goods and Services Tax
GTPUD	Gujarat Town Planning and Urban Development
GTPUDA	Gujarat Town Planning and Urban Development Act
GUDM	Gujarat Urban Development Mission
HDFC	Housing Development Finance Corporation
HFAPoA	Housing for All Plan of Action
HUDCO	Housing and Urban Development Corporation
IEA	International Energy Agency
IESS	India Energy Security Scenario
IGBC	Indian Green Building Council
INR	Indian Rupee
ISSR	In-Situ Slum Redevelopment
JNNURM	Jawaharlal Nehru National Urban Renewal
LED	Light-Emitting Diode
LIG	Low-Income Group
LPG	Liquefied Petroleum Gas
MEP	Mechanical, Electrical, and Plumbing
MIG	Middle-Income Group
MM-GRUH	Mukhya Mantri Gujarat Rural Urban Housing
MoA	Memorandum of Agreement
MoHUA	Ministry of Housing and Urban Affairs
MoSPI	Ministry of Statistics and Plan Implementation
MoUD	Ministry of Urban Development
MRV	Measurement, Reporting, and Verification
NA	Non-Agricultural Land
NBC	National Building Code
NBCC	National Buildings Construction Corporation
NBO	National Buildings Organisation
NCHFI	National Cooperative Housing Federation of India
NCRPB	National Capital Region Planning Board
NDC	Nationally Determined Contribution
NHB	National Housing Bank
NITI Aayog	National Institution for Transforming India
NIUA	National Institute of Urban Affairs
NOC	No Objection Certificate

NSS	National Sample Survey
NSSO	National Sample Survey Office
NUHF	National Urban Housing Fund
PIU	Project Implementation Unit
PMAY	Pradhan Mantri Awas Yojana
PMU	Project Monitoring Units
PPP	Public-Private Partnership
RAH	Residential- Affordable Housing
RBI	Reserve Bank of India
RERA	Real Estate (Regulation and Development) Act
RETV	Residential Envelope Transmittance Value
SDA	State Designated Agency
SDC	Swiss Agency for Development and Cooperation
SEEI	State Energy Efficiency Index
SHGC	Solar Heat Gain Coefficient
SLAC	State Level Appraisal Committee
SLNA	State Level Nodal Agency
SLSMC	State Level Sanctioning and Monitoring Committee
SOR	Schedule of Rates
SSMC	State Sanctioning and Monitoring Committee
TCPO	Town and Country Planning Organisation
TDR	Transferable Development Rights
TPO	Town Planning Office
TPS	Town Planning Scheme
TPVD	Town Planning and Valuation Department
UDA	Urban Development Authority
UDD	Urban Development Directorate
ULB	Urban Local Body
URDPFI	Urban and Regional Development Plans Formulation and Implementation
UT	Union Territory
VAMBAY	Valmiki Ambedkar Awas Yojana
VLT	Visible Light Transmittance
WFR	Window-To-Floor Area Ratio

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1

INTRODUCTION



India's urban population grew from 290 million in 2001 to 378 million in 2011 and is projected to reach 590 million by 2030.



1.1 Background



The use of air conditioners and electric fans for cooling accounts for about a fifth of the total energy used in buildings around the world, amounting to 10% of current global energy consumption.



The surging growth and employment in urban centres act as a magnet for people from rural areas and smaller cities; this, coupled with the natural population growth in cities, has led to a boom in the urban population in India and has significantly contributed to the increase in energy demand, as well.

The world economy is growing at a rate that was unimaginable fifty years ago. We live in a hyper-localised world where an event in one part of the world has a global impact, directly or indirectly. Energy demand in the developing world is increasing in parallel to the growing global economy. One of the new areas of energy demand in the developing world is that for cooling buildings, to achieve thermal comfort in tropical countries. According to International Energy Agency (IEA) estimates, the use of air conditioners and electric fans for cooling accounts for about a fifth of the total energy used in buildings around the world, amounting to 10% of current global energy consumption¹. Furthermore, with improving incomes and living standards in tropical developing countries like India, the global stock of air conditioners in buildings is projected to soar to 5.6 billion by 2050, up from 1.6 billion in 2018², growing at a rate of about 11% per annum. India alone has witnessed a Compound Annual Growth Rate (CAGR) of 13% in room air conditioner manufacturing since 2010³.

Recognising the global challenges—economic, social, and environmental—the United Nations Sustainable Development Goals envisage a world where everyone can live well and within the sustainable limits of our planet. In the current context, where over 4 billion people (68% of the total global population)⁴ live in urban areas and one of six people lives in India, it is prudent to assess and evaluate which way is India growing. The economic reforms in India in the 1990s unleashed investment in urban areas, leading to their expansion. Since then, urban centres have been the epicentre of growth, generating a large number of jobs in the service sector. The surging growth and employment in urban centres act as a magnet for people from rural areas and smaller cities; this, coupled with the natural population growth in cities, has led to a boom in the urban population in India and has significantly contributed to the increase in energy demand, as well.

India's urban population grew from 290 million in 2001 to 378 million in 2011 and is projected to reach 590 million by 2030⁵. Meeting the associated increase in demand for housing in urban areas has proven to be a challenge; in 2012, the Technical Action Group on housing estimated a housing shortage of 18.78 million in urban India⁶. As a response to the growing housing deficit, the Government of India (GoI) launched the Pradhan Mantri Awas Yojana (Housing for All by 2022 - PMAY) in 2015, with a vision to provide every family with a pucca (type of construction deemed permanent) house with a water connection, toilet facilities and 24x7 electricity supply⁷. Against the 18.78 million housing demand in urban areas, PMAY-Urban (PMAY-U) aims to build 12 million housing units by 2022⁸. With each dwelling's area expected to be around 30-60 square metres (sq. m.); it is estimated that, by 2022, the affordable housing sector will add about 360 million sq. m. to the building footprint.⁹

1 IEA. (2018). The Future of Cooling. Retrieved from IEA: <https://www.iea.org/reports/the-future-of-cooling>

2 ibid

3 Ministry of Environment, Forest & Climate Change. (2019). India Cooling Action Plan. New Delhi: Ministry of Environment, Forest & Climate Change.

4 Peters, T. (2018, June 25). Cooling for all – the 18th Sustainable Development Goal. Retrieved from Climate and Clean Air Coalition: <https://ccacoalition.org/en/blog/cooling-all-%E2%80%93-18th-sustainable-development-goal>

5 Office of the Registrar General & Census Commissioner. (2011). Primary Census Abstract: Houseless Population. Census of India.

6 Ministry of Housing & Urban Poverty Alleviation, Government of India. (2012). Report of the Technical Group on Urban Housing Shortage (TG - 12) (2012-17). Retrieved from Smartnet: <https://smartnet.niua.org/content/e4cad814-ff8d-497b-a5cc-74db29abe318>

7 MoHUA. (2015). Mission Document PMAY-U.

8 ibid

9 Kachhawa, S., Kumar, S., & Singh, M. (2019). Decoding India's residential building stock characteristics to enable effective energy efficiency policies and programs. EC3EE.



Houses built under PMAY will last 40- 60 years, and the decisions taken now will have an impact on the level of comfort that these dwellings provide to its occupants, thus impacting their energy use and costs and the associated carbon emissions over the lifetime of the buildings.



At present, electricity consumption in residential buildings accounts for 25% of the total electricity consumption in India and is expected to grow to about 39% of the total energy demand by 2047.

Houses built under PMAY will last 40- 60 years, and the decisions taken now will have an impact on the level of comfort that these dwellings provide to its occupants, thus impacting their energy use and costs and the associated carbon emissions over the lifetime of the buildings. However, given the urgency to meet the housing deficit, the focus of the Mission has been on faster and cheaper technologies and methods that can increase the pace of construction and reduce the cost. There is no direct, targeted focus on building future-ready, resilient infrastructure that could reduce the energy demand through material selection and enhance thermal comfort for the occupants.

The floor area of the residential sector is expected to increase from 15.3 billion sq. m. in 2017 to 21.9 billion sq. m. in 2027¹⁰. At present, electricity consumption in residential buildings accounts for 25% of the total electricity consumption in India¹¹ and is expected to grow to about 39% of the total energy demand by 2047¹². In absolute terms, this would mean a ten-fold increase- from 175 terawatt-hours (TWh) in 2012 to 1,840 TWh by 2047¹³. Furthermore, a large amount of energy is embedded in the extraction and manufacture/ processing of building materials and the construction process itself, which adds to the overall energy required to construct these dwellings and increases the proportion of embedded energy.

Recognising the projected increase in building energy consumption and the need to bring energy efficiency to the forefront, the Energy Conservation Building Code (ECBC) was launched in 2007 by the Ministry of Power, Gol and revised in 2017. The code provides a basic framework for regulating all initiatives related to the efficient use of energy and the building standards for commercial buildings. Given the current and anticipated rapid growth in the residential building stock across India and the consequent opportunities, as well as the need for energy conservation in this sector, the Ministry of Power formulated the Energy Conservation Code for Residential Buildings (Eco-Niwas Samhita) in 2018.

Energy codes for residential buildings are an essential regulatory measure, particularly for a developing country like India, where the building stock is increasing. These codes are crucial to ensuring that this growth follows a low carbon development pathway and avoids the long-term lock-in of inefficient, high energy-consuming residential buildings. In order to achieve India's Nationally Determined Contributions (NDCs), which aim to reduce the emissions intensity of its Gross Domestic Product (GDP) by 33-35 percent from the 2005 level by 2030, India needs a robust implementation framework that comprehensively addresses its growing resource needs in the building sector.

¹⁰ ibid

¹¹ NITI Aayog. 2020. India 2020 Energy Policy Review. NITI Aayog. Retrieved from: https://niti.gov.in/sites/default/files/2020-01/IEA-India%202020-In-depth-EnergyPolicy_0.pdf

¹² NITI Aayog. (2015). Report on energy efficiency and energy mix in the Indian Energy system (2030) using India Energy Security Scenarios, 2047. Retrieved from: <http://niti.gov.in/content/report-energy-efficiency-and-energy-mix-indian-energy-system-2030-using-india-energy>

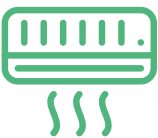
¹³ ibid



India is projected to double its energy demand and have the largest increase in energy consumption worldwide between 2020 and 2040.



95% of housing demand in urban India is in the low-income category.



As of 2018, around 8% of households in India owned air conditioners, and this figure is set to grow to 21% by 2027-28 and 40% by 2037-38.

1.2 Need for a focus on Affordable Housing

According to the IEA, based on the current policies and programmes, India is projected to double its energy demand and have the largest increase in energy consumption worldwide between 2020 and 2040¹⁴. A significant portion of this demand is projected to come from increased appliance ownership and cooling needs¹⁵ arising from the growing per capita income, coupled with aspirations for a better quality of life, enhanced access to housing, and higher expectations regarding the amount of built-up space per capita and the provision of thermal comfort¹⁶.

As per the GoI analysis, nearly 95% of housing demand in urban India is in the low-income category, as opposed to only 5% in the middle-income group (MIG) and higher-income group¹⁷. The disproportionate deficit has concentrated government efforts in affordable housing on enhancing the speed and ease of delivery of dwelling units by keeping them affordable. The focus on increasing the pace of delivery and keeping the cost of the dwelling units within the defined limits supersedes any considerations for energy and material efficiency, quality of life, and thermal comfort for the occupants. As per the India Cooling Action Plan, as of 2018, around 8% of households in India owned air conditioners, and this figure is set to grow to 21% by 2027-28 and 40% by 2037-38¹⁸. A significant portion of this increase is expected to come from households' first purchases of air conditioners.

Despite the projected increase in air conditioner penetration over the next twenty years, a significant portion of households will still not be able to afford air conditioners during this period¹⁹. Hence, thermally comfortable residential building are needed; this is not only essential to achieving reduced active cooling demand, but also to ensuring climate resilience. With their relatively high population density and large paved or built-up surfaces, urban areas are the most vulnerable to climate change, due to enhanced urban heat island effects. However, there is a lack of integration of passive cooling mechanisms and open spaces in current residential building design, which presents a challenge to addressing the increasing need for thermally comfortable houses. Due to the rising temperatures in urban areas, indoor temperatures in improperly designed and ventilated buildings increase disproportionately, impacting occupants' productivity and health. Thus, building climate-resilient and thermally comfortable housing for the Economically Weaker Section (EWS) and Low-Income Group (LIG) households and providing them with affordable and efficient appliances will not only reduce foreseeable energy consumption, but will also contribute positively to enhancing the households' overall quality of life and productivity.

14 IEA. (2020). India 2020 Energy Review Policy. IEA Publications.

15 ibid

16 Khosla, R. & Janda, K.B. (2019). India's Building Stock: towards energy and climate change solutions. Building Research and Information Vol 47.

17 Ministry of Housing and Urban Poverty Alleviation. (2012). Targeted Action Group on Housing.

18 Ministry of Environment, Forest & Climate Change. (2019). India Cooling Action Plan. New Delhi: Ministry of Environment, Forest & Climate Change.

19 ibid

1.3 Overall Project Aim, Objectives, and Phases



Despite the projected increase in air conditioner penetration over the next twenty years, a significant portion of households will still not be able to afford air conditioners during this period.



There is a lack of integration of passive cooling mechanisms and open spaces in current residential building design, which presents a challenge to addressing the increasing need for thermally comfortable houses.

With the overall aim of ‘formulating a policy strategy for decarbonising the building sector’, the project focuses on developing a complementary and simultaneous top-down and bottom-up approach to facilitate the implementation of the residential energy conservation code, Eco-Niwas Samhita (ENS). It builds on the hypothesis that integration of energy conservation code in affordable housing programs like that of PMAY-U, needs a holistic understanding of the sector as a whole, as the affordability of dwelling unit is a function of not the cost of material and construction alone but multiple factors like procurement and tendering for the housing project, location of the house, design specs of the project, the lifecycle cost of the building, etc. Based on the 74th Constitutional Amendment Act of 1992, India follows a three-tier governance structure (central, state, and local) in the building design and construction approval process. It has a designated list of roles and responsibilities for each level of governance. Figure 1 summarises the functions of the central and state governments in the implementation of ENS and how GBPN will help build capacity and strengthen the governance process.

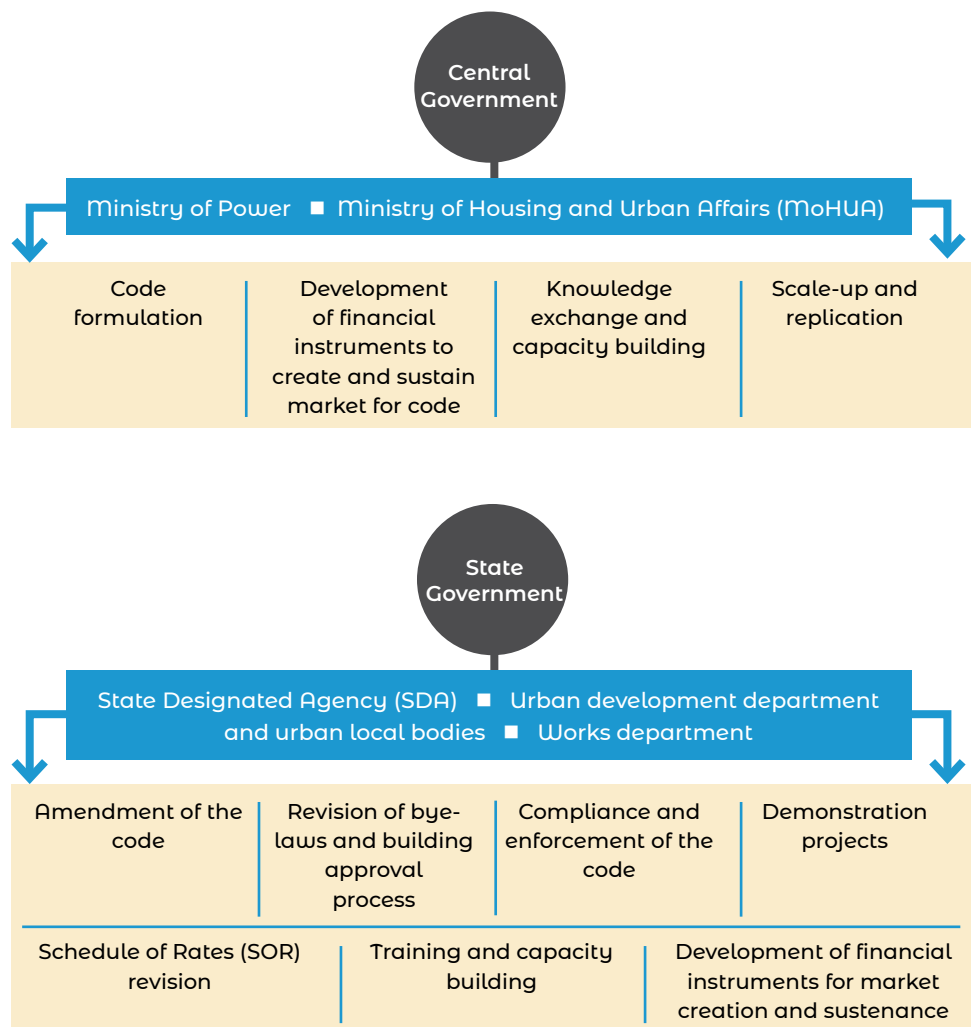


Figure 1: Governance Structure in India & Role of the GBPN Project

The project aims to provide technical support to a selected state government and an Urban Local Body (ULB) to facilitate the adoption of appropriate energy efficiency policies and codes for implementation in affordable housing projects. The implementation will contribute to the achievement of India's NDCs²⁰. The project's ultimate goal is to develop a replicable implementation framework for the affordable housing sector. The project is divided into 2 phases:

PHASE 1: The first phase focused on developing a policy implementation pipeline that guided regional jurisdictions through policy planning, adoption, and implementation up to 2020. The objective of the phase was to align with the Bureau of Energy Efficiency, other GoI ministries (e.g. MoHUA and Ministry of Environment, Forest and Climate Change (MoEFCC)), and a state government, by choosing a ULB in a state working on code adoption in affordable housing projects under the PMAY-U programme at the state level.

PHASE 2: The second phase plans to focus on code implementation through the development of guidelines, including a concrete set of recommendations, for incorporating ENS into the state-level regulations and standards. Technical assistance will be provided in the identified project to enhance thermal comfort and energy efficiency in construction materials, facilitate the implementation of best practice ENS projects in affordable housing units, and codify these practices through guidelines and recommendations. It will also entail the development of a framework for scaling up ENS implementation in affordable housing projects in various cities across different states in India.

²⁰ Climate Action Tracker. (2019, December 2). Country Summary. Retrieved from Climate Action Tracker: <https://climateactiontracker.org/countries/india/>

1.4 Report Objectives, Approach, and Methodology

This report was prepared at the end of Phase 1 of the project. It covers the overall aim and objectives of the project, draws linkages between affordable housing, thermal comfort, and energy efficiency, and lists the shortlisting criteria for the state and ULB selection. It also examines the relevant administrative procedures for the inclusion of ENS in PMAY-U projects in the selected state and city. The report's main hypothesis is that effective integration of energy conservation codes into affordable housing programmes like that of PMAY-U requires comprehensive understanding of the sector as a whole, as the affordability of dwelling units is not only a function of the material and construction cost, but also depends on various factors like procurement and tendering for the housing project, housing location, project design specifications, the lifecycle cost of the building, etc. Hence, along with the ENS compliance process, the report also presents detailed information on the affordable housing sector in India, within the context of the overall Indian housing sector. It highlights the affordable housing delivery mechanisms in different states and discusses the regulatory, urban planning, and financing processes needed to facilitate the delivery of affordable housing. Building on its hypothesis, the report outlines the key factors in affordable housing projects, in order to pave a comprehensive path for Phase 2 of the project and provide practical recommendations on the inclusion of ENS in PMAY-U projects. Figure 2 below shows the overall methodology adopted in Phase 1.



Project Inception



End of Phase 1



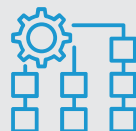
Scenario Mapping

Mapping of PMAY-U's key points and status mission, objectives, and goals



Literature Review

Review of literature on affordable housing, thermal comfort and energy optimisation.



Identification of administrative procedures

Review of city administrative procedures and framework for residential buildings



City Level Administrative Processes

Mapping of building approval processes and bye-laws, along with other affordable housing initiatives



Mapping other initiatives

Mapping of the status of work done in ENS under GIZ and SDC programmes



Mapping of Affordable Housing Policies

Identification of relevant administrative procedures that have to be followed to construct buildings and receive financial assistance under PMAY



Selection of state and city

Formation of criteria and shortlisting of state and city based on the criteria.



State Level Affordable Housing

Mapping of state-level enforcement mechanism for residential development



Project Inception Workshop

Round-table discussion on "A Policy Strategy for Decarbonising the Building Sector" (held in September 2019)



Stakeholder Consultation

Consultation with the ULB and MoHUA for effective ENS implementation

Figure 2: Phase 1 Methodology



2 AFFORDABLE HOUSING SECTOR IN INDIA



Providing housing for nearly 18 million households in the EWS and LIG income groups requires cohesive action, not only in order to pave a low carbon development pathway, thus avoiding the potential long-term negative impacts of high energy-consuming residential buildings, but to also ensure the long term climate-resilient health and productivity of the occupants.





The housing shortage has perhaps been one of the biggest challenges India has continually faced since obtaining independence.

This chapter begins by examining the housing shortage in India and the definition of affordable housing. It then describes the connection between thermal comfort, energy consumption, and affordable housing. It ends by highlighting the objectives and principles of ENS and the parallels between achieving thermal comfort in affordable housing and ENS implementation.

2.1 Housing Shortage in India

In order to develop a long-term and comprehensive strategy to decarbonise the building sector in India, one has to understand the existing and future building stock in the country. Given that, in the near future, the residential sector will be one of the most significant contributors to the overall building stock, and the typology of the future building stock is dependent on the present need, a detailed analysis of the current housing shortage is presented in this section. The housing shortage has perhaps been one of the biggest challenges India has continually faced since obtaining independence. Despite continual efforts and sustained initiatives by the government, affordable housing continues to fall short of the expected need and demand of the growing Indian population. In 2012, the Technical Group on Urban Housing Shortage 2012-17, formulated under the 12th five-year plan, estimated an existing housing shortage of 18.78 million dwelling units²¹ in urban India. Based on the Census and National Sample Survey datasets, the report infers that about 95% of the total housing shortage is in the EWS and LIG segments, as shown in Table 1.

Income Group	Shortage (in millions)	Percentage
EWS	10.55	56.18
LIG	7.41	39.44
MIG	0.82	4.38
Total	18.78	100.00

Table 1: Income Group-wise Housing Shortage

The demand for dwelling units was further analysed in terms of the quality of current housing (see Figure 3). Out of the 18.78 million households in need of proper housing:

- a) 0.99 million households lived in non-serviceable katcha (without permanent roofs) dwelling units;
- b) 2.27 million households lived in functionally obsolete houses beyond repair ;
- c) 14.99 million households lived in congested houses requiring reconstruction, out of which 0.10 million were severely congested. As per the Technical Action Group, congestion was defined as a situation where two or more households were living in ≤ 300 square feet (sq. ft) of built-up area, with one or more married couples not having a separate room; and
- d) 0.53 million households were homeless.

²¹ Ministry of Housing and Urban Poverty Alleviation. (2012). Targeted Action Group on Housing, New Delhi, GoI.



The focus of housing policies is on the delivery of a large number of housing units in a limited timeframe.

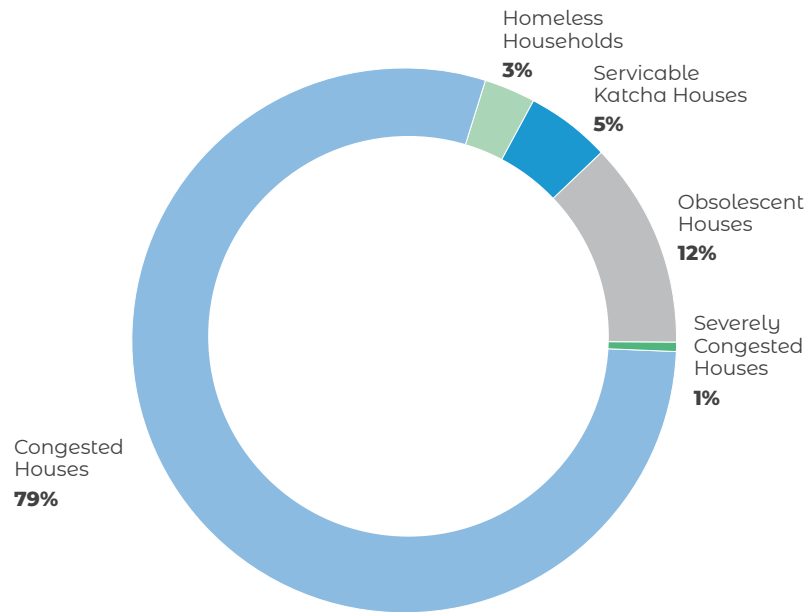


Figure 3: Housing Condition

The housing shortage in India forms the basis of policy reforms and initiatives taken by the Government of India, which are covered in subsequent sections of this report. The housing shortage requires a concerted push on the supply side of the housing market, with a need to provide housing and basic services at a minimal cost. The urgency of the action needed to fix the housing crisis in India has manifested itself at multiple levels driving the affordable housing eco-system, in terms of aspects such as the location of the dwelling units and selection of construction materials and technologies that are low cost and reduce the time required for construction. In trying to quickly fix the crisis, the focus of housing policies is on the delivery of a large number of housing units in a limited timeframe. The delivery is not focusing on the housing quality or evaluation of the energy impact and subsequent carbon emissions of housing construction²². In order to ensure decarbonisation of the affordable housing sector, decisions on construction practices, materials, etc. need to be taken considering the lifecycle energy usage by the building and occupants' thermal comfort.

The housing sector as a whole lies at the intersection of India's NDCs and Sustainable Development Goal targets. Providing housing for nearly 18 million households in the EWS and LIG income groups requires cohesive action, not only in order to pave a low carbon development pathway, thus avoiding the potential long-term negative impacts of high energy-consuming residential buildings, but to also ensure the long term climate-resilient health and productivity of the occupants.



In order to ensure decarbonisation of the affordable housing sector, decisions on construction practices, materials, etc. need to be taken considering the lifecycle energy usage by the building and occupants' thermal comfort.

²² Kumar, S., Singh, M., Chandiwala, S., Sneha, S., & George, G. (2018). Mainstreaming thermal comfort for all and resource efficiency in affordable housing: Status review of PMAY-U mission to understand. New Delhi: Alliance for an Energy Efficient Economy.



2.2 Defining Housing Affordability

Affordability is an expression of the challenge each household faces in balancing the cost of its current or potential housing and its other expenditures, within the limits of the household's income.

What is housing affordability?

According to Michael E Stone, a scholar in housing economics, housing affordability is an expression of the social and material experiences of people, constituted as households, in relation to their individual housing situations²³. Broadly speaking, affordability is an expression of the challenge each household faces in balancing the cost of its current or potential housing and its other expenditures, within the limits of the household's income.

What are the parameters for assessing housing affordability?

Affordability is a relationship between the household and housing. The relationship determines the extent to which a household can afford the housing (in terms of cost) without significantly impacting the non-housing expenditure of the household. For example, for some households, all housing is affordable, no matter how expensive it is, whereas for others, no housing is affordable unless it is free. Affordability can be determined based on various factors, e.g. the quality and size of the dwelling unit, congestion, the household's socio-economic aspirations, and its disposable income.

In India, the prime factors used to determine the affordability of a dwelling unit are the household income level, dwelling unit size, and proportion of overall household expenditure on housing and related expenses²⁴. The Deepak Parekh Committee, set up in 2008 by the erstwhile Ministry of Housing and Urban Poverty Alleviation, defined the size and monetary range of affordability for dwelling units based on income group segments and is described in greater detail in the following section. In 2009, the Wadhwa Committee, constituted by the same ministry, stated that an affordable housing unit for an EWS household should be financeable through Equated Monthly Installments (EMIs) (with the EMIs not exceeding 20% of the gross household monthly income; similarly, the EMIs for LIG and MIG should not exceed 30-40% of the monthly income²⁵). The definition of affordability thus varied for different income groups, as illustrated in Table 2.

Income Group	a) Affordability 1: Income Range (INR)	b) Affordability 2: EMI - Percentage of Monthly Income (%)	c) Affordability 3: Dwelling Unit Size (sq. m.)
EWS	Below 0.3 million	20	30
LIG	0.3-0.6 million	30-40	60
Middle-Income Group-1 (MIG-I)	0.6-0.9 million	30-40	120
Middle-Income Group-2 (MIG-II)	0.9-1.2 million	30-40	150

Table 2: Income Group-wise Affordability Definition

- ²³ Stone, M.E. (2006). What is housing affordability? The case for the residual income approach, *Housing Policy Debate*, 17:1, 151-184, DOI: 10.1080/10511482.2006.9521564.
- ²⁴ Tiwari, P. & Rao, J.. (2016). *Housing Markets and Housing Policies in India*. ADBI Working Paper 565. Tokyo: Asian Development Bank Institute. Retrieved from: <http://www.adb.org/publications/major-challenges-facing-small-and-medium-sized-enterprises-asia-and-solutions/>
- ²⁵ Wadhwa, K. (2009). *Affordable Housing for Urban Poor*. New Delhi: National Resource Centre, School of Planning and Architecture, New Delhi. Retrieved from: <http://www.spa.ac.in/NRC/ThemePaperAffordableHousing.pdf>

What constitutes housing expenditure?

Adequate shelter was defined as something “more than just a roof over one’s head; it meant access to adequate privacy, space, security, physical accessibility, adequate lighting, heating and ventilation, adequate basic infrastructure- all of which were to be made available at an affordable cost.

The Deepak Parekh Committee set up in 2008 not only defined affordability in terms of dwelling unit size and cost, but also specified standards for a decent house. Adequate shelter was defined as something “more than just a roof over one’s head; it meant access to adequate privacy, space, security, physical accessibility, adequate lighting, heating and ventilation, adequate basic infrastructure- all of which were to be made available at an affordable cost”.²⁶ Therefore, housing expenditure can be broadly divided into two components: a) initial cost: the cost of accessing the dwelling unit; and b) recurring cost: the lifecycle cost of operating and maintaining the dwelling unit. Based on this, affordability over the lifecycle of the dwelling unit becomes a function of both the initial and recurring costs, as shown in Figure 4.



Any solution to address the housing deficit in India has to include a multidimensional approach that offers variation in the dwelling unit size, structural quality, infrastructure services, quality of post-occupancy services, and tenure types to meet the needs of various socio-economic groups, while simultaneously maintaining the housing affordability.

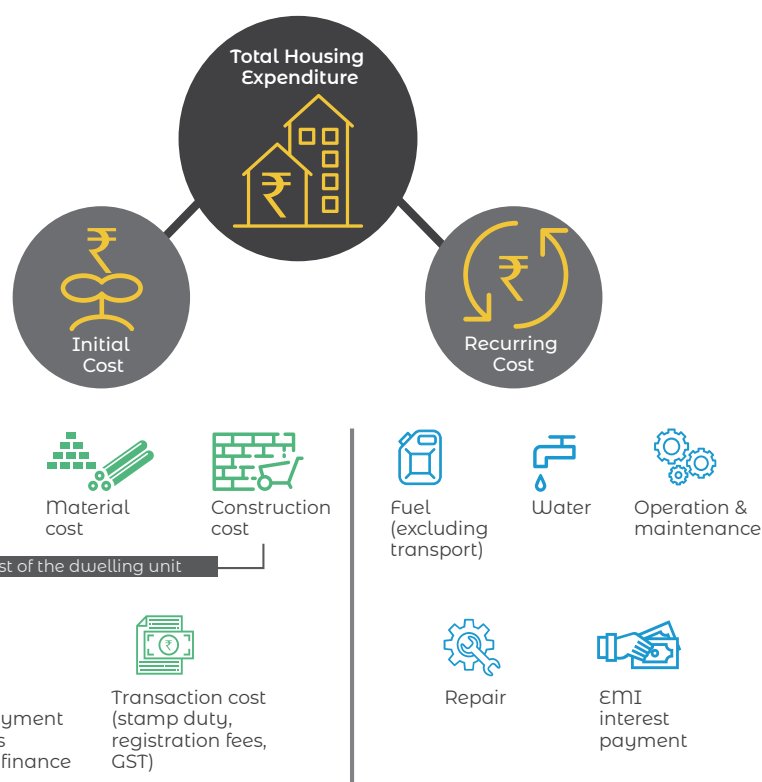


Figure 4: Housing Cost Components

However, the overall definition of affordability recognised by multiple GoI missions and departments does not include any reference to the quality of housing, which hinders provision of basic quality of life to the occupants. This is leading to many policies and construction practices that could cause significant long-term damage by exposing occupants to higher levels of thermal discomfort through non standardised construction of housing units as stranded assets in a world facing increasing temperatures due to global warming. A more holistic definition of affordability is required in order to ensure high-quality, comfortable housing units with reasonable energy consumption. Any solution to address the housing deficit in India has to include a multidimensional approach that offers variation in the dwelling unit size, structural quality, infrastructure services, quality of post-occupancy services, and tenure types to meet the needs of various socio-economic groups, while simultaneously maintaining the housing affordability. The following section explores electricity consumption and thermal comfort in relation to affordable housing.

²⁶ High Level Task force. (2008). Affordable Housing for All. Delhi: Ministry of Housing and Urban Poverty Alleviation.

2.3 Electricity Consumption, Thermal Comfort, and Affordable Housing

One of the significant components of recurring cost outlined in the previous section is household expenditure on fuel. As per the National Sample Survey 68th Round household survey, electricity accounts for 50% of an urban household's fuel consumption, on average²⁷.

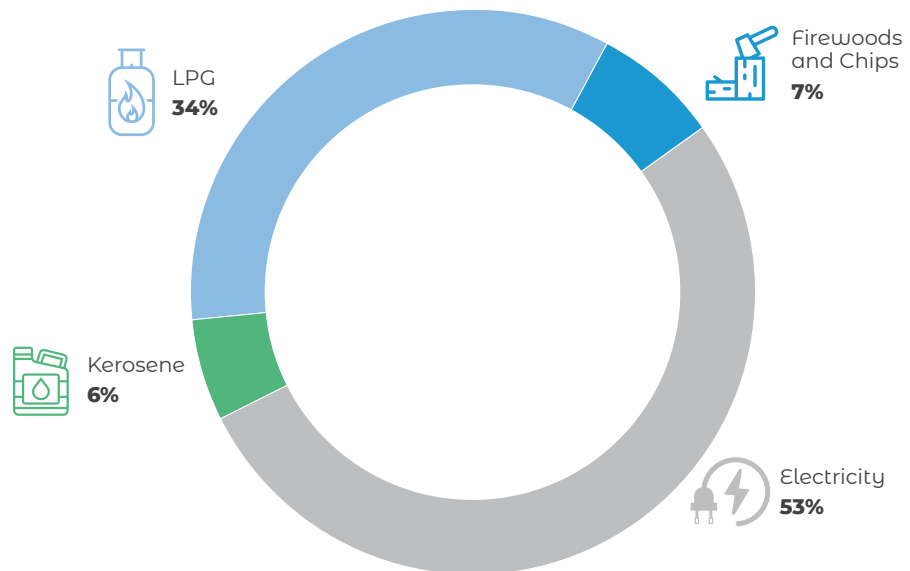


Figure 5: Fuel Consumption in Urban Areas

Box 2.1 Lack of Data on Residential Energy Consumption in India

Any attempt to conduct substantive research on energy optimisation or code implementation in the residential sector in India is constrained from the start by the acute shortage of reliable and high-quality data and information on the sector. The primary challenge in this study was collecting credible data in order to understand the demand-side trends and patterns of electricity consumption. India does not undertake periodic Residential Energy Consumption surveys, and, hence, there are no comprehensive datasets available at the national level that can be analysed to identify residential electricity consumption patterns and trends.

Overall appliance ownership and fuel consumption data is captured by various government bodies, research institutions, and civil society organisations. None of these surveys (including the Census and the periodic household consumption surveys undertaken by the National Sample Survey Office (NSSO)) collect data on appliance usage and efficiency. In an attempt to add to the limited knowledge base on India's residential energy consumption, civil society organisations like Council on Energy, Environment and Water (CEEW), Prayas (Energy Group), Centre for Policy Research (CPR), and Collaborative Labelling and Appliance Standards Programme (CLASP) have periodically undertaken residential energy surveys. These surveys, however, remain limited in terms of locations covered, number of households surveyed, and sample selection based on representative demographics. Thus, in order to fill the gaps and create datasets that are representative of the entire country, there is an urgent need for a coordinated effort between the government, academia, and civil society organisations to undertake a nationwide residential energy consumption survey.

²⁷ NSS. (2014). Household Consumption of Various Goods and Services in India 2011-2012. Delhi: National Sample Survey Office.



The India Cooling Action Plan estimates that, as of 2017-18, 10% of the population consumes 60% of the energy for space cooling.



The rising temperatures not only necessitate thermally comfortable indoor spaces, but also result in negative public health impacts, reduced workforce productivity, and poor air quality.



Decisions taken today on affordable housing will have a long-lasting impact on housing aspects like thermal comfort, energy consumption and costs, and carbon emissions.

The India Cooling Action Plan estimates that, as of 2017-18, 10% of the population consumes 60% of the energy for space cooling. Due to the mounting inequalities in Indian cities, the usage of active space cooling appliances is not evenly distributed. Despite having a relatively low penetration rate of room air conditioners of less than 10%, cities like Mumbai and Delhi use more than half of their electricity to run air conditioners in the summer months²⁸. Lack of access to thermally comfortable spaces makes the urban poor disproportionately vulnerable to the rising urban temperatures and heat waves. The rising temperatures not only necessitate thermally comfortable indoor spaces, but also result in negative public health impacts, reduced workforce productivity, and poor air quality²⁹. It further highlights that the affordable housing segment is not energy intensive as of now but with growing socio-economic aspirations and in the absence of thermally comfortable spaces, the affordable housing segment will start installing high energy-consuming appliances to achieve the desired level of thermal comfort. It builds on the narrative that the overall thermal discomfort, leads to decline in productivity and has negative impacts on public health.

According to the World Health Organisation, “adequate housing” or “sustainable housing” in the modern era is far from being “healthy” and tends to be informed by technological, rather than health, rationales³⁰. Internationally, building codes and housing regulations provide either too little or very vague information on the minimum standards that must be met to characterise housing from a health perspective. It is well-known that indoor thermal comfort is important for the occupants’ physiological and psychological well-being³¹. It is thus critical to explore, implement, and mainstream passive cooling strategies to make space cooling both sustainable and affordable in the upcoming housing stock.

Housing that is built as part of an affordable housing initiative has an estimated lifetime of 40-60 years, so decisions taken today on affordable housing will have a long-lasting impact on housing aspects like thermal comfort, energy consumption and costs, and carbon emissions. Apart from the use of energy-efficient appliances, building design, materials, and construction all have an impact on how much energy is needed to reach the desired comfort levels in the buildings. Large-scale construction of affordable housing provides an opportunity to evaluate, demonstrate, and build housing that also focuses on providing thermal comfort, thus minimising future energy and resource use, in line with India’s NDCs.

28 Abhyankar, N., Shah, N., Phadke, A., & Park, W.Y. (2017). Technical and Economic Aspects of Designing an Efficient Room Air-Conditioner Program in India. United States. doi:10.2172/1430684.
29 Aggarwal, M., & Ghosh, S. (2019, June 19). India: Poor urban neighbourhoods more vulnerable to extended effects of heat. Retrieved from Prevention Web: <https://www.preventionweb.net/news/view/66071>
30 Sustainable and Smart Space Cooling Coalition. (2017). Thermal Comfort for All- Sustainable and Smart Space Cooling. Alliance for an Energy Efficient Economy, New Delhi.
31 ibid

2.4 Eco-Niwas Samhita and Affordable Housing

Recognising the need to achieve indoor thermal comfort and thus reduce energy consumption in residential buildings, the Eco-Niwas Samhita (ENS) was launched in December 2018 by the Minister of Power to set minimum building envelope performance standards for specific geographies to limit heat gains in hot climates and heat losses in cold climates. It is estimated that if a building is designed in compliance with ENS, then the occupants can reduce their electricity bills by up to 20 percent³². ENS focuses on improving the thermal performance of the building envelope comprising walls, roofs, and windows. This enhances the thermal comfort and increases the number of hours the building is comfortable without the use of air conditioning. The code is therefore very important for the affordable housing sector in providing guidance on how to achieve thermal comfort without the use of active cooling/heating techniques.



ENS focuses on improving the thermal performance of the building envelope comprising walls, roofs, and windows.

So far, Part-I of the Code has been launched and prescribes minimum standards for building envelope designs for energy-efficient residential buildings³³. The Code is expected to assist architects and builders involved in the design and construction of new residential complexes in the following ways:

1. The code sets minimum building envelope performance standards to limit heat gains and losses and defines the following:
 - **Building Envelope** (except the roof)
 - a. The maximum residential envelope transmittance value (RETV) for the building envelope (except the roof) applicable to four climate zones, namely, composite, hot-dry, warm-humid, and temperate
 - b. The maximum value of thermal transmittance (U) of the building envelope (except the roof) for the Cold Climate zone (U envelope, cold).
 - **Roof:** Maximum value of thermal transmittance of the roof (U roof) for all climate zones.
2. The code sets the minimum building envelope performance standard for adequate natural ventilation potential by specifying the minimum openable Window-to-Floor Area Ratio (WFR_{op}) and the building envelope performance standard for adequate daylight potential by specifying minimum visible light transmittance (VLT) for the non-opaque building envelope components.

The code applies to (a) “Residential Buildings” built on a plot area ≥ 500 sq. m. and (b) Residential part of “Mixed land-use building projects”, built on a plot area of ≥ 500 sq. m. However, states and municipal bodies may reduce the plot area based on the prevalent plot sizes in their area of jurisdiction. This provision allows them to consider the locally prevalent plot sizes and housing typologies, enabling the inclusion of a greater percentage of new multi-dwelling unit residential buildings under the code. In Part-II of ENS, new components will be added to address other aspects, such as Energy Efficiency in Electro-Mechanical Equipment for Building Operation, Renewable Energy Generation, Embodied Energy of Walling Materials, and Structural Systems³⁴.

32 Greentech Knowledge Solutions (P) Ltd. (2020, April 15). Eco-Niwas Samhita: The quintessential code for the Indian Residential Building Sector. Retrieved from BEEP: <https://www.beepindia.org/eco-niwas-samhita-the-quintessential-code-for-the-indian-residential-building-sector/>

33 Bureau of Energy Efficiency. (2018). Eco-Niwas Samhita: (Energy Conservation Building Code for Residential Buildings). New Delhi: Bureau of Energy Efficiency.

34 Bureau of Energy Efficiency. (2018). Eco-Niwas Samhita: (Energy Conservation Building Code for Residential Buildings). New Delhi: Bureau of Energy Efficiency.





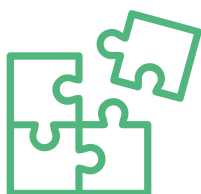
3

PROVISION OF
AFFORDABLE &
HOUSING IN
INDIA

Different housing initiatives have focused on slum upgradation, redevelopment, and environmental improvement, land reservation for LIGs in new projects, sites and services schemes, provision of night shelters for the homeless, and targeted EWS/ LIG housing programmes.



This chapter begins by giving a brief background of affordable housing policies in India. It outlines the evolution of housing policies, their objectives, and gaps in their success and implementation. It further describes the measures taken by the Government of India to increase the pace of delivery of affordable housing in India and their impact on the current housing policy. The final section provides an overview of the GoI's current affordable housing policy (PMAY-U), including its implementation mechanisms, administrative structure, and verticals.



Different housing initiatives have focused on slum upgradation, redevelopment, and environmental improvement, land reservation for LIGs in new projects, sites and services schemes, provision of night shelters for the homeless, and targeted EWS/ LIG housing programmes.



The affordable housing policies and programmes were never viewed through the lens of building climate sensitive and resilient infrastructure or ensuring occupant comfort.

3.1 Affordable Housing in India: Background

Lack of affordable housing has been one of the biggest developmental challenges for India since it obtained independence. As a response, GoI has adopted an array of policies and programmes to solve the housing crisis in the country. Different housing initiatives have focused on slum upgradation, redevelopment, and environmental improvement, land reservation for LIGs in new projects, sites and services schemes, provision of night shelters for the homeless, and targeted EWS/ LIG housing programmes. In parallel to the central government's actions, the state governments have developed their own programmes and policies, which are largely based on the same principles. To facilitate operations and implementation and assist in the financing, various institutions were set up, including state-level Housing Boards, city-level ULBs, the national Housing and Urban Development Corporation (HUDCO), and financing institutions like the National Housing Bank (NHB) and Housing Development Finance Corporation (HDFC)³⁵.

To address the looming housing crisis and widening urban housing deficit driven by the natural growth of cities and rural-urban migration, GoI changed its role from direct housing provider to enabler of the housing delivery eco-system in the 1990s³⁶. The new approach aims to expand the coverage of relevant policies and overcome the housing deficit at all income levels, e.g. by introducing fiscal initiatives and housing sector reforms for the middle- and upper-income groups, who are more likely to access housing through market mechanisms. At the same time, social housing schemes were devised for the EWS, LIG, & MIG segments, with the provision of cash transfer to encourage self-construction, subsidies, and ready-to-move in houses. Launched in 2005, Jawaharlal Nehru National Urban Renewal Mission (JNNURM) aimed to improve housing access along similar lines. Most of the programmes and policies were short-lived and experienced a shortage of fund allocation when the government changed. The local governments, at the ULB level, also lacked the requisite skills and capacities to sustain the implementation³⁷.

The affordable housing policies and programmes were never viewed through the lens of building climate sensitive and resilient infrastructure or ensuring occupant comfort. They had the sole objective of tackling India's huge developmental challenge by reducing the housing deficit as quickly as possible. In parallel to the economic shift in India from building a manufacturing economy to a service sector-based one, the housing policies and programmes also saw a change in the role of the government

³⁵ Tiwari, P. & Rao, J. (2016). Housing Markets and Housing Policies in India. ADBI Working Paper 565. Tokyo: Asian Development Bank Institute. Retrieved from: <http://www.adb.org/publications/major-challenges-facing-small-and-medium-sized-enterprises-asia-and-solutions/>

³⁶ ibid

³⁷ Hingorani Pritika. (2013). Revisiting Low Income Housing: A Review of Policies and Perspectives, Indian Institute for Human Settlements.



PMAY-U, Smart Cities Mission and AMRUT work in complementary manner to enhance the liveability and quality of life in Indian cities.

in the provision of affordable housing, from being a direct provider to a facilitator. In addition to the government’s focus on cheap, quick solutions, another challenge is that the segment targeted by affordable housing policies normally meets its housing needs through self-built incremental housing, which mostly lie outside of the organized formal sector. The lack of existing formal sector engagement poses serious challenges to benchmarking construction practices and standards, thus limiting the adoption of energy efficiency and thermal comfort measures.

3.2 Regulatory Reforms in the Affordable Housing Sector

To reform the housing ecosystem through various initiatives focusing on regulatory measures, capacity building, fund disbursement, and quick delivery of housing, Pradhan Mantri Awas Yojana (PMAY) was launched in June 2015. The Mission was launched by the Ministry of Housing and Urban Affairs (MoHUA) with an ambitious mandate of building 12 million dwelling units by 2022³⁸. The different departments and programmes under MoHUA are depicted in the schematic in Figure 6.

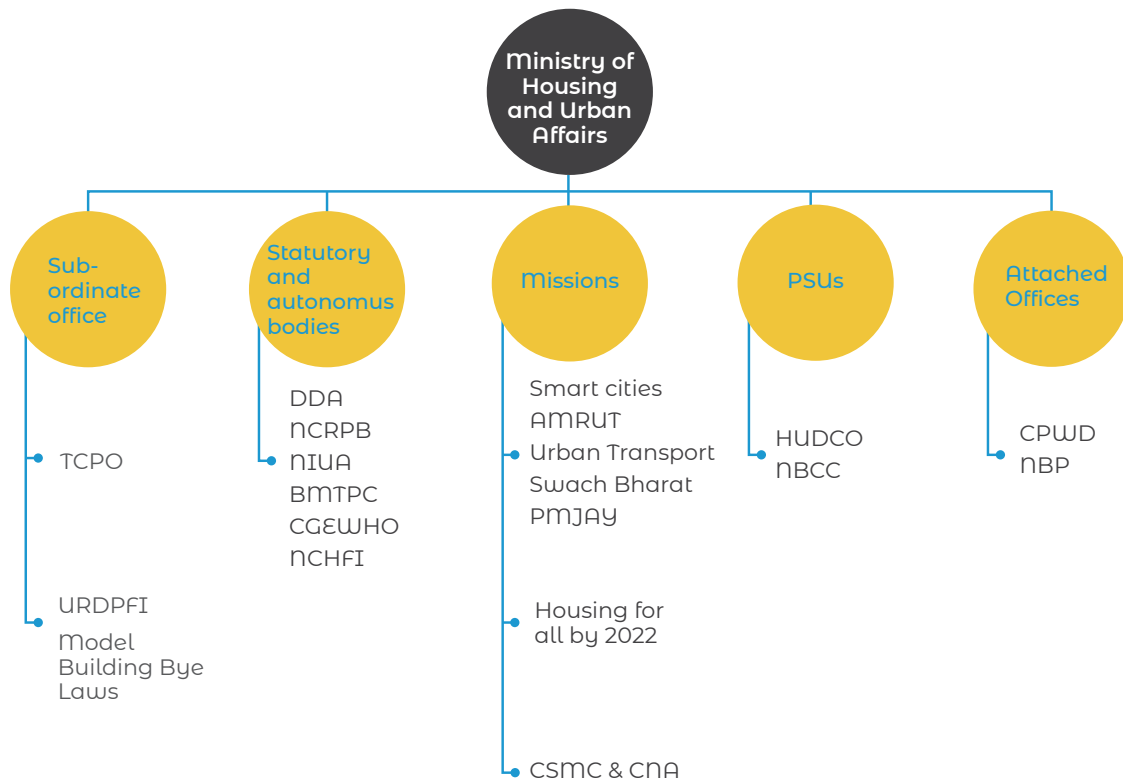


Figure 6: MoHUA Departments & Programmes

Source: MoHUA, 2020

The mission was launched with two complementary policies: 1) Smart City Mission, to make the short-listed cities citizen friendly and sustainable through an area-based development approach; and 2) Atal Mission for Rejuvenation and Urban Transformation (AMRUT), to provide for infrastructure services like water and sewerage to the urban population. The three missions work in coordination and have the overall aim of using the Public-Private Partnership (PPP) model to enhance the liveability and

³⁸ Ministry of Housing and Urban Affairs. (2019). PMAY-U Mission Guidelines, Delhi, Government of India.



The reforms highlight the priority GoI is putting on overcoming India's housing deficit of India, through fast-paced implementation of affordable housing policies and programmes and considerable tax concessions in the affordable housing sector.



The construction practices largely depend on the availability of skilled labour, cost of construction material in the city, and availability of construction techniques, with the quickest, lowest cost options favoured.

quality of life in Indian cities. Various supply-side reforms at the macro and micro level have been the driving force behind the fast-paced delivery of PMAY-U:

REAL ESTATE (REGULATION AND DEVELOPMENT) ACT, 2016 (RERA): GoI incorporated the RERA Act in 2017 to regulate and promote the development of the real estate sector in the country. Through RERA, the government aims to strengthen the faith of buyers in the real estate sector and bring about a transparency regime in the transactions. It has introduced a grievance redressal system to protect the rights of buyers, through the establishment of a Regulatory Authority³⁹.

INFRASTRUCTURE STATUS GIVEN TO AFFORDABLE HOUSING: The 2017-18 union budget was announced with the Transform, Energise and Clean India theme, geared towards infrastructure growth and poverty alleviation⁴⁰. The budget provided affordable housing with infrastructure status. This enables affordable housing projects to avail of the associated benefits, such as lower borrowing rates, tax concessions, and increased flow of foreign and private capital⁴¹.

NATIONAL URBAN HOUSING FUND (NUHF): In 2018, the Union Cabinet approved the creation of NUHF for Rs. 60,000 crores. The corpus will facilitate fundraising until 2022 to ensure that the flow of central assistance under the different verticals of PMAY-U is maintained⁴².

REDUCTION OF GOODS AND SERVICES TAX (GST): In an attempt to give a major boost to the affordable housing sector, the Government of India cut the GST rates for under-construction housing projects from 12% to 5% and from 8% to 1% for affordable housing projects⁴³.

EASE OF DOING BUSINESS: In 2019, India climbed from the 142nd to 63rd position in the Ease of Doing Business Index issued by the World Bank. In the ease of obtaining permits for construction, it jumped from 52nd to 27th place. The rankings improved because of the single window clearance and e-governance initiatives introduced by the Government of India⁴⁴.

The reforms highlight the priority GoI is putting on overcoming India's housing deficit of India, through fast-paced implementation of affordable housing policies and programmes and considerable tax concessions in the affordable housing sector. The overall focus of the reforms has been on reducing the bureaucratic processes involved in obtaining construction permits and increasing the investment in the affordable housing sector through enhanced government and private sector contributions.

However, the lack of standardisation of construction practices and technologies has left room for large variations in the technologies and practices used by developers. The construction practices largely depend on the availability of skilled labour, cost of construction material in the city, and availability of construction techniques, with the quickest, lowest cost options favoured. Aggregating housing demand in affordable housing projects to ensure profitability for the developer without enforcing standards thus prevents the mainstreaming of thermal comfort and energy optimisation through appropriate design and construction practices in compliance with ENS.

39 GoI. (2016, March 26). The Real Estate (Regulation and Development) Act, 2016. New Delhi, India: The Gazette of India.

40 Ministry of Finance, Government of India. (2017). Key Features of Budget 2017-18. Retrieved from: <https://www.indiabudget.gov.in/budget2017-2018/ub2017-18/bh/bh1.pdf>

41 FICCI. (n.d.). (2018). Union Budget Analysis 2017-2018. Delhi: FICCI.

42 Ministry of Housing and Urban Affairs. (2018). PMAY-U Mission Guideline.

43 Department of Revenue, GoI. Retrieved from: www.pib.gov.in/PressReleasePage.aspx?PRID=1555274

44 The World Bank. (2019). Doing Business 2019. Washington DC: International Bank for Reconstruction and Development.



The minimum size of the dwelling unit should conform to the standards provided in the National Building Code (NBC).



The Mission was able to sanction 10 million houses up to December 2019.

3.3 Pradhan Mantri Awas Yojana- Urban

PMAY-U aims to support the construction of dwelling units with up to 30 sq. m. of carpet area with basic services, including toilet facilities, water, sewerage, roads, and electricity connections. States and Union Territories (UTs) have the flexibility to determine the size of the dwelling unit and other facilities in consultation with MoHUA. However, the disbursement of funds from the central government remains the same. The minimum size of the dwelling unit should conform to the standards provided in the National Building Code (NBC). The dwelling units built under the mission should meet the requirements of structural safety against disasters, conforming to NBC and other Bureau of Indian Standards (BIS) codes. The houses constructed/ acquired with central assistance under PMAY-U should be in the name of the female head of the household or in the joint name of the male head of the household and his wife⁴⁵.

All 4,041 statutory towns recognised in Census 2011 are covered under PMAY-U, with a focus on all 200 Class I cities, to be covered in three phases:

- Phase I (April 2015- March 2017): 100 cities selected from states/ UTs as per their willingness
- Phase II (April 2017- March 2019): 200 additional cities
- Phase III (April 2019- March 2022): all remaining cities.

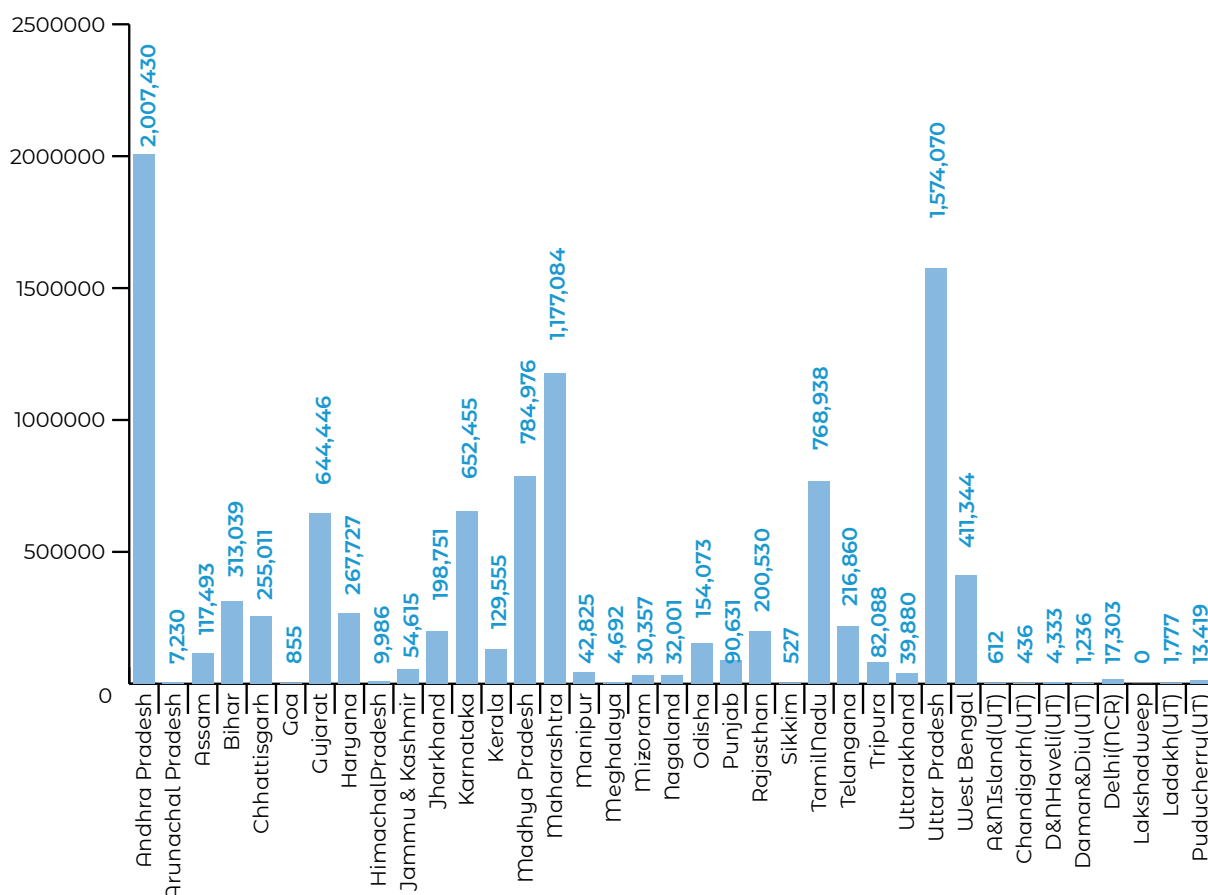


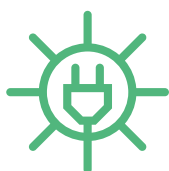
Figure 7: PMAY-U Sanctioning Status (January 2020)

Source: MoHUA, 2020

⁴⁵ Ministry of Housing and Urban Affairs. (2018). PMAY-U Mission Guidelines, Delhi, Government of India.



The role of the third tier of governance, i.e. the ULB, in the PMAY-U implementation process provides sufficient scope for context-specific local initiatives that respond to the local housing demands at the city level.



The ULBs can promote research and development for contextualised strategies to achieve a balance between energy supply and demand as per the city's response.

Thanks to the regulatory reforms at the central level and mandatory reforms at the ULB level (described below), the Mission was able to sanction 10 million houses up to December 2019. The distribution of delivery across states is shown above in Figure 7; Andhra Pradesh and Uttar Pradesh have the highest number of sanctioned dwelling units. Each city where PMAY-U is being implemented needs to undertake various mandatory reforms in its policy and planning procedure to increase the pace of implementation and streamline the land allocation process. The following mandatory reforms⁴⁶ have to be undertaken at the ULB level for PMAY-U implementation:

- Removal of non-agriculture land permission from the residential zone in the city's master plan
- Earmarking land for affordable housing in the master plan
- Implementation of single window and time bound building construction approval system
- Adoption of pre-approved building design system
- Amendment of existing rental laws as per Model Rental Act
- Provision of additional Floor Area Ratio (FAR)/Transferrable Development Rights (TDR) to the developer for provision of low-cost housing.

The role of the third tier of governance, i.e. the ULB, in the PMAY-U implementation process provides sufficient scope for context-specific local initiatives that respond to the local housing demands at the city level. There is room for the ULBs to adopt their own strategies and formulate processes to ensure energy optimisation and thermal comfort in PMAY-U projects. The ULBs can promote research and development for contextualised strategies to achieve a balance between energy supply and demand as per the city's response. Simultaneously, aligning with the local market, climate, and available skillsets of the workforce, the ULB can develop its own residential energy optimisation and thermal comfort strategies that overlap with the overall housing policies and programmes.

⁴⁶ Ministry of Housing and Urban Affairs. (2018). PMAY-U Mission Guidelines, Delhi, Government of India.

3.4 PMAY-U Implementation Mechanism

PMAY-U Verticals

PMAY-U is being implemented through the following four verticals: beneficiary led construction/ enhancement, affordable housing in partnership, in-situ slum rehabilitation using land as a resource, and credit-linked subsidy scheme. The first three are centrally sponsored schemes wherein the assistance is given to the state governments and then subsequently to the ULBs and beneficiaries, whereas the credit-linked subsidy scheme is a central sector scheme, providing a direct subsidy to the beneficiaries at the time of the sanctioning and disbursement of the housing loan⁴⁷.

Overall, the Mission provides three distinct housing delivery mechanisms. In the In-Situ Slum Slum Redevelopment (ISSR) and Affordable Housing in Partnership (AHP) components, the dwelling unit design and construction are governed by a developer or government body, whereas the type of dwelling unit and construction under Beneficiary Led Construction (BLC) is solely dependent on the beneficiary, as the dwelling units are self-built incremental housing units. The Credit-Linked Subsidy Scheme (CLSS) is driven by the city's local market, and a beneficiary can opt for either developer-built housing or self-built incremental housing, but in this vertical, the financing agency can regulate construction. The three different approaches to affordable housing delivery require a combination of effective regulatory and financial mechanisms to ensure ENS compliance in the dwelling units constructed under PMAY-U. In terms of area, while BLC entails self-built incremental housing, the built-up area of the dwelling unit cannot exceed 30 sq. m. A beneficiary obtaining a subsidy under CLSS can either opt for a self-built, incremental housing unit or can purchase a dwelling unit within the prescribed area limit corresponding to the household income group (specified in Table 2). In contrast, AHP and ISSR are perceived as group housing projects, where land is used as a resource to deliver affordable housing to large numbers of households. The breakup of housing units sanctioned, grounded, and constructed under the different verticals is depicted below in Figure 8.



Figure 8: Vertical-Wise PMAY-U Implementation Status (March 2020)

Source: MoHUA, 2020

⁴⁷ Ministry of Housing and Urban Affairs. (2015). PMAY-U Guidelines, Delhi, Government of India.

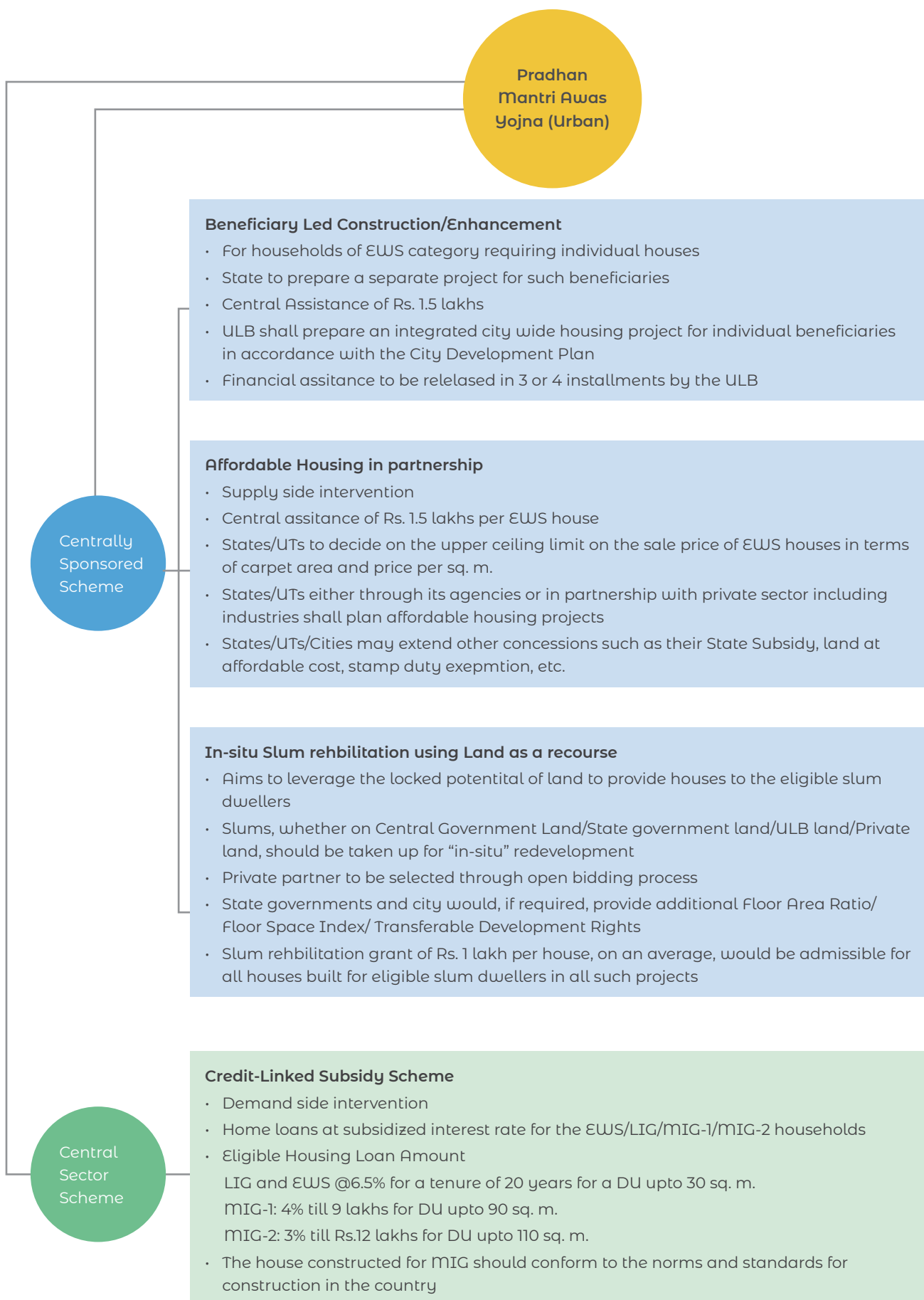


Figure 9: PMAY-U Implementation Verticals

Source: MoHUA, 2016

Box 3.1 Self-Built Incremental Housing

While ENS implementation in self-built incremental housing is beyond the scope of this study, it is important to highlight the fact that a large part of the housing requirement in India is met through self-built incremental housing, which is initiated by the households themselves. Self-building largely remains dependent on the household's capacity and capability. Under PMAY-U, the BLC vertical offers direct cash transfers to the beneficiaries who have land deeds to undertake self-building. BLC accounts for more than 60% of the dwelling units constructed under PMAY-U.

Most of the construction initiated by LIG households falls under the informal housing sector, in which housing is constructed without legal land deeds and construction permits. As per Census 2011, over 65 million people in India live in slums, amounting to almost 17.4% of the total urban population. Through BLC, PMAY-U targets these households (if the slum is not being covered by any other vertical of the Mission). However, the initiative remains limited to providing financial assistance to the household; there are no established mechanisms or practices to regulate or monitor the quality of construction undertaken once the funds are released. Since the main motive in this case is to keep the cost of construction low, it is likely that poorly designed, energy intensive ghettos with poor quality of life will be developed, neglecting thermal comfort in the name of affordable housing.

To enhance the liveability of housing and meet PMAY-U's objectives, there is a dire need for provision of technical assistance in the construction of self-built incremental housing, along with the other verticals, in order to ensure energy optimisation and thermal comfort. To enhance awareness amongst the beneficiaries, along with the availability of energy efficient materials and construction practices, strategies need to be developed according to the local market conditions. The possibility of working on the procurement chain to reduce the cost of materials by leveraging economies of scale could also be explored.

PMAY-U Implementation Mechanism

Since housing and urban development fall within the purview of states as per the Indian Constitution, PMAY-U is implemented in states/ UTs. These states/UTs sign a Memorandum of Agreement (MoA) to participate in the mission, agreeing to the mandatory conditions and other modalities. However, beneficiaries applying for the CLSS subsidy from the statutory towns can directly avail of the subsidy if they fulfil the prerequisites specified under the Mission. A beneficiary can only avail of the benefits available under one of the four verticals. For the Centrally Sponsored Schemes, the state/ city conducts a demand survey to assess the actual demand for housing. On the basis of the demand survey and other available data, the city prepares the Housing for All Plan of Action (HFAPoA). HFAPoA specifies the housing demand of eligible beneficiaries in the city, along with the interventions selected out of the four verticals.

On the basis of HFAPoA, states/ cities prepare the Annual Implementation Plan (AIP), dividing the tasks up to 2022 according to the availability of resources and priority. For larger cities, the HFAPoA and AIPs can be prepared at the sub-city level with approval from the concerned state/ UT government. Houses constructed under previous missions/ programmes/ policies should also be considered when preparing the HFAPoA. The HFAPoA should be reviewed on a yearly basis to make changes based on the implementation of the Annual Implementation Plan (AIP) in the preceding years. The prepared HFAPoA and AIPs are then submitted to the State Level Sanctioning and Monitoring Committee (SLSMC) for assessment of the overall plan and required central assistance. The Detailed Project Reports (DPRs) prepared on the basis of AIPs and HFAPoAs are reviewed and approved by SLSMC. SLSMC is in charge of the overall implementation of the Mission, and its functions are mentioned in the Housing for All scheme guidelines. Apart from SLSMC, the state/ UT must identify a State Level Nodal

Agency (SLNA) and set up a State Level Mission Directorate for coordination of the scheme and reform-related activities. The state may nominate a separate SLNA under the CLSS component. The projects approved by SLSMC and SLNA are then sent to the Central Sanctioning and Monitoring Committee (CSMC) and Central Nodal Agency (CNA) for approval and disbursement of funds. Figure 10 below depicts the PMAY-U implementation mechanism.

CSMC and CNAs have been formed at the national level to facilitate implementation. CSMC is an important decision-making body that reviews the overall mission and monitors the progress at regular intervals. CNAs (HUDCO and NHB) are formed under the CLSS component to channelise the subsidy to lending institutions and monitor the progress of this component. For CLSS, a beneficiary approached the Primary Lending Institute (PLI) directly, once the application is approved at the level of PLI, it is then forwarded to CNAs for disbursement of subsidy. The mechanism described above operates in coordination with the implementation procedures outlined by the respective state governments. The successful implementation of PMAY-U is highly dependent on the reforms and regulations put in place at the state and city level.

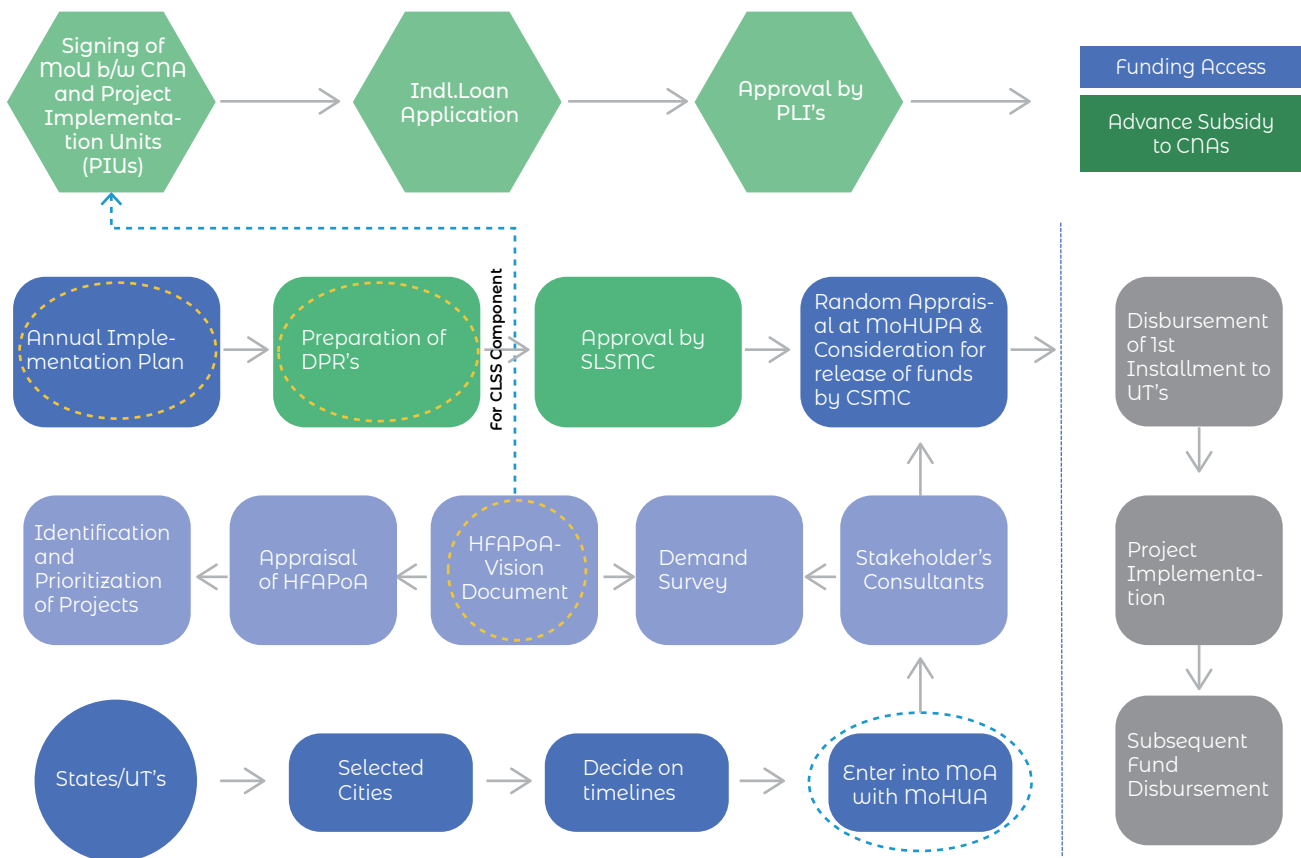


Figure 10: PMAY-U Implementation Mechanism

Source: MoHUA, 2015





4

CRITERIA FOR STATE SELECTION

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The overall methodology adopted by the team to identify a potential state for the pilot project for this study is depicted in Figure 11.

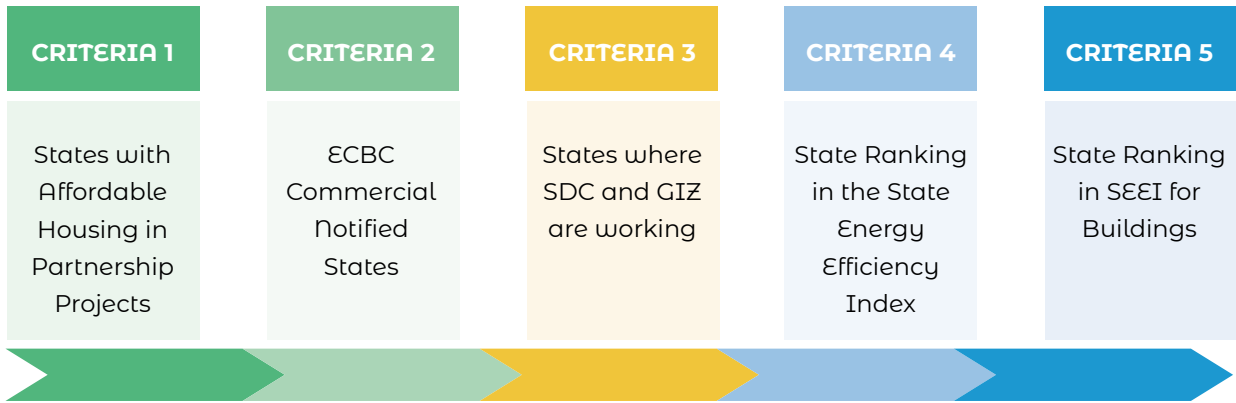


Figure 11: Criteria for State Selection

CRITERIA 1: States with Affordable Housing in Partnership Projects: As per the ENS guidelines, the code can only be implemented in residential projects with more than 500 sq. m. of plot area, due to which only two out of the four PMAY-U verticals, i.e. the ones focused on group housing projects, are under consideration: ISSR and AHP. Based on the mission implementation status displayed in the MoHUA mission dashboard, the states with operational AHP and ISSR projects were shortlisted.

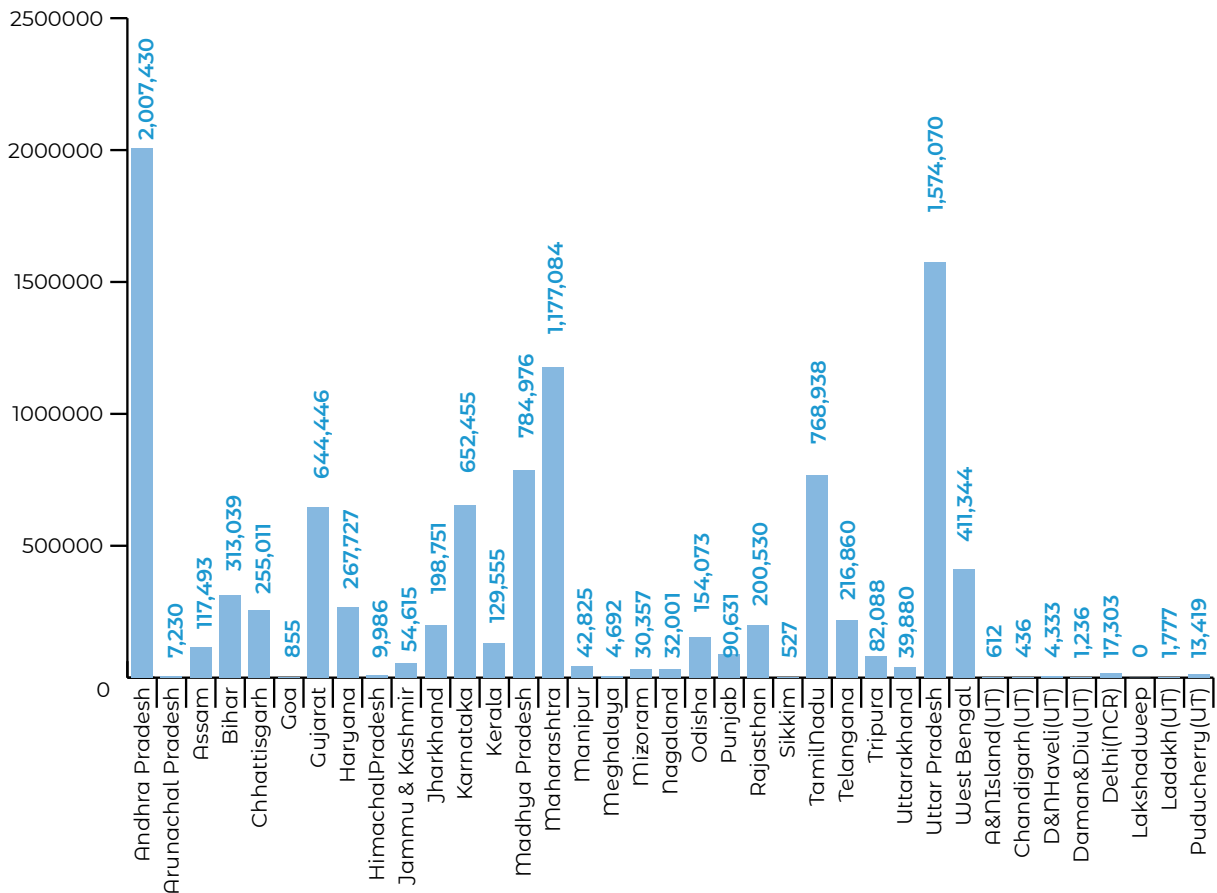


Figure 12: AHP Sanctioning Status (January 2020)

Source: MoHUA, 2020

The graph in Figure 12 shows the AHP sanctioning status in different states as of January 2020. The sanctioning status indicates the release of funds from the central government (MoHUA) for housing construction under the specified vertical. According to the available datasets, Andhra Pradesh, Maharashtra, Tamil Nadu, Karnataka, Gujarat, and Madhya Pradesh are the highest recipients of funds from the MoHUA for AHP housing construction⁴⁸.

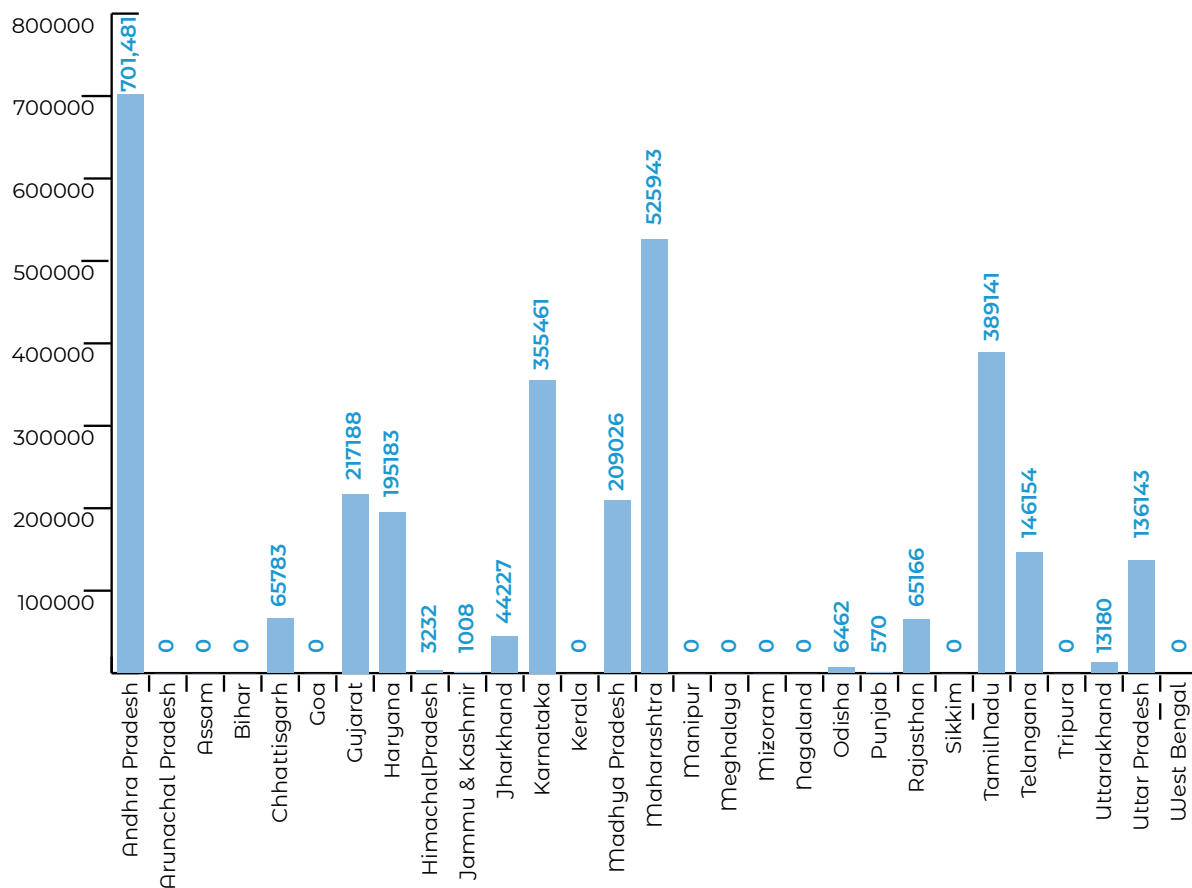


Figure 13: ISSR Sanctioning Status (January 2020)

Source: MoHUA, 2020

The graph in Figure 13 highlights the states where the ISSR vertical is being implemented and the number of dwelling units sanctioned per state. ISSR is highly dependent on the availability of private developers in the state, as the projects are undertaken in the PPP format. According to the available datasets, ISSR is only present in big/medium-sized states. Currently, ISSR projects are being implemented in Maharashtra, Gujarat, Himachal Pradesh, Jharkhand, Uttarakhand, and Punjab.



The minimum size of the dwelling unit should conform to the standards provided in the National Building Code (NBC).

CRITERIA 2: ECBC Commercial Notified States: A significant number of states in India have set in place the institutional structure and required legislative and regulatory processes for ECBC implementation in the commercial sector. States where ECBC Commercial has already been notified and the state's gazette has been appropriately amended to accommodate the notification are likely to have more willingness and resources to fast-track ENS implementation to enhance energy efficiency in residential buildings. As per the current status (up to December 2019), fourteen states in India have adopted the ECBC for commercial buildings: Punjab, Himachal Pradesh, Haryana,

⁴⁸ Ministry of Housing and Urban Affairs. (2020). PMAY State Wise Progress, Delhi, Government of India.

Uttarakhand, Delhi, Uttar Pradesh, Rajasthan, Assam, Odisha, West Bengal, Kerala, Telangana, and Maharashtra (AEEE, 2019)⁴⁹.

CRITERIA 3: States where SDC and GIZ are working: As mentioned in Chapter 2, certain states, in collaboration with development agencies such as Deutsche Gesellschaft Für Internationale Zusammenarbeit (GIZ) and Swiss Agency for Development and Cooperation (SDC), are in the process of implementing ENS. It was decided that mapping these states and the ongoing work in this field could help identify scope for mutual collaboration and implementation of complementary activities to fast-track the adoption of ENS at the state level. It could also create substantial scope for leveraging each other's scope of work and help prevent duplication.

- States collaborating with SDC: Rajasthan, Gujarat, and Andhra Pradesh
- States collaborating with GIZ: Punjab, Uttar Pradesh, Maharashtra, and Karnataka

CRITERIA 4: State Ranking in the State Energy Efficiency Index: AEEE, in collaboration with the Bureau of Energy Efficiency (BEE), publishes an annual State Energy Efficiency Index (SEEI). The index assesses the states based on six categories: Buildings, Industry, Municipalities, Transport, Agriculture and Electricity Distribution Companies (DISCOMs), and Cross-Sector; within these categories, the SEEI has 97 qualitative, quantitative, and outcome-based indicators. It monitors progress made in the implementation of energy efficiency policies, programmes, and projects⁵⁰. The index examines the state's policies and regulations, financing mechanisms, institutional capacity, adoption of energy-efficiency measures/technologies, and the resultant energy savings achieved. The index classifies states in four groups based on the total primary energy supply in the states in 2014-15.

In each category, energy efficiency indicators have been developed to measure the impact of state initiatives in driving energy efficiency. Based on the rankings across the 97 indicators, it classifies states as Front Runners (with a score of more than 60), Achievers (score between 50 and 60), Contenders (score between 30 and 49), and Aspirants (score below 30).

The criteria helped the team identify the states that have a conducive policy ecosystem facilitating the uptake of energy efficiency programmes and policies. The presence of such an eco-system could act as a catalyst in fast-tracking the uptake of ENS at the state level. While none of the states qualified as a Front Runner as per the assessment, Haryana, Karnataka, and Kerala were ranked as Achiever states. Gujarat, Punjab, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Andhra Pradesh, Telangana, and Maharashtra were ranked as Contenders. Figure 14 below shows the comparative ranking of the states across the five sectors.

⁴⁹ Alliance for an Energy Efficient Economy, Bureau of Energy Efficiency. (2019). The State Energy Efficiency Index Delhi: BEE.

⁵⁰ Alliance for an Energy Efficient Economy, Bureau of Energy Efficiency. (2019). The State Energy Efficiency Index Delhi: BEE.

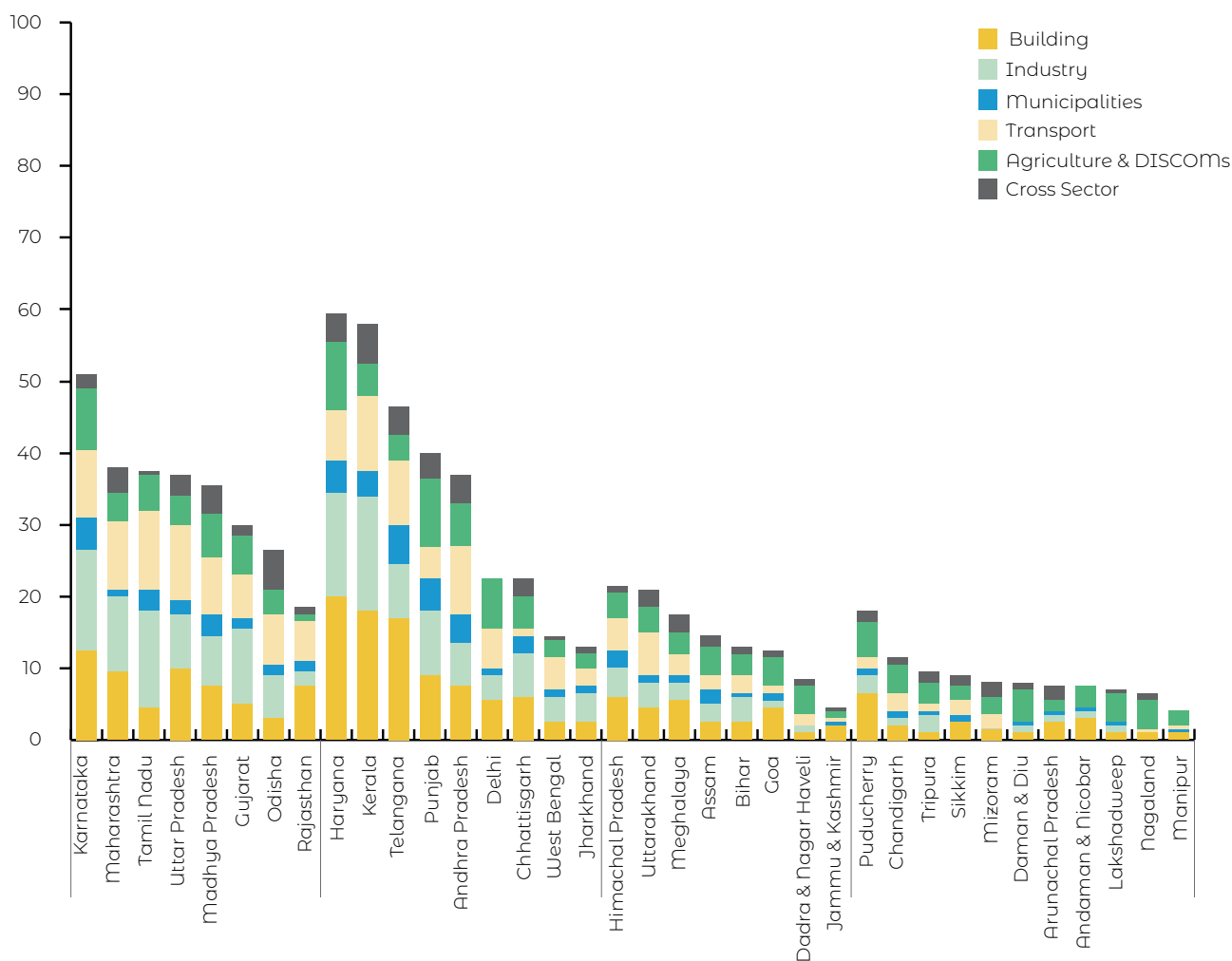


Figure 14: 2019 SEEI Rankings

Source: AEEE, 2020

Criteria 5: State Ranking in SEEI for Buildings: Based on the sectoral share in energy consumption, energy savings potential in a sector, and the state’s role in the promotion of energy efficiency, sectors and performance indicators were selected for the assessment. The 2019 SEEI 2019 had 23 (out of the total 97) indicators to capture states’ initiatives and progress in energy efficiency in buildings, as this sector accounts for 33% of total electricity consumption in India⁵¹. The indicators cover various aspects such as the ECBC-2017, ENS 2018, programmes and incentives for ECBC-compliant construction and adoption of energy-efficient appliances, institutional capacity for supporting energy efficiency in buildings, energy savings, and reduction in energy intensity. The index, among various indicators, looks at the state’s and authority’s role in driving energy efficiency in the buildings sector. The overall index evaluates how well a state is performing in terms of notifying energy codes, making rules, and carrying out the provisions of the Energy Conservation (EC) Act, and the outcome-based indicators measure the effectiveness of a state’s energy efficiency policies, programmes, and established institutional capabilities.

The criteria helped in conducting evidence-based evaluation of the initiatives taken by states to promote and adopt energy efficiency measures at the building level. It further helped in ranking states as per the willingness and presence of a conducive

51 Alliance for an Energy Efficient Economy, Bureau of Energy Efficiency. (2019). The State Energy Efficiency Index Delhi: BEE.

environment for the uptake of ENS. As per the assessment framework, Haryana, Kerala, Telangana, Punjab, Andhra Pradesh, Maharashtra, Madhya Pradesh, Rajasthan, and Gujarat were identified as high scoring states from Groups 1 and 2. Figure 15 below presents the comparative ranking of states in the SEEI for buildings.

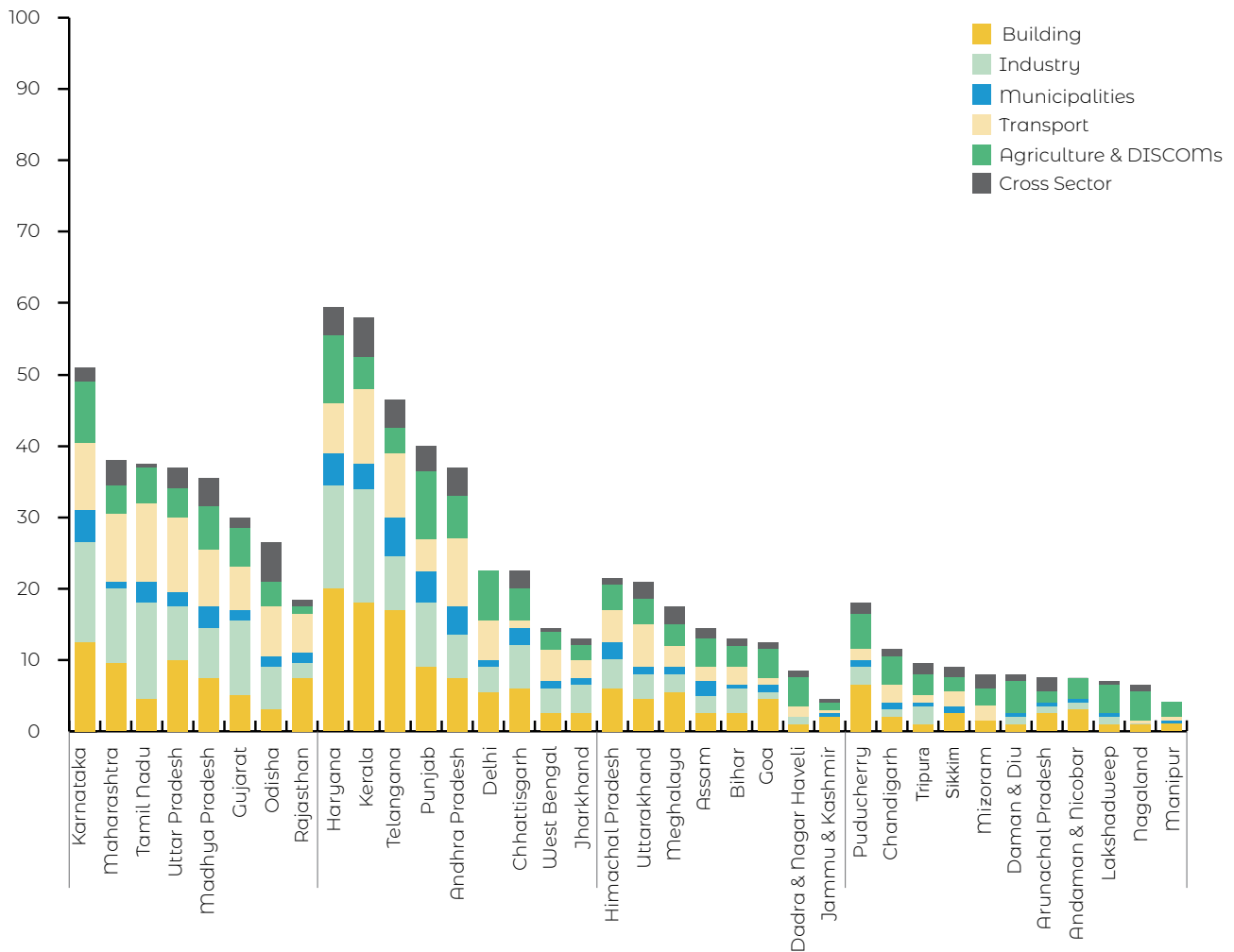


Figure 15: 2019 SEEI for Buildings Ranking

Source: AEEE, 2020

Based on the above mentioned selection criteria, the following matrix (Table 3: Criteria-wise Score of Each State) was prepared to shortlist the most desirable state for the ongoing project based on the weightage allocated to each of the criteria.

Based on the matrix, a rapid assessment was carried out, and states were ranked in order of preference for the project. After the analysis, five states were found appropriate for city selection: Andhra Pradesh, Gujarat, Karnataka, Maharashtra, and Tamil Nadu. For the selection of one state out of the five, a sixth criteria regarding the logistics and stakeholder consultation was introduced, and then a detailed matrix was prepared giving a weighted average to all the six assessment criteria where a higher weightage was given to the implementation status of AHP and ISSR in the state.

State	ECBC Commercial notified state	Supported by GIZ - for ENS	Supported by SDC - for ENS	State Energy Efficiency Index 2019	SEEI for Buildings 2019	PMAY-U Implementation Status (sanctioned houses up to 27.01.2020)	ISSR	AHP
Andhra Pradesh						20,07,430	0	7,01,481
Arunachal Pradesh						7,230	0	0
Assam						1,17,493	0	0
Bihar						3,13,039	0	0
Chhattisgarh						2,55,011	5,946	65,783
Goa						855		
Gujarat						6,44,446	64,370	2,17,188
Haryana						2,67,727	55,412	1,95,183
Himachal Pradesh						9,986	4,069	3,232
Jammu & Kashmir						54,615	0	1,008
Jharkhand						1,98,751	15,517	44,227
Karnataka						6,52,455	0	3,55,461
Kerala						1,29,555	0	0
Madhya Pradesh						7,84,976	2,172	2,09,026
Maharashtra						11,77,084	2,23,237	5,25,943
Manipur						42,825	0	0
Meghalaya						4,692	0	0
Mizoram						30,357	0	0
Nagaland						32,001	0	0
Odisha						1,54,073	7,300	6,462
Punjab						90,631	1,025	570
Rajasthan						2,00,530	0	65,166
Sikkim						527	0	0
Tamil Nadu						7,68,938	0	3,89,141
Telangana						2,16,860	0	1,46,154
Tripura						82,088	0	0
Uttarakhand						39,880	6,443	13,180
Uttar Pradesh						15,74,070	0	1,36,143
West Bengal						4,11,344	0	0





	SEEI: Achiever		SEEI: Buildings (high-performing)
	SEEI: Contender		AHP/ ISSR: high no. of dwellings

Table 3: Criteria-wise Score of Each State

Criteria 6: Logistics and Stakeholder Consultation: To shortlist one state out of the five high scoring states in the matrix above, multiple rounds of stakeholder consultation were undertaken between December 2019 and January 2020. Considering the logistics involved in the project, on-ground networks for AEEE and CEPT University, and the outcome of the discussions and consultation with multiple government departments and authorities, Gujarat was selected as the pilot state for the current project, and Ahmedabad was selected as the city within Gujarat.





5

ADMINISTRATIVE PROCEDURES FOR AFFORDABLE HOUSING DELIVERY IN GUJARAT

The lack of available public land in a state/city is the biggest hurdle in the provision of affordable housing, despite the availability of funds from the central government





In Gujarat, like most of India, continuous urban growth is expected to exacerbate the existing planning challenges in Indian cities: uncontrolled urbanisation, haphazard growth, informal housing, and lack of adequate infrastructure.



Land thus becomes a primary resource available to the state governments to undertake two antithetical activities: attract private investment in the post-liberalised economy of India and provide welfare services to its citizens.

The housing policies and programmes formulated by GoI are implemented and operationalised in coordination with the respective state governments. This chapter focuses on the legislative and administrative mechanisms employed by the Government of Gujarat in the delivery of affordable housing. Recognising land availability as one of the most important factors in determining housing affordability, the chapter begins by drawing parallels between the overall land management and urban planning practices in Gujarat and their roles in the delivery of affordable housing. In the later sections, it reviews the urban level building bye-laws in Ahmedabad and the process for obtaining the development permissions for affordable housing construction. In addition to the legislative and administrative processes, the chapter also evaluates and describes the PMAY-U implementation status and mechanisms in Gujarat and Ahmedabad.

5.1 Urban Planning and Affordable Housing in Gujarat

In Gujarat, like most of India, continuous urban growth is expected to exacerbate the existing planning challenges in Indian cities: uncontrolled urbanisation, haphazard growth, informal housing, and lack of adequate infrastructure⁵². To overcome these challenges, cities require the availability of public land to effectively achieve the state's developmental targets. Land thus becomes a primary resource available to the state governments to undertake two antithetical activities: attract private investment in the post-liberalised economy of India and provide welfare services to its citizens. The tension between the two activities and the limited amount of land available has led to the formulation of innovative policies to re-establish the space-state relationship.

Mechanisms to Increase Land Availability

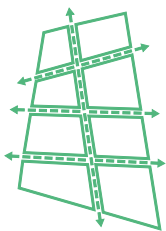
The lack of available public land in a state/city is the biggest hurdle in the provision of affordable housing, despite the availability of funds from the central government⁵³. In the national context, the former Land Acquisition Act of 1894 was the most widely used legislation. It was amended in 2013 to the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, making the former Land Acquisition Act more equitable, transparent, and fair to landowners⁵⁴. However, the process of compensation is time-consuming, due to multiple rounds of stakeholder consultations and social impact assessment. Despite these factors, the “Gujarat Model” of urban development and land redistribution and the town planning schemes provide a unique solution to the problem of land availability in cities, and Gujarat remains a model case for facilitating urban development in India.

Town planning in Gujarat is regulated by the Gujarat Town Planning and Urban Development Act (GTPUDA or GTPUD Act), 1976. The Act is administered by the Urban Development and Urban Housing Department (UDD). The urban development authorities of various cities in Gujarat have also been constituted (or designated)

52 Mahadevia, D., Pai, M., & Mahendra, A. (2018). “Ahmedabad: Town Planning Schemes for Equitable Development—Glass Half Full or Half Empty?” World Resources Report Case Study. Washington, DC: World Resources Institute. Retrieved from: [at www.citiesforall.org](http://www.citiesforall.org)

53 Tiwari, P. & Rao, J. (2016). Housing Markets and Housing Policies in India. ADBI Working Paper 565. Tokyo: Asian Development Bank Institute. Retrieved from: <http://www.adb.org/publications/major-challenges-facing-small-and-medium-sized-enterprises-asia-and-solutions/>

54 GoI. (2013, September 27). Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act. New Delhi: The Gazette of India.



The lack of available public land in a state/city is the biggest hurdle in the provision of affordable housing, despite the availability of funds from the central government.



Intent of the TP Schemes is to give a push to the new order economy in the state, building on PPP, by facilitating the creation of high-quality living/working environments with adequate infrastructure and services, in the form of sustainable integrated townships.

under the provisions of the GTPUDA, 1976, reporting to the UDD⁵⁵. The Act provides an integrated framework for defining an agency, empowering it to undertake urban planning, and providing a mechanism for the agency to implement its plan. The GTUPDA was amended in 1999 to accommodate a structured process for pooling and readjusting land plots, introducing the formulation of Town Planning Schemes (TPS)⁵⁶.

Town Planning Schemes

TPS were introduced with the objective of ensuring service provision in cities in Gujarat, enhancing the availability of land for affordable housing, and regulating the urban expansion of cities⁵⁷. The intent of the policy is to give a push to the new order economy in the state, building on PPP, by facilitating the creation of high-quality living/working environments with adequate infrastructure and services, in the form of sustainable integrated townships⁵⁸. To provide an established framework for the development of townships under the TPS and regulate the functions of the participants in such transactions, the Government of Gujarat formulated the Gujarat Integrated Township Policy in August 2007. The integrated township approach, i.e. encouraging the private sector to assemble and acquire parcels of land to accommodate new growth, was proposed as a faster alternative to the delivery of serviced land in 2009. Over the past two decades, TPS has been applied in Gujarat in many different contexts: urban development and the control of urban expansion (Ahmedabad, Surat, etc.), reconstructing a town following a natural calamity (earthquake in Bhuj in 2001); and developing a complete greenfield site (Dholera Special Investment Region, 567 sq. kilometres (km))⁵⁹.

Figure 16 depicts the urban planning and governance structure in Gujarat and Ahmedabad and the linkages between departments at the national, state, and city level. The schematic largely focuses on two main aspects: decision-making power and financial flows.

The focus on increasing the provision of land for affordable housing has remained limited by the amount of available land, with an objective of reducing the initial cost of housing. There has been no consideration of the quality of land being designated for housing—quality here denotes parameters such as accessibility to the land, distance from livelihood sources, sustainability, and environmental impact—, which ultimately impacts the recurring cost incurred by the households occupying these dwelling units. Ironically, while so much effort is put into enhancing the availability of land for affordable housing, the lifecycle cost, including the transportation cost, overall operation and maintenance cost, and living cost incurred after accessing these housing units, is not taken into consideration.

55 Govt. of Gujarat. (1976). The Gujarat Town Planning and Urban Development Act. Ahmadabad: Govt. of Gujarat.

56 Govt. of Gujarat. (1976). The Gujarat Town Planning and Urban Development Act. Ahmadabad: Govt. of Gujarat.

57 Mahadevia, D., Pai, M., & Mahendra, A. (2018). "Ahmedabad: Town Planning Schemes for Equitable Development—Glass Half Full or Half Empty?" World Resources Report Case Study. Washington, DC: World Resources Institute. Retrieved from: www.citiesforall.org

58 ibid

59 Town Planning & Valuation Department, Government of Gujarat. (2018). Government of Gujarat.

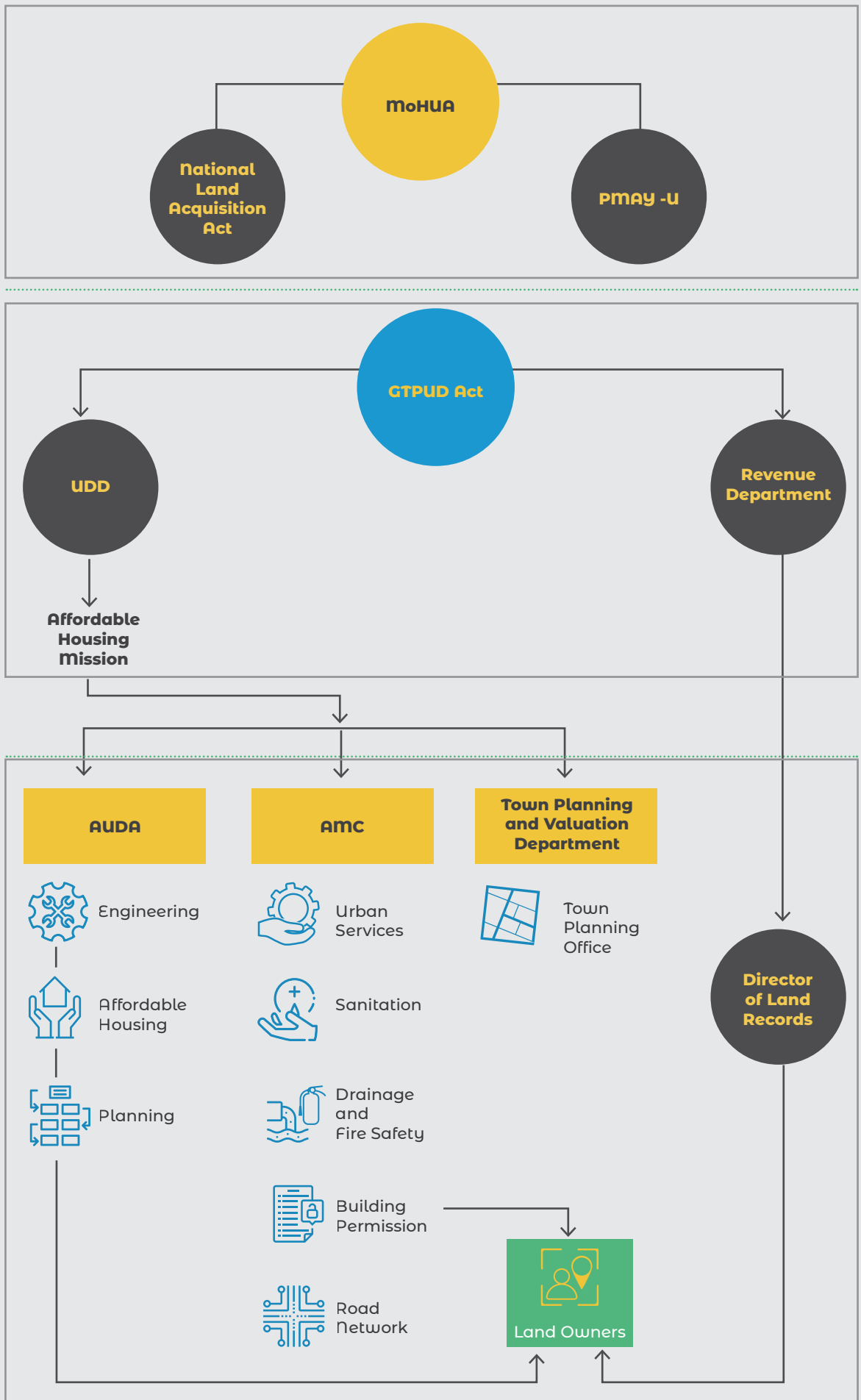


Figure 16: Urban Governance Structure in Gujarat and Ahmedabad

Source: AUDA, 2020

5.2 Town Planning Schemes and Affordable Housing in Ahmedabad

In Ahmedabad, two institutions are responsible for urban planning: Ahmedabad Municipal Corporation (AMC) and Ahmedabad Urban Development Authority (AUDA). While they both operate under the UDD, they have mutually interlinked but distinct functions. AMC is the locally elected body responsible for urban services, whereas AUDA (set-up under GTPUDA) is responsible for spatial planning⁶⁰. AUDA is thus a technical entity answerable not to the electorate, but to the state government. It is charged with the spatial development of the entire area identified under the Ahmedabad Urban Agglomeration (AUA). AMC, in contrast, is answerable to the electorate and responsible for provision of physical infrastructure and services at a micro level within the area defined as the municipal boundary of Ahmedabad. The services within AMC's purview include land management, solid waste management, water, and sanitation. AMC also acts as a money lending institution for the town planning department and estate department.



The Draft Development Plan, 2021 proposes inclusion of a Residential-Affordable Housing (R-AH) zone of 76 sq. km.

In Ahmedabad, the TPS works in conjunction with the city level Development Plan. The Development Plan is prepared for the entire AUDA area (of which the AMC is a part) and is divided into 480 TPS areas across the AUDA area⁶¹. The Development Plan of Ahmedabad is revised every 10 years and requires approval from the state government. The current draft Development Plan of Ahmedabad is for the year 2021⁶². Ahmedabad is one of the few cities in India that earmark areas for affordable housing in their Development Plans. The Draft Development Plan, 2021 proposes inclusion of a Residential-Affordable Housing (R-AH) zone of 76 sq. km (the blue line on the map in Figure 17) with an increased maximum Floor Space Index (FSI) of 2.7 (out of which 1.8 is the base and 0.9 is to be paid for on-demand). It is envisaged that the designated affordable housing area will be able to provide land for about 15 lakh dwelling units, with each dwelling having a built-up area of up to 80 sq. m. To catalyse investment in the affordable housing sector, the Development Plan proposed charging the extra FSI of 0.9 at the minimum property value rates of the circle⁶³. In addition to the financial incentive, the area consumed in passages and internal corridors for dwelling units of built-up area up to 66 sq. m. is excluded from the FSI calculation, indirectly expanding the developer's total available built-up area. The increased FSI has been provided to accelerate the quantitative delivery of affordable housing units⁶⁴.

Figure 17 highlights the AMC and AUDA boundaries in the Ahmedabad urban area. The blue line on the map marks the land delineated for affordable housing as per the Development Plan of Ahmedabad.

60 Ahmedabad Urban Development Authority. (2016). General Development Control Regulations-A. Ahmedabad: Govt. of Gujarat.

61 Ahmedabad Urban Development Authority. (2014). Development Plan 2021. Ahmedabad: Govt. of Gujarat.

62 *ibid.*

63 *ibid.*

64 Ahmedabad Urban Development Authority. (2014). Development Plan 2021. Ahmedabad: Govt. of Gujarat.

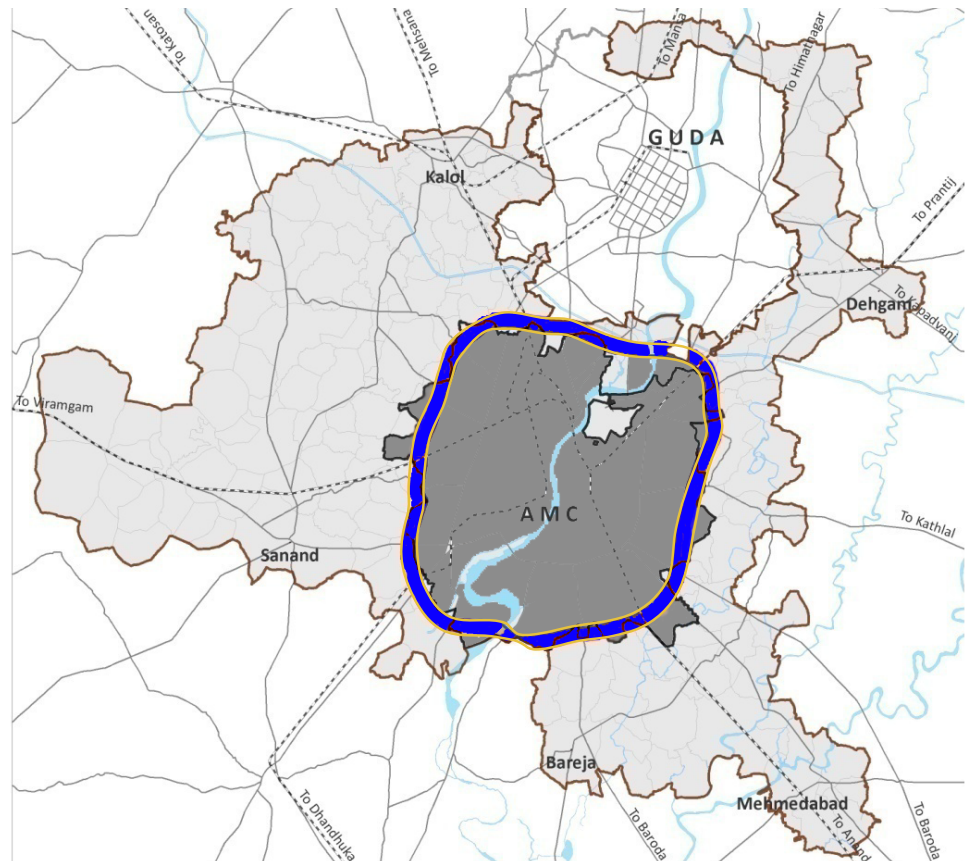


Figure 17: AUDA & AMC Boundaries and Area Earmarked for Affordable Housing

Source: AUDA, 2020



The identification of land and selection of beneficiaries remain two mutually exclusive processes, making it difficult to create a balanced socio-economic, spatial environment that can enhance the household's overall quality of life, energy optimisation, and thermal comfort.

The principles outlined by the GTPUDA and the TPS have been put into implementation through the Ahmedabad Development Plan. Even though there has been an attempt to earmark land for affordable housing, the land is on the outskirts of the AMC boundary, whereas most of the livelihood opportunities for the potential occupants of these dwelling units lie within the AMC boundary. When earmarking the land, there was no consideration given to the holistic idea of affordability; the focus was on reducing the initial cost of housing. Due to poor accessibility to the city centre and the associated additional transportation cost to access services, maintaining the overall affordability of the dwelling unit is a challenge. Furthermore, the identification of land and selection of beneficiaries remain two mutually exclusive processes, making it difficult to create a balanced socio-economic, spatial environment that can enhance the household's overall quality of life, energy optimisation, and thermal comfort.

General Development Control Regulations, Ahmedabad

Building construction in Ahmedabad is regulated by the General Development Controls and Regulation (GDCR), which forms a part of the Draft Development Plan 2021. The building bye-laws are the direct tools used to facilitate, control, and regulate the design and construction of all types of buildings within the city. The current building bye-laws for residential affordable housing in Ahmedabad regulate the shape and form of the building, include parameters such as FSI, Building Height, Setbacks, Internal Open Space, etc., as outlined below in Table 4.



The current bye-laws do not include any explicit focus on passive design, construction techniques, building materials, resource efficiency, energy optimisation, or thermal comfort within the dwelling units.

S. No	Section of GDCR	Parameter	Existing guideline
1.	Section 14.4	Maximum FSI	2.7, out of which 1.8 is the base FSI, and 0.9 is to be paid for on-demand
2.	Section 14.5	Building Height	The Maximum Permissible Building Height to be regulated according to the width of the road on which it abuts
3.	Section 14.6	Margins/ Setbacks Height Space Ratio	Gives minimum margin between buildings - increases with building height Gives minimum rear and front margins for plot areas above and below 500 sq. m.
4.	Section 14.7	Permissible Ground Coverage	Entire area available after providing for the required margins and common plot; other regulations may be utilised for construction of the superstructure
5.	Section 14.8	Internal Open Space	The minimum width of any interior open space used for light or ventilation in the rooms to be regulated based on the shorter side of this open space

Table 4: Relevant GDCR Bye-Laws for ENS Compliance

Source: AUDA, 2020



The integration of ENS into the existing building bye-laws would create an opportunity to incorporate energy efficiency measures into the affordable housing sector, which, in turn, would enhance the overall affordability of the dwelling unit by decreasing the recurring cost incurred on fuel and other health related expenditures due to rising temperatures and unhealthy indoor spaces.

The current bye-laws do not include any explicit focus on passive design, construction techniques, building materials, resource efficiency, energy optimisation, or thermal comfort within the dwelling units. Thus, they do not facilitate the use of energy efficient, thermally comfortable and climate resilient infrastructure that could respond to rising urban temperatures and ensure comfortable and healthy dwelling units for the occupants. Moreover, presenting a blanket, checklist approach discourages site-based design layouts that could play a significant role in ensuring the building's thermal comfort, daylight penetration, and thermal performance and enhancing overall energy optimisation.

Within this context, the integration of ENS into the existing building bye-laws would create an opportunity to incorporate energy efficiency measures into the affordable housing sector, which, in turn, would enhance the overall affordability of the dwelling unit by decreasing the recurring cost incurred on fuel and other health related expenditures due to rising temperatures and unhealthy indoor spaces. By setting minimum building envelope performance standards for the walls, roof, and windows, ENS influences the overall heat loss, ventilation, and daylighting in a building, thus impacting indoor temperatures, thermal comfort, and the sensible cooling demand⁶⁵. Early integration of the code would not only improve the design, construction, and overall quality of the residential building stock currently being built in Ahmedabad, but would also significantly curtail the overall cooling demand in the city's hot and dry climate.

Table 5 lists the additional clauses that could be integrated into the existing building bye-laws for affordable housing in Ahmedabad, to ensure compliance with ENS.

⁶⁵ Bureau of Energy Efficiency. (2018). Eco-Niwas Samhita: (Energy Conservation Building Code for Residential Buildings). New Delhi: Bureau of Energy Efficiency.

Parameter	Minimum Requirement		Benefit
WFR	10%		This is an indicator of potential use of external air for ventilation. Setting a minimum WFR helps ensure good ventilation, improvement in thermal comfort, and reduction in required cooling energy. ⁶⁶
VLT	Window-to-wall ratio	Minimum VLT	The visible light transmittance of the non-opaque building envelope components (transparent/ translucent panels in windows, doors, ventilators, etc.) indicates the potential daylight penetration. Ensuring minimum VLT helps improve daylight penetration, thereby reducing the energy required for artificial lighting ⁶⁷ .
	0-0.30	0.27	
	0.31-0.40	0.20	
	0.41-0.50	0.16	
	0.51-0.60	0.13	
0.61-0.70	0.11		
Thermal Transmittance of Roof	1.2 W/m ² ·K		Thermal transmittance (U_{roof}) characterises the thermal performance of the building's roof. Limiting the U_{roof} helps reduce heat gains or losses from the roof, thereby improving the thermal comfort and reducing the energy required for cooling or heating ⁶⁸ .
Residential Envelope Transmittance Value (RETV)	15 W/sq. m.		RETV characterises the thermal performance of the building envelope (except the roof). Limiting the RETV helps reduce heat gains from the building envelope, thereby improving the thermal comfort and reducing the electricity required for cooling.

Table 5: Proposed Additional Clauses for Building Bye-laws



ENS estimates that household electricity consumption can be reduced by up to 20% by limiting the thermal transmittance through the building envelope, increasing natural ventilation, and capturing the daylight potential.

Building Construction Materials

ENS estimates that household electricity consumption can be reduced by up to 20% by limiting the thermal transmittance through the building envelope, increasing natural ventilation, and capturing the daylight potential. As seen in Table 5, to set standards to reduce residential energy consumption, the code recommends values for thermal transmittance, WFR, and VLT. Thermal transmittance is determined by the building material, i.e. the wall & roof material (opaque building envelope) and window material (non-opaque building envelope). To achieve the desired value of thermal transmittance, the code sets standards for building materials in terms of material density, thermal conductivity, and specific heat capacity. It is recommended that the building bye-laws provide a list of materials that meet the thermal transmittance standards corresponding to the local conditions in Ahmedabad, in order to achieve energy optimisation in affordable housing. And to simplify implementation of ENS by removing unnecessary technical jargon and language that will come onto the way of simple guidance.

⁶⁶ ibid

⁶⁷ ibid

⁶⁸ ibid

5.3 Legislative Procedures for Building Construction Approval in Ahmedabad



To facilitate the implementation of ENS, it is advisable to include compliance requirements at all three stages of the approval process, so that ENS compliance can be verified at each stage.

Legislative procedures called development permissions and controls laid down for building construction are one of the strongest mechanisms that can be used to regulate the type of construction carried out in the city. Any mandatory parameter for successful ENS implementation should be included in the existing legislative procedures and controls for obtaining building construction approval in the city. In Ahmedabad, the existing legislative procedures for getting construction approval are specified in the GDCR, as well as the building bye-laws. They are divided into three categories—pre-construction, during construction, and after the completion of construction—and are summarised in Figure 18. To facilitate the implementation of ENS, it is advisable to include compliance requirements at all three stages of the approval process, so that ENS compliance can be verified at each stage.

Pre-Construction Phase

The approval for construction is given by AMC, for which it introduced an online procedure in 2002 as part of its larger e-governance project. All applications for development permissions are accepted and approved on AMC's website (www.egovamc.com). The portal has the capability to validate the information, assess the document requirement, and check the no objection certificates (NOCs) obtained from multiple departments. The detailed scrutiny of all accepted building plans and other required documents is made under the provisions of GDCR 2021 by the Building Plan Scrutiny Pool Office (BPSO), housed under AMC⁶⁹.

After the preliminary check, the application data is entered into the web portal. The portal has inbuilt checks and control for FSI, built-up area, margins, building height, and other building regulation standards mentioned in GDCR 2021. The system automatically verifies these provisions, and unless a query is raised by the applicant, the portal generates a detailed calculation of the required fees. The final approval for construction is given after the applicant ensures full compliance with the GDCR provisions. To review any discrepancies, objections, or different interpretations of the regulations, a weekly meeting is held (open to all applicants and architects/ engineers) by the Deputy Municipal Commissioner to discuss and make decisions regarding issues related to the development permissions. After the final permission is given, the cases are sent to the zonal office for site verification and monitoring.

The portal on AMC's website⁷⁰, along with the existing checks and controls for existing building bye-law provisions, can also ensure checks and compliance with the minimum requirements of multiple components under ENS. It can host a tool to carry out the required calculations, which presents the real-time result to the user and can accordingly issue compliance certificates. Furthermore, in addition to the requirement of NOCs from multiple departments, the portal could also make a provision for self-certification by the applicant with a document that lists the measures undertaken to ensure ENS compliance.



The portal could also make a provision for self-certification by the applicant with a document that lists the measures undertaken to ensure ENS compliance.

69 Ahmedabad Municipal Corporation. (2020, March 15). Building permission. Retrieved from Ahmedabad Municipal Corporation: https://ahmedabadcity.gov.in/portal/jsp/Static_pages/buildingPermission_dept.jsp

70 www.egovamc.com

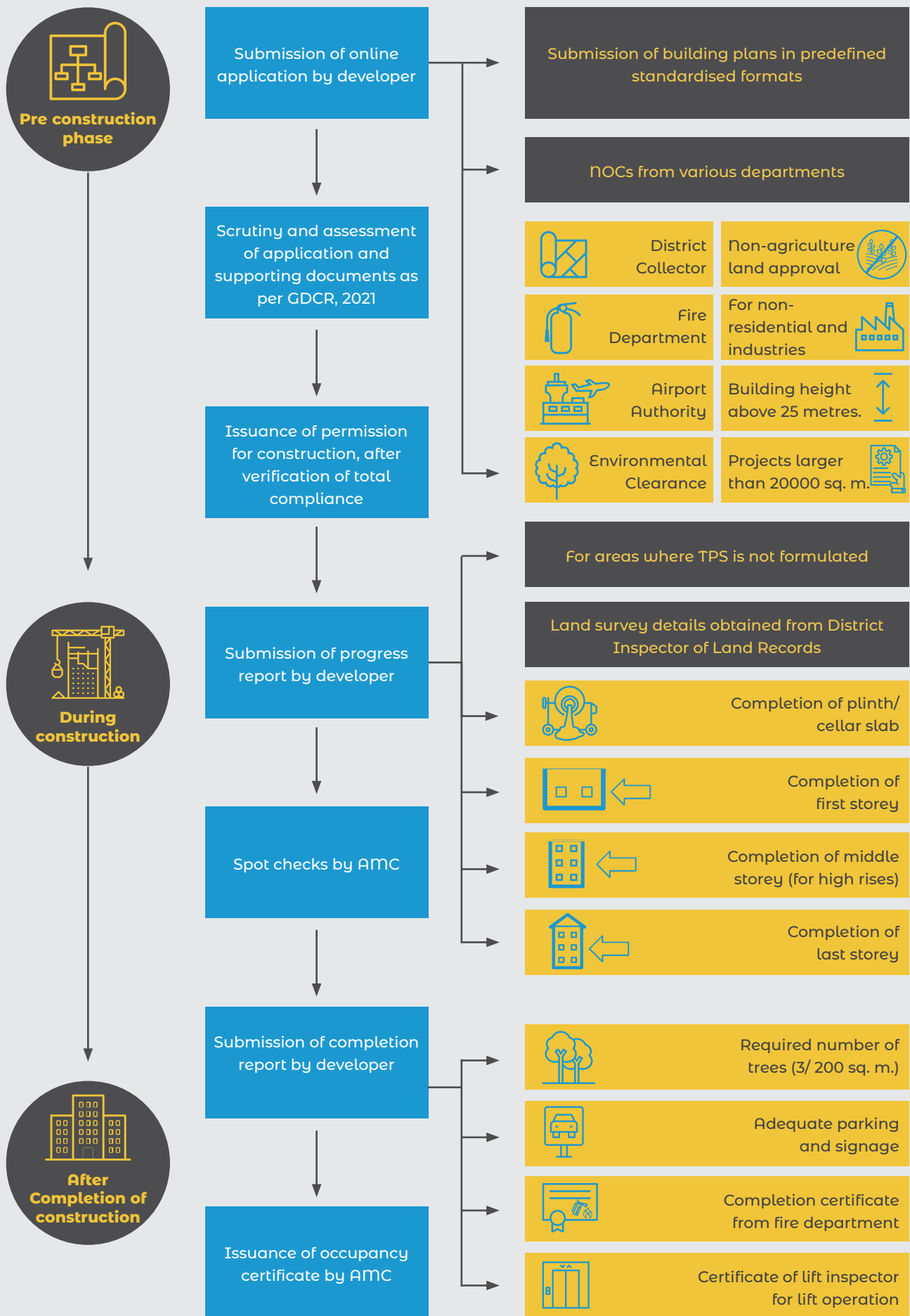


Figure 18: Process for Obtaining Development Permit in Ahmedabad

Source: AMC, 2020

Box 5.1 The Indian Urban Model

Over two decades ago, municipal/city governments in India were given constitutional recognition through the introduction of the 74th Constitutional Amendment Act (CAA), 1993. While decentralisation is a central feature in all the contemporary urban development initiatives, viz. the Smart Cities Mission, AMRUT, and PMAY-U, the lack of required capacity at the local government, i.e. ULB, level poses a huge challenge to rolling out the envisaged implementation mechanism. On one hand, the 74th CAA allows the ULB to take responsibility for urban planning, water supply, socio-economic planning, slum upgradation, public health, etc., but on the other, it does not establish a clear revenue base for the ULB; the power to determine the revenue base still rests with the state governments.

Moreover, the devolution of power envisaged under the current regime of urban development requires improvement in the functional efficiency of the ULBs, as these functions are being added to the already existing scope of work. The lack of the technically skilled work force needed to undertake the various additional tasks envisaged as part of the urban development programmes is a serious barrier to the successful implementation of these programmes. Moreover, the programme results would vary drastically depending on the different ULBs' capacities even within the same state. Therefore, there is a need to organise capacity building programmes and modules specific to the urban development programmes to enhance delivery.

Cities are especially vulnerable to climate change, and although there is a recognition of this issue at the central level through various initiatives, e.g. the National Action Plan for Climate Change—which includes the National Mission on Sustainable Habitat—and India Cooling Action Plan, climate change and the related impacts should be incorporated as an important component within the urban development programmes and processes. In order to meet the national goals, there is an urgent need for coordinated local action through localised mitigation measures that promote effective resource planning, altering energy consumption patterns through measures such as energy efficiency in buildings, improved land use planning, and promotion of public transport.



During the spot checks on compliance with the pre-sanctioned structural design and layout and other criteria provided in the pre-construction approval phase, the compliance with commitments made under ENS by self-certification should also be verified.

During Construction

During the construction process, it is mandatory for the owners/ developers to submit a progress report with the signatures of the developer, architect, structural designer, and supervising engineer at the following stages of construction: completion of the plinth (or before the casting of the cellar slab), first storey, middle storey (of high rise buildings), and last storey. After the receipt of the progress report, the AMC conducts spot checks for any deviation, and the results of the check are conveyed to the owner/ developer within seven days. In the case of non-compliance or unauthorised development, AMC takes suitable action, which may include demolition of unauthorised works as provided in the GTPUD Act and the relevant provisions of the Gujarat Provincial Municipal Corporation Act- 1949, as well as action against the registered architect/engineer and/or owner/developer.

During the spot checks on compliance with the pre-sanctioned structural design and layout and other criteria provided in the pre-construction approval phase, the compliance with commitments made under ENS by self-certification should also be verified.

After the Completion of Construction

After the construction is complete, the owner and other professionals involved in construction are required to submit a completion report (in the specified form under GDCR) to AMC. AMC then carries out the final inspection of the construction work within 21 days and communicates the decision on the granting of the occupancy certificate/ building use permissions to the owner/developer. The occupancy certificate is to be obtained prior to any occupancy or use of the development.

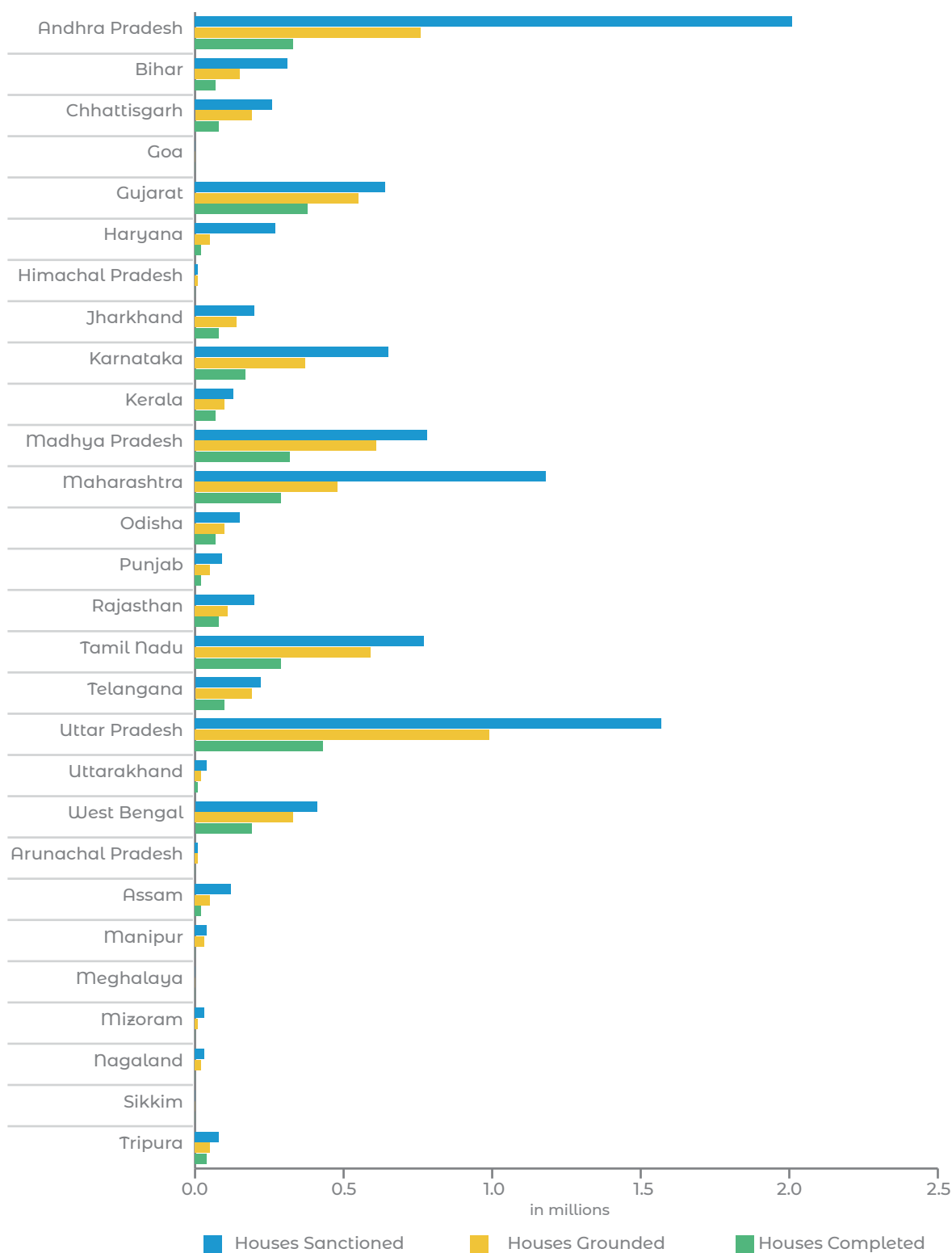


Figure 19: PMAY-U Implementation Status in India (February 2020)

Source: MoHUA, 2020

5.4 Housing Policies in Gujarat

Responding to the increasing urban development and urbanisation and the growing need for affordable housing, the Government of Gujarat announced the Mukhya Mantri Gujarat Rural Urban Housing (MM-GRUH) Yojana, i.e. Gujarat Affordable Housing Scheme, in 2014. The aim of the scheme was to make urban areas slum-free by providing housing at a reasonable price to poor and lower- and middle-income group urban families, with the state engaging both public institutions and private developers in such projects. The state government planned to construct 50 lakh houses in five years, out of which 22 lakh houses were planned in urban areas⁷¹. It was decided that, under this scheme, the beneficiaries would get well-planned houses with basic civic amenities at an affordable price, and the work would be carried out by ULBs and Urban/Area Development Authorities (UDAs/ADAs) on public land.

When GoI launched PMAY-U in 2015, it was implemented in Gujarat as a complement to the MM-GRUH scheme. In 2016, the Redevelopment of Public Housing Scheme was proposed. The scheme focused on the redevelopment of existing public housing schemes and creating additional housing. In this scheme, UDD recommended undertaking the redevelopment of public housing schemes in urban areas across the state under the PPP model, upgrading the existing housing stock, and adding more units to the stock wherever possible. Table 6 below summarises the key housing policies/ initiatives undertaken by the Government of Gujarat with an objective to improve statewide access to affordable housing.

Policy	Year	Objectives
GTPUDA	1976	Definition of development area and constitution of ADAs
Regulation for Residential Township	2009	Regulations applicable to any Residential Township, focused on the development of Socially & Economically Weaker Section Housing
MM-GRUH Yojana	2014	Policy issued with parameters and planning for effective and quick implementation of affordable housing through PPPs
PMAY-U	2015	Affordable housing to be provided to the urban poor, with a target of building 12 million affordable houses by 2022
Redevelopment of Public Housing Scheme	2016	Redevelopment of existing public housing scheme and construction of additional affordable housing

Table 6: Gujarat Housing Policies

Source: GHB, 2020

⁷¹ Urban Development and Urban Housing Department. (2014). Mukhya Mantri Housing Scheme (MMHS), Gandhinagar, Government of Gujarat.



Given that there is a significant number of houses that are yet to be built, there is an opportunity to improve the thermal comfort and enhance energy optimisation in the pending dwelling units approved under PMAY-U.

5.5 PMAY-U Implementation Mechanisms in Gujarat

PMAY-U has been implemented in Gujarat since 2015. As on 10th February 2020, Gujarat ranks second after Uttar Pradesh in achieving the highest total number of completed dwelling units (see Figure 19).

Gujarat has approximately 6,44,446 dwelling units that have been sanctioned for construction, out of which 5,50,901 have been grounded, and 3,75,120 have been completed and delivered⁷². There have been 1,195 total projects considered up to February 2020 for implementation under PMAY-U, at a financial cost of Rs. 56,357.73 crores (including the contribution of the central and state governments and private sector)⁷³. The vertical-wise distribution of dwelling units is given in Table 7.

Status	ISSR	AHP	BLC	CLSS	Total
Approved	64,370	2,18,332	94,289	2,17,123	5,94,114
Progress	19,404	58,096	48,186	-	1,25,686
Completed	2,976	76,771	21,974	2,17,974	3,19,695
Under approval process	25,697	21,147	-	-	46,844
Construction yet to be started	41,770	80,851	19,073	-	1,41,694

Table 7: PMAY-U Implementation Status in Gujarat

Source: MoHUA, 2020

ENS, launched in December 2018, is still at a nascent stage in terms of its implementation in different states and cities. Given that there is a significant number of houses (as can be seen in Table 7) that are yet to be built, there is an opportunity to improve the thermal comfort and enhance energy optimisation in the pending dwelling units approved under PMAY-U. The incorporation of ENS into the construction practices for these units will also strengthen the overall objective of the mission by enhancing the affordability and liveability for the target households.

Administrative Procedures in PMAY-U Implementation in Gujarat

On the basis of the primary demand survey and other available data, the ULBs prepare the HFAPoA, containing the list of eligible beneficiaries in the city, along with the selected vertical. It is the responsibility of the state government to avoid duplication in allotment to the beneficiaries. For PMAY-U implementation (as explained in Chapter 3), an MoU is signed between the state and the MoHUA.

As mentioned in Chapter 3, the state government has to identify an SLNA as part of the implementation structure defined in the PMAY-U guidelines. The Government of Gujarat has identified the Affordable Housing Mission (AHM) as the SLNA for PMAY-U planning and implementation. The demand surveys undertaken by the ULBs are



ENS should be incorporated into upcoming projects to future of under AHM and the housing over its entire lifecycle as this will optimise consumption.

⁷² MoHUA. (2020). PMAY State Wise Progress, Delhi, Government of India. Retrieved from: [http://mohua.gov.in/upload/uploadfiles/files/4\(26\).pdf](http://mohua.gov.in/upload/uploadfiles/files/4(26).pdf)

⁷³ MoHUA. (2019). PMAY, 50th Meeting of CSMC, Gujarat. Retrieved from: [http://mohua.gov.in/upload/uploadfiles/files/Gujarat_compressed\(1\).pdf](http://mohua.gov.in/upload/uploadfiles/files/Gujarat_compressed(1).pdf)

submitted to AHM for approval. The core objective of AHM is to make towns and cities in Gujarat slum-free and provide affordable housing to the EWS, LIG, & MIG categories in urban areas⁷⁴. AHM has the following functions:

- Formulating urban housing policy and programme proposals
- Proposal evaluation, with final approval obtained from SLSMC/ CSMC
- Facilitating project planning and implementation
- Disbursement of grants for various housing schemes & programmes
- Capacity building at various levels for effective project implementation
- Formulation of Project Monitoring Units (PMUs) and Project Implementation Units (PIUs) at the state and zonal/ regional levels
- Monitoring of project implementation

ENS should be incorporated into upcoming projects to future of under AHM and the housing over its entire lifecycle as this will optimise consumption

Table 8 outlines the administrative procedures formulated in Gujarat to facilitate PMAY-U implementation under AHM.

Administrative Procedure	Year	Objective
Identification of SNA	October 2015	Identification of AHM as SLNA and AHM mission director as State Level Mission Director
Formation of SLSMC	June 2015	Constitution of interdepartmental SLSMC
Formulation of SLAC	2016	Constitution of State Level Appraisal Committee (SLAC)
Amendment of the Gujarat Flats Ownership Act, 1973	2019	Amendment to allow for the redevelopment of flats and apartments

Table 8: PMAY-U Administrative Procedures in Gujarat

Source: AHM, 2020

PMAY-U Financial Mechanism in Gujarat

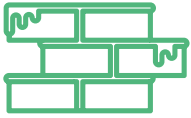
In addition to the implementation mechanism of PMAY-U, there is also the financial mechanism. PMAY-U funding has two major components: central and state. In Gujarat, the state share is fulfilled by the Gujarat Urban Development Mission (GUDM), Government of Gujarat. The state government invites suppliers and contractors to submit tender proposals. Once the project is approved by the state government, it is sanctioned by the central government for the disbursement of funds. The funds from the central government come through two schemes: the Central Sector Scheme and the Centrally Sponsored Schemes (Refer to Chapter 3).

As highlighted in earlier sections of the report, the availability of urban land is the biggest constraint in affordable housing delivery. Therefore, to ease administrative and regulatory bottlenecks, a set of mandatory conditions has been included in the PMAY-U guidelines (refer to Chapter 3) to facilitate its implementation and thus promote

⁷⁴ Affordable Housing Mission. 2020. Affordable Housing Mission. Retrieved from: http://www.ahmgujarat.org/pages/About_Us/Function.aspx



Ahmedabad is one of the first cities in India to earmark land for affordable housing construction.



If buildings are constructed with poor end-use technologies or energy performance, they will eventually form cities with high energy demand, leading to a series of correlated and path-dependent high energy outcomes.



A large part of the embodied building energy is consumed in the construction phase, operational energy continues to be added annually.

the construction of affordable housing⁷⁵. To participate in the mission, improve the speed of affordable housing delivery, and avail of financial assistance from the central government, Gujarat has fulfilled the mandatory conditions in the following manner:

- **Dispensing with the need for separate Non-Agriculture Permission:** The formulation of the Master Plan process was amended in Gujarat, and a clause to facilitate the smooth sanctioning of housing under PMAY-U was incorporated into the Gujarat Comprehensive Development Control guidelines in 2017.
- **Earmarking Land for Affordable Housing:** Ahmedabad is one of the first cities in India to earmark land for affordable housing construction. Similar area has been earmarked across all cities having master plans and implementing PMAY-U in Gujarat.
- **Single window and time-bound clearance for layout approval and building permissions:** ULBs have introduced an e-portal for approval as an initiative under the e-governance and Ease of Doing Business schemes. The decisions on applications are given within 90 days.
- **Granting deemed building permissions and approving layouts based on pre-approved layouts and building plans:** This practice is already in place at the district level, and technical assistance is provided by town planners in the preparation of layout plans. The layout is prepared as per the land availability and varies from project to project.
- **Amending or legislating existing rent laws on the lines of the Model Tenancy Act:** This amendment/ legislation is still under consideration.
- **Additional FAR/ TDR and relaxed density norms:** The State Policy of Gujarat for Slum Redevelopment and Affordable Housing already has provisions for incentives like additional FSI/TDR and relaxation in planning norms. In negative premium cases, e.g. slum redevelopment, the state government also has provisions for funding of up to Rs. 3 lakhs per household.

How can PMAY-U help ensure thermal comfort for all and energy optimisation in Gujarat?

An important implication of ENS implementation in affordable housing projects under PMAY-U is the potential to enhance thermal comfort and therefore improve the liveability of Gujarat's upcoming built stock. Over one million dwelling units are being constructed in Gujarat alone under PMAY-U between 2015 and 2022, driving a socio-economic and urban transition. And because these dwelling units will last at least 40-60 years, they have the potential to alter long-term energy consumption patterns. If buildings are constructed with poor end-use technologies or energy performance, they will eventually form cities with high energy demand, leading to a series of correlated and path-dependent high energy outcomes. Therefore, decisions taken today when designing and constructing these dwelling units could significantly alter the possibility of carbon lock-in, ultimately determining the overall developmental path.

A building requires energy throughout its lifecycle for construction and operation, which is broadly divided into two categories: embodied and operational energy. While a large part of the embodied building energy is consumed in the construction phase, operational energy continues to be added annually. In buildings that use active space cooling mechanisms like coolers, air conditioners, and fans, the operational energy

⁷⁵ Ministry of Housing and Urban Affairs. (2015). PMAY-U Guidelines. Delhi, Government of India.



The projected increase in demand for space cooling could lead to even earlier adoption of cooling technologies, because of the rising temperatures and urban heat island effects.

consumed is significantly higher than the embodied energy. ENS thus aims to reduce the operational energy by ensuring thermal comfort, sufficient daylight penetration, and energy optimisation in the dwelling unit. With the population's growing socio-economic aspirations and per capita income, the affordable housing units are expected to shift to more energy intensive means for space cooling, depending on the household's disposable income. The projected increase in demand for space cooling could lead to even earlier adoption of cooling technologies, because of the rising temperatures and urban heat island effects. The adoption of ENS has the potential to delay this shift through the incorporation more effective passive space cooling mechanisms.

6

CONCLUSION AND WAY FORWARD



PMAY-U presents a unique opportunity for India to promote action-oriented leadership in energy efficiency in the affordable housing sector, which has thus far not been exploited



In Chapter 1, the activities carried out in Phase 1 of the project entitled 'A Policy Strategy for Decarbonising the Building Sector' were outlined. Phase 1 focused on the identification of the appropriate state and city for the pilot project (Gujarat) and mapping of relevant stakeholders for its implementation. The report summarised the roles and objectives of the identified stakeholders in affordable housing delivery at all three levels of governance: central, state, and ULB (Chapter 2). The report also examined the policy, legislative, and administrative procedures involved in the delivery of affordable housing in India as a whole (Chapter 3), as well as in Gujarat and Ahmedabad (Chapter 5).

The urban affordable housing policy framework, i.e. PMAY-U, has been robust in its formulation and implementation and has yielded successful results. The framework has a very well defined and structured implementation framework clearly laying out the objectives and scope of work for all three levels of government. However, PMAY-U presents a unique opportunity for India to promote action-oriented leadership in energy efficiency in the affordable housing sector, which has thus far not been exploited. As set in the mission objectives, 12 million dwelling units are going to be constructed in India between 2015 and 2022. This provides a ground-breaking opportunity for the three levels of government to alter energy consumption patterns during construction and post-occupancy to reduce India's overall greenhouse gas (GHG) emissions and help the nation meet its NDCs, while simultaneously achieving its Sustainable Development Goal targets.

Below is a summary of the key findings of this study, including a discussion on the way forward and how to fill the identified gaps:

- **The definition of affordability needs to be broadened, and housing expenditure needs to be understood in terms of both initial and recurring costs.**

The understanding of affordability at the policy and programme level is limited to the initial cost of the dwelling unit. However, the recurring cost poses a significant burden and opportunity cost to the household. The consideration of recurring costs when determining the affordability of the dwelling unit for the household would substantially impact target households' overall quality of life. It would also further enhance the accessibility of affordable housing in the country and broaden the understanding of lifecycle expenditure incurred by a household in accessing a dwelling unit.

- **The lack of available data on residential energy consumption hinders the formulation of energy efficiency measures and code adoption.**

Due to a lack of reliable data on residential energy consumption, there is a limited understanding of household electricity consumption patterns. While there is a significant supply side push for the adoption of energy efficient end-use technologies at the household level (e.g. through initiatives like BEE's Standard & Labelling Programme), there has been limited effort made thus far to study the emerging patterns and trends on the demand side. A comprehensive understanding of residential energy consumption trends would facilitate demand-side interventions and resource planning and would also strengthen building code design and implementation.

- **PMAY-U promotes decentralisation in terms of demand assessment and offers a diverse range of housing types, and there will therefore not be one universally applicable solution for energy optimisation and thermal comfort.**

PMAY-U is applicable in the 4,041 statutory towns in India and offers three distinct delivery mechanisms; thus, ENS implementation would need to factor in a wide range of different aspects, including the local context, climate, housing demand, state and city level governance mechanisms, construction practices, and the local capacities of the ULB and construction industry. ENS implementation should be based on the local demand assessment, linking beneficiaries with their potential energy consumption and determining appropriate energy optimisation strategies accordingly. Selection of construction technologies and materials to achieve the desired levels of thermal transmittance would largely be dependent on the scale of construction, to be economically viable, and the skillsets of the construction workers.

- **The success of policies like PMAY-U depends on the implementation mechanisms used at the ULB level. In order to create an eco-system that responds to the local demand and context and avoid a cookie-cutter ‘one size fits all’ approach, capacity building needs to be undertaken at the ULB level.**

PMAY-U gives the ULB significant scope to undertake its own demand assessment based on the local context, housing demand, land prices, etc. It also allows the ULB to finalise the design and other PMAY-U project components. However, successful implementation of PMAY-U in cities ultimately depends on the ULBs’ capacity to effectively carry out these projects. There is an urgent need to disaggregate the housing demand and targets at the ULB level in order to develop better housing designs and other project components that match the beneficiary’s use patterns, aspirations, and needs, while simultaneously factoring in local energy consumption patterns, minimum requirements for achieving thermal comfort, and construction practices.

- **A large portion of India’s buildings, including the dwelling units sanctioned under PMAY-U, are self-built incremental housing units, and an innovative approach is needed to promote energy optimisation and thermal comfort in such buildings.**

Self-built incremental housing is the most successful delivery mechanism under PMAY-U; two of the four PMAY-U verticals—BLC and CLSS—provide scope for self-built incremental housing. More than 60% of the total dwelling units under PMAY-U are sanctioned under BLC alone, forming the dominant part of the housing stock created under the Mission. However, there is a lack of understanding of how to integrate design support and low cost technologies and material to facilitate energy optimisation and thermal comfort in self-built incremental housing. Hence, there is scope for the research community and industry to engage with the Mission to explore the possibilities for improving the quality of self-built incremental housing, as well as optimising both embodied and operational energy.

India’s unique case presents an unparalleled combination of large-scale and rapid economic development, bringing with it a range of development challenges and needs to address, including higher energy consumption. As the housing units built

under PMAY-U will be long-lasting components of the built-up infrastructure and shape long-term energy consumption patterns, energy efficiency measures need to be introduced in the early stages of development and implemented throughout the building construction and occupancy phases. One way to implement energy efficiency in affordable housing is to ensure ENS compliance in the upcoming projects. There is scope to incorporate energy efficiency parameters into the national policy guidelines and model building bye-laws and ensure the modification and fast-tracking of ENS compliance at the state and city level. As a part of Phase 1 of the project, the legislative and administrative processes related to affordable housing delivery in Gujarat and Ahmedabad were analysed. The analysis revealed that there is good potential to contextualise and incorporate ENS into the local building bye-laws and development permission regimes of Ahmedabad and the PMAY-U implementation mechanism for Gujarat and Ahmedabad. Potential mechanisms for incorporation of ENS into the affordable housing building construction and approval processes under PMAY-U will be further explored through stakeholder consultations and roundtables, to be organised in the near future as part of Phase 2 of the project.

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