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Towards climate-responsive and low-carbon development

Addressing the critical urban issues in Residential and Transport sector in Uttarakhand

Mapping of existing residential sector energy efficiency policies and guidelines in Uttarakhand

Prepared For

G. B. Pant Institute of Himalayan Environment and Development
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Contents

List of Acronyms

AAC	Autoclaved Aerated Concrete
AEEE	Alliance for an Energy Efficient Economy
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
BMTPC	Building Material & Technology Promotion Council
CAGR	Compound Annual Growth Rate
CAN	Central Nodal Agency
CBIC	Central Board of Indirect Taxes and Customs
CEERP	Centre for Energy Economics Research And Policy
CFL	Compact Fluorescent Lamp
CLC	Cellular Lightweight Concrete
CLSS	Credit Linked Subsidy Scheme
CMSC	Central Sanctioning And Monitoring Committee
CAN	Central Nodal Agency
COVID-19	Coronavirus Disease 2019
CPWD	Central Public Works Department
DDA	Designated Development Authority
DSCL	Dehradun Smart City Limited
ECBC-R	Energy Conservation Building Code – Residential (now known as ECO-Niwas Samitha 2018)
EDB	Ease of Doing Business
EIA	Environmental Impact Assessment
ENS	ECO-Niwas Samitha
EPI	Energy Performance Index
EWS	Economically Weaker Sections
FAR	Floor Area Ratio
FSI	Floor Space Index
GDP	Gross Domestic Product
GRIHA	Green Rating for Integrated Habitat Assessment
GSDP	Gross Space Domestic Product
GST	Goods and Services Tax
HIG	High Income Group
HVAC	Heating, Ventilation, and Air Conditioning
ICAP	India Cooling Action Plan
IEA	International Energy Agency
IGBC	Indian Green Building Council
IHR	Indian Himalayan Region
IIT	Indian Institute of Technology
INR	Indian Rupee
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
kg	Kilogramme
km²	Square kilometre
KVA	Kilo-Volt-Ampere
kWh	Kilowatt-Hour
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
LIG	Low Income Group
LPD	Litres Per Day
LPG	Liquefied Petroleum Gas

m^3	Cubic metre
MBBL	Model Building Bye-Laws
MHUPA	Ministry of Housing and Urban Poverty Alleviation
MIG	Middle Income Group
MNRE	Ministry of New and Renewable Energy
MoF	Ministry of Finance
MoHUA	Ministry of Housing and Urban Affairs
MoL&J	Ministry of Law and Justice
MoP	Ministry of Power
MoSPI	Ministry of Statistics and Programme Implementation
MoUD	Ministry of Urban Development
MRP	Maximum Retail Price
MSMEs	Micro, Small, and Medium Enterprises
MW	Megawatt
NBC	National Building Code
NBO	National Building Organisation
NDC	Nationally Determined Contribution
NIUA	National Institute of Urban Affairs
NOC	No Objection Certificates
NMHS	National Mission on Himalayan Studies
NMSHE	National Mission for Sustaining the Himalayan Ecosystem
NSMH	National Society of Minorities in Hospitality
PTCUL	Power Transmission Corporation Of Uttarakhand Limited
PMAY	Pradhan Mantri Awas Yojana
PMAY-U	Pradhan Mantri Awas Yojana (Urban)
PV	Photovoltaic
PWD	Public Works Department
R&D	Research and Development
RA	Regulatory Authority
RAC	Residential Air-Conditioner
RERA	Real Estate (Regulation and Development) Act
SAPCC	State Action Plan on Climate Change
SDA	State Development Authority
SDG	Sustainable Development Goal
SCP	Smart City Plan
SoR	Schedule of Rates
T&D	Transmission & Distribution
TCPO	Town and Country Planning Office
TDR	Transferable Development Rights
TFL	Tubular Fluorescent Lamp
TWh	Terawatt-Hour
UAAVP	Uttarakhand Avas Avam Vikas Parishad
UDD	Urban Development Directorate
UHUDA	Uttarakhand Housing and Urban Development Authority
UJVN	Uttarkhand Jal Vidyut Nigam
ULB	Urban Local Body
UPCL	Uttarkhand Power Corporation Limited
UREDA	Uttarakhand Renewable Energy Development Agency
US	United States
UT	Union Territory

A detailed review of the policy landscape at the state level for Uttarakhand has been conducted to identify entry points for mainstreaming climate change adaption and mitigation into the process of urban development.

Executive Summary

This report presents an analysis of the overall policy framework that drives the residential sector's development in urban India, particularly in Uttarakhand. This document is part of the larger National Mission on Himalayan Studies (NMHS) project, which aims to achieve climate-responsive and low-carbon development in colder climates through low-cost and sustainable interventions. The national laws, policies, and regulations supporting urban governance have been reviewed in terms of housing and energy efficiency. The report primarily focuses on the corresponding state-level framework for Uttarakhand. A detailed review of the policy landscape at the state level for Uttarakhand has been conducted to identify entry points for mainstreaming climate change adaption and mitigation into urban development. The report identifies the following opportunities to achieve energy efficiency and thermal comfort in the urban residential sector in Uttarakhand:

1. Urban Planning
    - Consider climate-responsiveness and sustainability during urban planning
2. Building Bye-laws and Schedule of Rates (SoR)
    - Mandate sustainable and energy-efficient materials for building construction
    - Mandate Eco-Niwas Samhita in the building bye-laws
    - Mandate Central Public Works Department's (CPWD) Green Habitat Accomplished Rating (GHAR) in government housing projects
3. Policy and Programmes
    - Enforce Renewable Energy Policy, focusing on interventions in the residential sector
    - Implement programmes and schemes under Solar Energy Policy for the residential sector
    - Enforce energy-efficient appliances through market mechanisms
    - Enable off-grid (solar) heating systems through market mechanisms to provide thermal comfort in residential units
    - Undertake capacity building of architects, planners, and Urban Local Body (ULB) officials
    - Undertake pilot of the Residential Labelling Programme
    - Provide guidelines and mandatory provisions for passive and sustainable architecture
    - Create a roadmap to ensure thermally comfortable and net-zero energy households in existing residential buildings
    - Create a roadmap to develop a climate-resilient residential sector

While the outcomes of urban planning interventions and mandatory provisions of the Building Bye-laws/SORs can be realised in the short term, policy and programme interventions may take longer to achieve.

An energy-efficient residential building stock's multi-fold benefits will complement several state policies and programmes, such as Uttarakhand: Vision 2030, Uttarakhand State Action Plan on Climate Change, and Uttarakhand Solar Energy Policy 2013, to meet the state's target under Sustainable Development Goal (SDG) 7. It will also help mainstream green building construction, as promulgated in the Uttarakhand Building Bye-Laws, and help achieve the central government's goal of meeting India's National Determined Contributions (NDCs) and SDGs. The study done as part of this report helped the project team identify and understand the possible intervention areas to streamline and include climate-responsive design and low-carbon development under Uttarkhand's existing policy framework.

01 INTRODUCTION

ABOUT THE PROJECT

The Indian Himalayan Region (IHR) represents 16.2% of India's total geographical area and comprises nine states and two Union Territories (UTs), of which Uttarakhand is the most populated state. With a population of over 10 million as per Census 2011 (Directorate of Economics and Statistics, 2020), Uttarakhand also has the highest Gross State Domestic Product (GSDP) amongst the Himalayan states (Economic and Statistical Organization, Government of Punjab, 2020) & (Directorate of Economics & Statistics, 2017). Uttarakhand, with 53,483 square kilometres (km^2), is also the most densely populated Himalayan state. More than 86% of the state is hilly, and about 65% is under forest cover (2017). Even though urban areas constitute only 1.69% of the total geographical area, the state holds more than 30% of the regional population (MoP, 2015). At present, the overall residential sector's electricity consumption in Uttarakhand is approximately 24% of the regional total, as per the Uttarakhand government statistics (MoSPI, 2018). The state has achieved 100% household electrification, and household electricity consumption has tripled from the 2002 baseline. The monthly household electricity consumption is 22.5 kilowatt-hours (kWh)/person in urban areas (National Sample Survey Office, 2014) which expected to grow at a rate of 7% per year (Crisil Infrastructure Advisory, 2015). A summary of Uttarakhand's key indicators is given in Table 1. The number of deaths attributed to extreme climates in the state has also increased from the 2015-16 baseline (National Statistical Office, 2020). This calls for a comprehensive analysis of the current situation, identifying the future planning needed to tackle the extra development pressure, and, a set of recommendations and actions that the states and city authorities can implement in the short and medium term to embark on this journey.

The overall residential sector's electricity consumption in Uttarakhand is approximately 24% of the regional total, as per the Uttarakhand government statistics (MoSPI, 2018).

Key Uttarakhand statistics

Population
10.08 million (as per Census 2011)

Total geographical area
53,483 km²

Area under hilly region
86% (45,996 km²)

Forest cover
65% (34,764 km²)

Total urban area
1.69% of total geographical area

Total urban population
30% of total population

Electrification rate
100%

Total electricity consumption
11,208.82 megawatts (MW) (2017-18)

Household electricity consumption in urban areas
22.5 kWh/person/month (expected to grow at annual rate of 7%)

Contribution of the residential sector to overall electricity consumption (percentage)
24% (2017-18)

Recognising that the increasing demand for energy and other resources will put immense pressure on the Himalayan ecosystem, the Ministry of Environment, Forest & Climate Change (MoEF&CC) aims to address critical issues related to conservation and sustainable development in the region (MoEF&CC, n.d.) through the National Mission on Himalayan Studies (NMHS). One of the focus areas under this mission (The missions are the main functions and the strategic objectives pursued, using financial, human and material resources for those purposes. The programs represent homogeneous groups of activities to achieve the defined objectives in missions (researchGate) addresses the critical/strategic urban issues in the residential and transport sectors in Uttarakhand. The overall objectives of the NMHS are the following:

01 Foster conservation and sustainable management of natural resources

02 Enhance the overall economic well-being of the region

03 Support human and institutional capacity building and the knowledge and policy environment in the region

04 Strengthen the development of climate-resilient core infrastructure and basic service assets

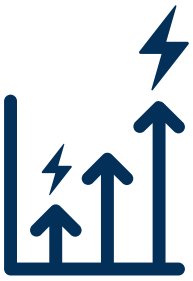
05 Support national priorities like the Sustainable Development Goals (SDGs) and Nationally Determined Contributions (NDCs) under the Paris Agreement

The rapid increase in the urban population and city-based economic activities has put urban infrastructure under significant stress, not to mention the unprecedented air pollution level in Indian cities. The Himalayan states and their cities are no exception in this regard. Use in parallel/simultaneously instead the issue of urban infrastructure has come to the fore of policy-related discourse at various levels. Fostering research and development (R&D) in areas related to energy and the built environment in colder regions is necessary to address the targeted issues. In this context, the project adopts a state-specific approach in designing required interventions to support the NMHS objectives. The overall project aims to address the critical urban issues in Uttarakhand's residential and transport sectors by creating collaborative, science-based policy-practice initiatives through a network of policy makers and practitioners.

1.1 Background

Urbanisation in India is increasing the number of towns and cities, along with an increase in the urban population[1]. India's total electricity consumption doubled to 1130.2 billion kWh in 2017-18, from 554.9 billion kWh in 2008-09, with a Compound Annual Growth Rate (CAGR) of 7.39 (Central Statistics Office, MoSPI, 2019). It ranked third in 2017 as the largest electricity consumer, after China and the United States (US) (US. Energy Information Administration, 2017).

The building sector's contribution to India's Gross Domestic Product (GDP) was 8.04% in 2014-15, and it is estimated to increase to 16.74% by 2025 (Planning Commission, 2011). Assuming an annual growth rate of 4.6%, India will add approximately one billion m2 of built-up area (new construction) by 2050 (AEEE analysis). However, poor construction and non-adoption of energy efficiency measures undermine the energy-saving potential. India must develop energy efficiency strategies focused on the residential sector to limit the increasing energy demand.



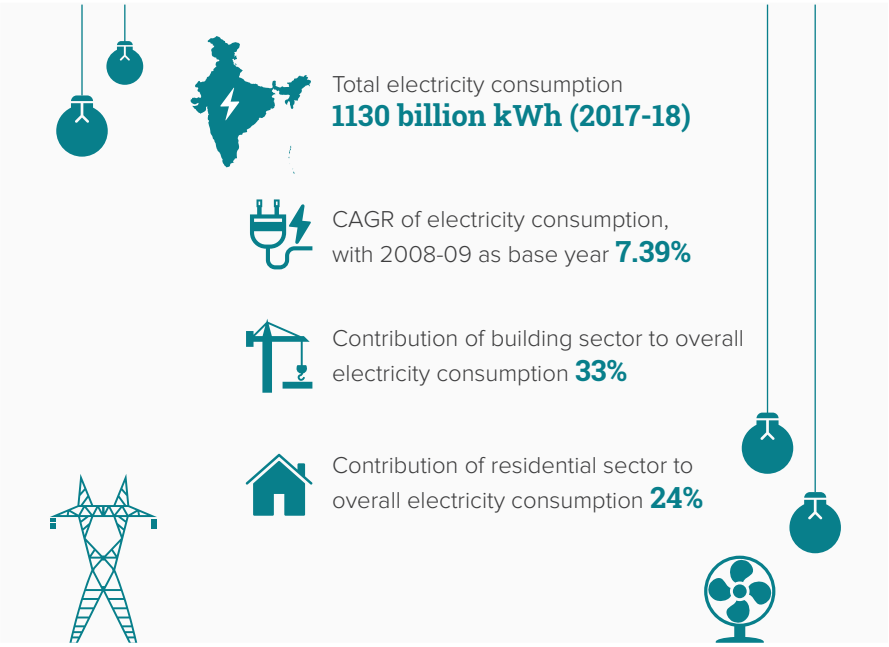
The monthly household electricity consumption is **22.5 kilowatt-hours (kWh)/ person** in urban areas (National Sample Survey Office, 2014) and is expected to grow at a rate of 7% per year (Crisil Infrastructure Advisory, 2015).

Building sector to India's Gross Domestic Product (GDP) was **8.04% in 2014-15**, and it is estimated to increase to **16.74% by 2025** (Planning Commission, 2011)

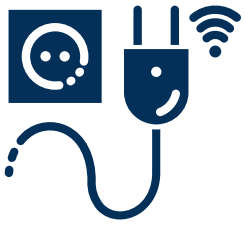
1. Projections are pre-Coronavirus Disease 2019 (COVID-19) estimates, and, as a result, some of them are likely to change, at least in the short or medium term.

In India, the building sector consumes about 33% of total energy, following the industrial sector, which accounts for 42% of net production (Central Statistics Office, MoSPI, 2019). The residential segment contributes as much as 24% of the energy consumed by the building sector. If the current scenario continues, buildings will account for 55% ofthe total electricity consumed by 2047 (US. Energy Information Administration, 2017). Furthermore, electricity demand in the residential sector is predicted to experience a five-fold increase by 2032 and more than eight-fold increase by 2050. In residential buildings, fans and lights are the primary energy consumers, whereas, in commercial buildings, major electricity is consumed in Heating, Ventilation, and Air Conditioning (HVAC) systems (AEEE, 2017). Additionally, 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 and operate these buildings. The key statistics are summarised below in Table 1.

Table 1: Key electricity consumption statistics in India



Uttarakhand's GDP grew at a rate of 9.5% from 2013-14 to 2017-18, and the 2019-20 GDP is estimated to be 11% higher than the revised estimate for 18-19 (PRS, 2019). The annual residential per capita electricity consumption in Uttarakhand is 237 kWh, whereas the national average is 194 kWh (Alliance for an Energy Efficient Economy, 2019), and this is bound to increase due to the decadal population growth rate of 20% since 1961 (Directorate of Economics and Statistics, Uttarakhand).



The annual residential per capita electricity consumption in Uttarakhand is 237 kWh, whereas the national average is 194 kWh

Rapid urbanisation is mounting considerable pressure on the available resources and infrastructure, with an ever-increasing demand for housing across different states in India. In Uttarakhand, the urban centres are experiencing significant increases in housing demand across income groups. The housing sector needs low-cost, sustainable, and affordable solutions that ensure the occupant's comfort to minimise the carbon footprint. The fragmented character of the residential sector, with a lack of guidelines for climate-responsive design and low-carbon construction, has impeded past efforts to address energy efficiency in this sector.

The residential buildings in the cold climate of Uttarakhand, and the Himalayan region, require strategic interventions in building design and construction, and a holistic approach to climate change adaptation and mitigation. The design, construction, and operation of residential buildings in a cold region vary considerably and have to prevent heat loss and ensure heat gain to enhance indoor thermal comfort while simultaneously optimising energy use. Since the design, construction, and operation of residential buildings in cold climates in India remain largely unaddressed, there is an opportunity to explore climate-responsive and energy-efficient design and construction strategies to avoid the long-term lock-in of inefficient, high energy-consuming residential buildings while also ensuring that the growth follows a low-carbon development pathway.

1.2 Report objective

This report aims to map the existing residential building design and energy-related policies/ guidelines that address climate change, along with their implementation status, under various departments in the local/ state government of Uttarakhand. The detailed mapping and review of the existing policy landscape will facilitate the identification of critical issues and interventions already recommended for Uttarakhand, and the significant implementation issues in low-carbon development.

1.3 Our approach

A macro-level analysis of policy related to housing development and energy efficiency in India was done to map the policies, programmes, and initiatives undertaken by the central government and government of Uttarakhand. The aim was to identify the gaps and challenges in implementing relevant policies and the key players actors necessary to pave the pathway for low-carbon development of the residential sector in Uttarakhand. The report is based on literature review of the information available in the public domain.

1.4 Report structure

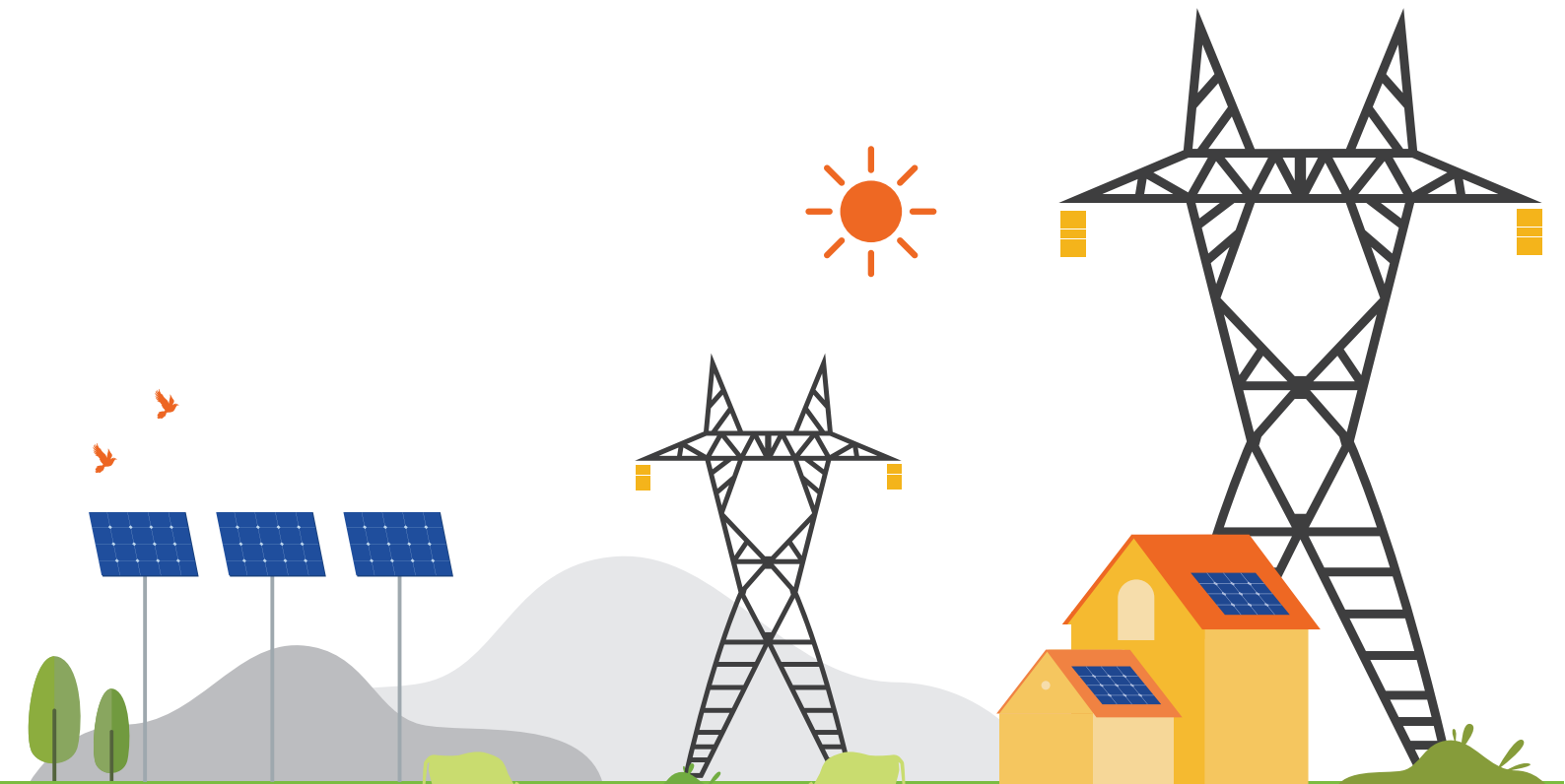
The report includes the following chapters:

Chapter 2 **National policy overview:** This chapter summarizes the various policies and regulatory frameworks institutionalised by the central government, an overview of the residential sector and its growth, and the energy efficiency landscape of the building sector.

Chapter 3 **Policies and programmes in Uttarakhand:** This chapter maps existing policies and regulations for the residential sector in Uttarkhand and key stakeholders.

Chapter 4 **Challenges and opportunities in the current policy scenario:** Through the information gathered and analysed in Chapters 3 & 4, we identify the major challenges and opportunities in achieving energy efficiency in the urban residential sector in Uttarakhand.

Chapter 5 **Conclusions:** This chapter proposes a way forward in the above mentioned sector.



02 NATIONAL POLICY OVERVIEW

OVERVIEW

Residential energy demand in India is drastically increasing and is predicted to grow significantly over the next few decades due to increasing lifestyle aspirations, appliance penetration, and climate change. Many government branches have established focused programmes directed by the targets and indicators set in the NDCs, SDGs, and schemes like “24X7 Power for All”. The central government defines country-level targets, programmes, schemes, and policies, and, the state government adapts them to the local context and needs. The Ministry of Housing and Urban Affairs (MoHUA) check housing for all. The ministry also administers other programmes and policies such as Pradhan Mantri Awas Yojana (PMAY), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Smart Cities, Jawaharlal Nehru National Urban Renewal Mission (JNNURM), and other Acts and Rules such as the Real Estate (Regulation and Development) Act (RERA), Tenancy Act, Model Building Bye-Laws (MBBL), Municipal Law, etc. Its attached offices and bodies, including the Town and Country Planning Office (TCPO), National Building Organisation (NBO), Central Public Works Department (CPWD), National Institute of Urban Affairs (NIUA), Building Material & Technology Promotion Council (BMTPC), and others are responsible for supporting the ministry and allied state-level offices to implement MoHUA programmes, policies, and acts (Ministry of Housing and Urban Affairs, Govt. of India, 2020).

Many government branches have already established focused programmes directed by the targets and indicators set in the NDCs, SDGs, and schemes like “24X7 Power for All”.

2.1 The residential sector in India

MoHUA is responsible for broad policy formulation and the monitoring of programmes on urban housing and urban at the central level. Urban development being a state subject, under the Constitution and 74th Amendment Act of 1992 provides a common framework for the structure and mandate of ULB and has delegated has delegated many functions to Urban Local Bodies (ULBs). However the Government of India, plays a key coordinating and monitoring role and supports various urban housing programmes, urban livelihood missions, and overall urban development through Central and Centrally Sponsored Schemes. The Ministry facilitates the resolution of various urban issues through appropriate policy guidelines, subordinate legislation, and sectoral programmes. This section summarises the significant housing policies/ schemes launched by the Government of India that have contributed to the housing sector.

In addition to the essential features in redevelopment and greenfield models of Smart Cities, at least **80% of the buildings** should be energy-efficient and green.

National Urban Housing & Habitat Policy 2007 (MoHUPA, 2007) seeks to promote various types of public-private partnerships to realise the goal of "Affordable Housing for All', emphasizing the urban poor. The policy intends to promote sustainable habitat development to ensure an equitable supply of land, shelter, and services at affordable prices to all sections of society.

The policy could help establish a linkage between building construction and energy efficiency by including the use of technology to modernise the housing sector to enhance the energy efficiency, promoting R&D on alternative building materials and technologies, outlining steps for the standardisation and quality benchmarking of building materials, and incorporating provisions into the Building Bye-laws for innovative energy conservation practices.

Smart City Mission, 2015 (MoUD, 2015), mandates to meet 10% of a smart city's energy requirement through solar energy and makes provisions for energy-efficient street lighting, adequate water supply, and rainwater harvesting. In the case of redevelopment and greenfield models of Smart Cities, in addition to the essential features, at least 80% of the buildings should be energy-efficient, green buildings. Furthermore, at least 15% of the total housing provided in greenfield development should be affordable housing.

Pradhan Mantri Awas Yojana (Urban) was launched by MoHUA in June 2015 to ensure housing for all in urban areas (MoHUPA, 2015). It is a first-of-its-kind initiative designed to provide 'Housing for All' by the end of 2022. The Mission offers Central Assistance to implementing agencies through States/UTs and Central Nodal Agencies (CNAs) to provide houses to all eligible families/ beneficiaries against the validated housing demand. Housing provided under the mission should be designed and constructed to meet the structural safety requirements conforming to the National Building Code (NBC) and other relevant Bureau of Indian Standards (BIS) codes (MoHUPA, 2015). The Mission will be implemented through four verticals, viz. "In-situ" Slum Redevelopment, Affordable Housing through Credit Linked Subsidy, Affordable Housing in Partnership, and Beneficiary-Led Individual House Construction (MoHUPA, 2015).

Technology Sub-Mission under the PMAY was set up to facilitate modern, innovative, and green technologies and building materials to ensure faster and better quality housing construction. The mission aims to facilitate the preparation and adoption of layout designs and building plans suitable for various geo-climatic zones and assist state agencies deploy environmentally-friendly technologies. One of the mission's key roles is to coordinate with various regulatory and administrative bodies to mainstream and upscale the deployment of modern construction technologies and material in place of conventional construction and coordinate with agencies working on green and energy-efficient technologies, climate change. (MoHUPA, 2015).

Real Estate (Regulation and Development) Act, 2016: (MoL&J, 2016) The Government of India introduced the RERA in 2016, and all the provisions of the Act came into effect in May 2017. Every state is required to establish a Regulatory Authority

(RA), which will supervise all the activity in the real estate sector and regulate and promote the development of this sector in the state. It aims to protect the rights of buyers by introducing a grievance redressal system through the RA.

National Mission on Sustainable Habitat: This is one of the eight missions under the National Action Plan on Climate Change, which aims to tackle climate risks and facilitate clean, green, and sustainable development. To accelerate the mission goals, the Climate Smart Cities Assessment Framework was launched by MoHUA in 2019 for 100 Smart Cities. Energy & Green Buildings is one key component of this framework and focuses on the implementation and enforcement of green buildings, green building ratings, and energy efficiency.

Reduction of GST: To enhance the affordable housing sector, the Government of India cut the goods and services tax (GST) rates for under-construction housing projects to 5%, from the previous rate of 12%, and from 8% to 1% for affordable housing projects (MoF, 2019). In Uttarakhand, for construction of a complex building, civil structure, or part thereof intended for sale to a buyer, wholly or partly, 12% GST is charged. Service Tax Exemptions are applicable to GST for works related to the Housing for All (Urban) Mission/ PMAY, as GST Council Services (CBIC, 2019) decided.

2.2 Energy Efficiency in the Residential Sector

Given the increasing electricity demand and the need to manage it, efforts at energy conservation were initiated by the Government of India by introducing of the Energy Conservation Act (EC Act), 2001. Recent developments, such as the revision of the National Building Code (2016), Model Building Bye-Laws (MBBL) (2016), Eco Niwas Samhita (ENS) 2018, and State Action Plans on Climate Change (SAPCC), are set to potentially substantially increase the impact on energy savings. The importance of energy efficiency in buildings has been recognised and addressed in fundamental building norms and, green building certifications. These have been an integral part of central and state policies and apply to almost all types of buildings. The polices/codes mentioned below highlight the importance of energy efficiency in residential buildings.

National Building Code of India (NBC),2016 (BIS, 2016) is a comprehensive building code that unifies building regulations across the country by providing national guidelines. The provisions of this code are intended to serve as a model for adoption by government departments, state/local bodies, and other construction agencies all over the country. Part 11, 'Approach to Sustainability' provides guidelines to make buildings and the built environment energy-efficient and environmentally compatible. It describes multiple measures for low energy building design and construction covering the parameters that must be considered in the planning, design, construction, operation, and maintenance of the building, and those related to land development, from a sustainability point of view.

Model Building Bye-Laws 2016 (MoHUA, 2016) are mandatory legal guidelines developed by TCPO to regulate building design and construction to ensure controlled development of an area. Environmental concerns discussed in Chapter 10, including green buildings, sustainability provisions, rainwater harvesting, norms for solar rooftop photovoltaic (PV) installations, and sustainable building materials. It also mentions green building rating systems. Chapter 13 discussed the ease of doing business through an Online "single window" building plan process. It also directs the state and local authorities to enforce the Energy Conservation Building Code prepared by the Bureau of Energy Efficiency (BEE).

CPWD Green Rating Manual – 2019, released by MoHUA in April 2019, proposed a building rating scheme developed by CPWD, which is also known as the Green Habitat Accomplished Rating (GHAR) (Central Public Works Department (CPWD), 2019). The rating criteria include passive architecture design strategies, sustainable building materials, and energy efficiency and conservation, focusing on an efficient building envelope, equipment, lighting, renewable energy, and innovations in energy efficiency, among other criteria.

To enhance the **affordable housing sector**, the Government of India cut the goods and services tax (GST) rates for under-construction housing projects to **5%, from the effective rate of 12%, and from 8% to 1% for affordable housing projects (MoF, 2019).**

07

Measures for energy optimisation and user comfort include:

01 Site planning and development;

02 Energy-efficient building envelope measures;

03 Shading for openings;

04 Efficient lighting;

05 Use of sustainable and local materials;

06 Adoption of alternative construction technologies and materials that are cost-effective and sustainable; and

07 Renewable energy integration to sustainably meet the energy demand

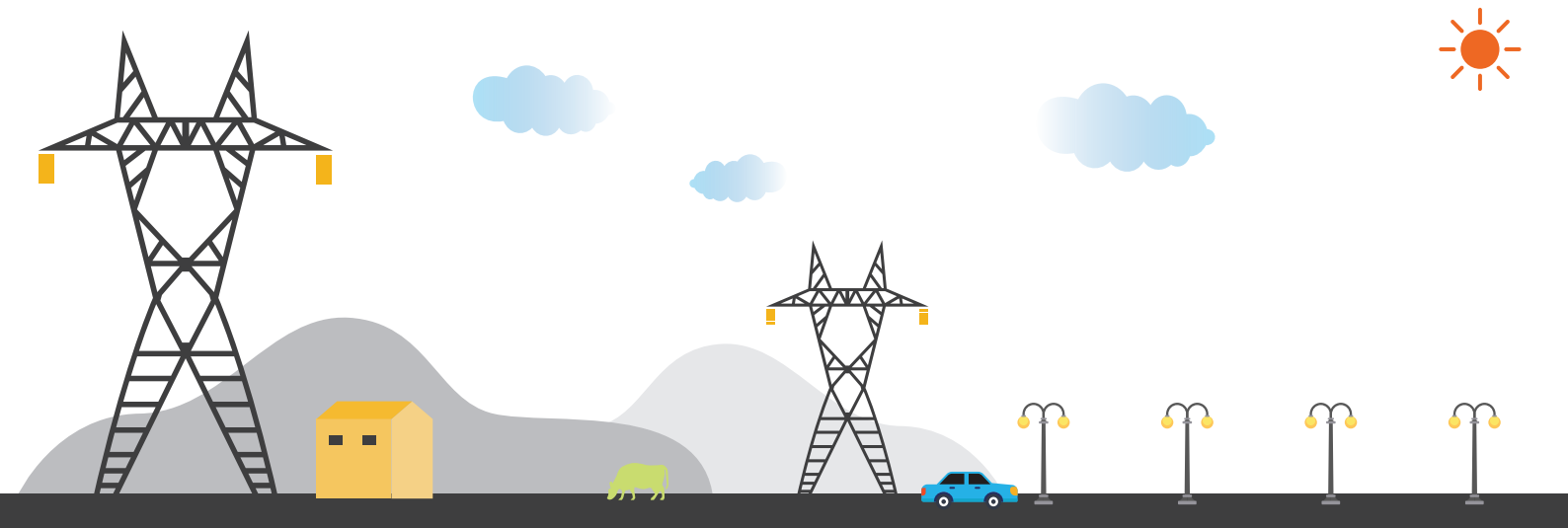
Eco-Niwas Samhita (ENS) (MoP, 2018), launched in December 2018 by the Ministry of Power (MoP), has been developed to set minimum building envelope performance standards for residential buildings in India. Part-I of the Code has been launched, recommending minimum standards for building envelope designs to ensure energy-efficient residential buildings. The code applies to (a) "Residential Buildings" built on a plot area ≥500 m^2 and (b) Residential part of "Mixed land-use building projects", built on a plot area of ≥500 m^2. However, states and municipal bodies may reduce the plot area based on the prevalent plot's sizes in their area of jurisdiction.

Green building ratings (MNRE, 2012), such as Indian Green Building Council (IGBC) Homes, Leadership in Energy and Environmental Design (LEED) Homes, and Green Rating for Affordable Housing, have been developed by IGBC, LEED, and Green Rating for Integrated Habitat Assessment (GRIHA), respectively. The ratings comprise a predefined set of criteria relating to the building design, construction, and operations. Their approach is to encourage the adoption of simple and low cost measures and enhance user comfort with no/ minimal additional cost to the developer or occupant. Measures for energy optimisation and user comfort include: (1) Site planning and development; (2) Energy-efficient building envelope measures; (3) Shading for openings; (4) Efficient lighting; (5) Use of sustainable and local materials; (6) Adoption of alternative construction technologies and materials that are cost-effective and sustainable; and (7) Renewable energy integration to sustainably meet the energy demand.

Energy Efficiency Label for Residential buildings: BEE has developed energy efficiency labels for residential buildings (Bureau of Energy Efficiency, 2018). The main objective of the labelling programme is to complement the efforts of ENS implementation and help home buyers compare the energy efficiency performance of different houses, thus creating a transparent market for efficient homes and driving market transformation. Both new and existing residential units are included under the scope of the labelling programme. Unlike the ENS, the label is applicable for an individual dwelling unit and not for an entire building. Although the initiative was launched in December 2018 as a voluntary scheme, no guidelines or programmes have been initiated to implement the scheme, meaning a large section of the residential sector can benefit.

India Cooling Action Plan: The India Cooling Action Plan (ICAP), developed by the Ozone Cell, MoEF&CC, aims to achieve a reduction in cooling demand, reduction of refrigerant use, and improvements in energy efficiency across all sectors (Ministry of Environment, Forest & Climate Change, 2019). Even though ICAP's prime focus is on reducing India's cooling demand, it also provides recommendations on accelerating passive design and energy efficiency codes for buildings, adopting adaptive thermal comfort standards, and promoting not-in-kind technologies. Low energy alternatives, sustainable technologies, thermal comfort for all, enhancing livelihoods, and making the residential sector resilient are key focuses of the ministry.

Appliance Standards and Labelling: BEE's standard and labelling programme currently include ten appliances under the mandatory labelling scheme and 16 appliances under the voluntary scheme (Bureau of Energy Efficiency, 2020). Out of these 26 appliances/ pieces of equipment, nine home appliances—residential air-



conditioners (RACs – Cassettes; Floor standing; Inverter AC), Light Emitting Diodes (LEDs), Electric Geysers, Colour TV, Tubular Fluorescent Lamps (TFLs), and refrigerators (direct cool and frost-free)—are under the mandatory star rating programme. Seven appliances—ceiling fans, liquefied petroleum gas (LPG) stoves, washing machines, computers (laptops), microwave ovens, solar water heaters, and pump sets—are under the voluntary rating scheme.

Looking at the entire landscape for energy policies and codes in India, we can see that the importance of energy efficiency in buildings has been recognised from the early stages. However, the policies developed at the central level do not get implemented in a state unless the state government notifies the policies or programmes in its respective state gazette. The state, at its disposal, can also notify policies and impose new regulations to achieve some of the state's targets and government's plan. Therefore, the state government plays a crucial role in implementing and monitoring national-level policies. The following chapter examines the various policies in Uttarakhand that focus directly or indirectly on climate change action and energy efficiency in the residential sector.

Building Materials and Technology Promotion Council (BMTPC): BMTPC was established in 1990 by the Ministry of Urban Development (now MoHUA) to bridge the gap in R&D on new building material technologies and their application (MoHUA, 2020). They also undertake capacity building and skill development of professional construction agencies, promote new technologies, and consultancy services, including third-party inspection of government-led housing projects. Their key focus areas include environmentally-friendly materials, construction of model demonstration houses using energy-efficient and environmentally-friendly technologies, and development of home design packages (design concepts for housing under Indira Awas Yojana, using alternative materials and technologies). They are also developing a compendium of energy-efficient construction materials and technologies based on region, cost-effectiveness, and suitability for low-cost housing.

03

POLICIES AND PROGRAMMES IN UTTARAKHAND

Uttarakhand is one of the most populated states in the IHR, and the state government plays a crucial role in safeguarding its environment and biodiversity. To drive economic growth, the Government of Uttarakhand emphasises "Clean, Pollution-Free Environment" as one of the reasons to invest in the state. However, with tourism growing significantly every year and a rising population, the state could face unprecedented challenges ahead, exacerbated by rapid industrialisation and urbanisation. The project team has attempted to map the various policies and programmes undertaken by the Government of Uttarakhand to combat climate change and its adverse impacts, address increasing housing demand, and promote energy efficiency in order to meet the state's commitment to achieving the SDGs and NDCs.

To drive **economic growth,** the Government of Uttarakhand emphasises **"Clean, Pollution-Free Environment"** as one of the reasons to invest in the state.

3.1 Policy landscape for climate action

The key programmes that drive the energy sector are the National Solar Mission, National Mission on Enhanced Energy Efficiency, National Mission on Sustainable Habitat, and Nation Wind Mission. The **Uttarakhand State Action Plan on Climate Change (SAPCC)** was developed in 2014 (Government of Uttarakhand, 2014) and aims to make the state carbon neutral by 2020. The following steps have been taken by the state to combat climate change:

01 Several ongoing programmes/projects, such as the natural-resource based livelihoods programme, Green India Mission, and National Mission for Sustaining the Himalayan Ecosystem (NMSHE), focus on conserving biodiversity, combating disasters like floods, and enhancing the economy through sustainable measures.

02 Targeted activities for commercial buildings under the SAPCC's Human Health and Urban Development section include: building retrofitting with Compact Fluorescent Lamps (CFLs) and LEDs, promotion and construction of green buildings through property tax concessions, solar water heaters, development of strategic knowledge on climate change, provision of rainwater harvesting tanks in all ULB buildings and new construction in municipal limits, promotion of CFLs and LEDs in all ULB buildings, promotion of installation of solar lights and solar geysers in all ULB buildings.

03 Mitigation measures are also proposed, such as reducing energy use, improving energy efficiency and increasing the use of renewable energy to facilitate research and education, and increasing the awareness and motivation of stakeholders and the general public to adopt energy-efficient measures through capacity building, workshops, interactive discussions, and presentations.

UREDA also promotes the installation of **Solar Water Heating Systems** under the Jawaharlal Nehru National Solar Mission. Up to 2015-16, the total installed capacity is **33,00,250 litres per day (LPD)**

State Climate Change Centre (SCCC): SCCC Uttarakhand was set up by the Department of Science and Technology under the NMSHE in 2016. The centre's goal is to integrate state climate change actions into the state government bodies. The aim is to enhance the capacity of the state authorities and create a model for implementing the SAPCC, with a focus on water, forestry, disaster management, and energy. Since its inception, the centre has advanced significantly and paved the path for the state to integrate climate action into its development planning and process.

Twenty Point Programme: The state launched the "Twenty Point Programme" in 1975 and subsequently revised it in 1982, 1986, and, most recently, in 2006, to eradicate poverty and improve quality of life (Twenty Point Programme, Government Of Uttarakhand, India., 2020). Point #6, "Subke Liye Aawas (Housing for All)", is monitored by the target set for Rural Housing under the Indira Awaas Yojana and Economically Weaker Section (EWS)/Low Income Group (LIG)/ Middle Income Group (MIG) houses in urban areas. Point #18, "Grameen Oorja", focuses on renewable energy and electricity supply, among four other indicators.

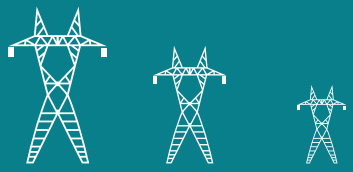
Uttarkhand Solar Energy Policy: The Uttarakhand Solar Energy Policy 2013 (Uttarakhand Power Corporation Limited (UPCL), 2013) was enacted with the objectives of promoting green and clean power using solar energy to reduce dependency on conventional fuel and facilitating environmental pollution mitigation, among three others. One of its specific targets was to set up 500 MW of solar plants by 2017, but this was eliminated during the second amendment, done in 2018. As of March 2019, the total grid-interactive solar power capacity was 306.75 MW, against an estimated potential of 16,800 MW (MoSPI, 2020). The policy promotes the establishment of solar

power projects; however, it does not focus on solar photovoltaic systems for residential buildings. Nevertheless, with the aim of promoting renewable energy, Uttarakhand Renewable Energy Development Agency (UREDA) is installing LED-based Solar Home Lighting Systems under the aegis of Renewable Energy Programmes. From 2008-2011, more than 6,500 such systems were installed by UREDA across the state (Department of Renewable Energy, Govt. of Uttarakhand, 2020). UREDA also promotes the installation of Solar Water Heating Systems under the Jawaharlal Nehru National Solar Mission. Up to 2015-16, the total installed capacity is 33,00,250 litres per day (LPD). However, even though the scheme is applicable for the both residential and commercial building sectors, there has been minimal penetration in the residential sector.

Uttarakhand Vision 2030: In 2018, the Department of Planning, Uttarakhand adopted "Uttarakhand: Vision 2030", outlining the state's vision, targets, and indicators for the SDGs up to 2030 (Institute for Human Development, 2018). The vision document outlines ten focus areas, including planning for sustainable urbanisation and enhancing environmental sustainability. Under this, the aim is to reduce the use of fossil fuels and opt for renewable energy, while planning for rapid urbanisation. There is also a focus on reducing greenhouse gas emissions to zero by 2030; however, the strategies to achieve this are limited to replacing biomass with LPG for cooking, increasing the use of energy-efficient equipment, and replacing conventional lighting and heating systems with LEDs and solar systems, respectively. No emphasis has been made on buildings' operational energy use or energy efficiency. Furthermore, no funds have been allocated to energy efficiency-related measures/ programmes. However, the broad goals set under the deployment of green energy include:

Reducing energy consumption by up to **25 %;**

Meeting 15% of the total energy demand through **renewable sources**; and



Reducing transmission & distribution (T&D) losses to 9% (they were close to 25% as of 2019).

7 AFFORDABLE AND CLEAN ENERGY

Below are the targets set under the SDG 7:

Ensure universal access to **affordable, reliable, and modern energy access**

Increase the share of **renewable energy** in the global energy mix

2x Double the global rate of **improvement in energy efficiency**

The climate change policies formulated by the Uttarakhand Government mainly focus on enhancing energy efficiency and promoting solar energy in commercial and government buildings. The only notable measures for the residential building stock are the Energy Conservation Building Code (ECBC) for construction, new green building construction, and retrofitting of old buildings under the aegis of the National Sustainable Habitat Mission. However, these are only applicable in government buildings/ projects.

The main implementing authority lies with the Urban Development Department (UDD) and the ULBs for matters concerning urban development and programmes; Uttarakhand Jal Vidyut Nigam (UJVN), Power Transmission Corporation Of Uttarakhand Limited (PTCUL), and Uttarakhand Power Corporation Limited (UPCL), on the power generation, transmission and distribution front, along with UREDA, are in charge of implementing programmes related to renewable energy and energy conservation. The following section elaborates upon the institutional framework and various policies/schemes for the residential sector in Uttarakhand.

3.2 Institutional and policy landscape for the residential sector

The Uttarakhand Urban and Country Planning and Development Act was adopted, amended, and contextualised for the state of Uttarakhand from "The Uttar Pradesh Urban Planning and Development Act, 1973" and came into force in 1973. It was amended in 2013 as the Uttarakhand Urban and Country Planning and Development (Amendment) Act, 2013 (UHUDA, 2020). The Department of Town & Country Planning, Uttarakhand acts as the nodal department to prepare guidelines for regulated urban development in the state. The department is entrusted with the preparation of master plans for urban centres, zonal plans, and industrial hub plans for integrated planned urban development.

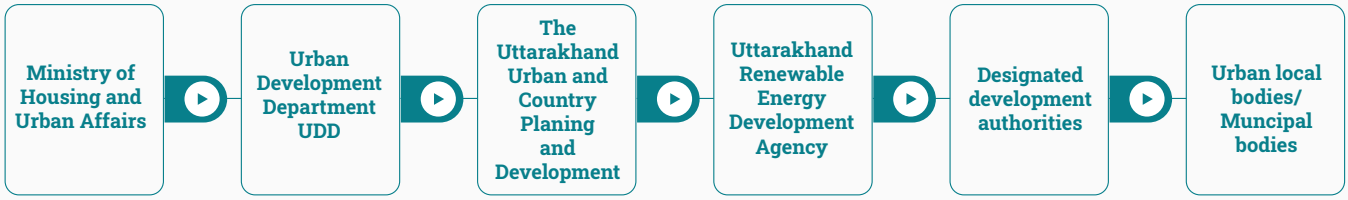
Jan Awas Yojana was introduced in 2016 to provide **more than 35,000** homes for various sections and income groups, and, in 2018, the Uttarakhand Awas Niti (Uttarakhand Housing Policy) was issued to ensure housing for weaker sections of the population.

Designated Development Authorities (DDAs): Uttarakhand Housing & Urban Development Authority (UHUDA) (UHUDA, 2020) has area wise DDAs in every major city, which act as local decision-making agencies and oversee the overall development of that area. A DDA is an autonomous state government agency responsible for urban planning and development control. The objective of these authorities is to ensure the implementation of different schemes and plans and environmental protection. Their main roles and responsibilities are:

- Ensuring implementation of the master plan
- Acquisition of land to implement the various schemes
- Enforcement of plans and development schemes
- Adaptation of measures for the protection of the natural environment in the development area

There are 92 ULBs in Uttarakhand (8 Municipal Corporations, 41 Municipal Councils, and 43 Town Panchayats). To streamline the provisions for building regulations and construction and assist citizens, the Uttarakhand Building Construction and Development Bye-laws 2011 were issued, applying to the entire state of Uttarakhand (UTCP, 2017). The governance structure for housing and urban development in the state is illustrated in Figure 1 below.

Figure 1: Housing and urban development governance structure in Uttarakhand; Source: (UHUDA, 2020)



Being the nodal agency, the TCPO is involved in framing state housing policies, building bye-laws, and zoning regulations. UHUDA develops the guidelines for construction, building approval, and sustainability measures. In addition to state norms, there are central schemes implemented in the state for further development. As with mapping codes/ guidelines for residential buildings at the central level in Chapter 3, this chapter maps all procedures at the state level, including their approach and designated authority.

Along with increasing development and urbanisation, the demand for affordable housing development is growing. In the case of Uttarakhand, almost all houses under the PMAY-U scheme are grounded against the total number of houses sanctioned. The status of PMAY in the state is presented in Table 2 below. Furthermore, the state has achieved mandatory conditions like the "Single-window time-bound building approval process", adopted an approach for deemed building permission and layout permission based on pre-approved layouts and building plans, incorporated additional Floor Area Ratio (FAR)/ Floor Space Index (FSI), and amended existing rent laws in line with the Model Tenancy Act (MoHUA, CSMC Minutes of Meeting, 2019).

Table 2: Current PMAY status in Uttarakhand (August 2020)

Name	Proposed projects considered	Financial Progress (INR in Crore)			Physical Progress (no.)		
		Project investment	Central assistance sanctioned	Central assis-tance released	Houses sanctioned	Houses grounded for construction	Houses completed
Uttarakhand	209	2959.08	727.37	410.28	39,084	22,651	15,932

Source: (Ministry of Housing and Urban Affairs, 2020)

The Smart Cities Mission was launched in 2015 with the objective of promoting sustainable and inclusive cities that provide core infrastructure and ensure decent quality of life for the citizens, a clean and sustainable environment, and application of 'Smart' Solutions. Dehradun was selected in 2017 in the third round of this programme (MoUD, 2015). The Smart City Plan of Dehradun, under area-based development projects, covers facade improvement, green building design features in commercial buildings, and solar energy solutions & rainwater harvesting in government buildings (DSCL, 2020). However, no information on measures in the residential sector could be found in this plan.

The Government of Uttarakhand, under UHUDA, has formulated three different schemes (Land Pooling Scheme, One Time Settlement Scheme, and Jan Awas Yojana) related to land acquisition and housing, which are focused on facilitating land pooling for public welfare and development, to regulate unauthorised construction and housing for the EWS in the state (UHUDA, 2020). The Jan Awas Yojana was introduced in 2016 to provide more than 35,000 homes for various sections and income groups, and, in 2018, the Uttarakhand Awas Niti (Uttarakhand Housing Policy) was issued to ensure housing for weaker sections of the population (i.e. the EWS and LIG).

The state-level schemes relevant to the residential sector are summarised in Table 3 below:

Table 3: State-level schemes related to the residential sector

Policy	Year	Relevant authority	Roles and responsibilities	Observations
Uttarakhand Urban and Country Planning and Development Act, 1973 (adapted to Uttarakhand's context) **Uttarakhand Urban and Country Planning and Development (Amendment) Act, 2013**	1973 (amended in 2013)	TCPO	• Declaration of development areas • Master Plans and Zonal Developmental Plans • Development of land in a developed area • Regulation of land use: use of land and buildings in compliance with the plans • Acquisition and sale of land	Uttarakhand Housing and Urban Development Authority oversees all the development areas in the state as stipulated in Uttarakhand Urban and Country Planning and Development (Amendment)Act, 2013, Uttarakhand Act No. 25 of 2013, vide amendment No. 5 (a).
Uttarakhand Building Construction and Development Bye-Laws / Regulations	2011 (amended in 2017)W	TCPO	• Guidelines for construction of various types of residential units and provisions for sanctions • Also includes separate chapter on sustainable measures	A dedicated section (Chapter 03, Section 3.1.1) of the document explains the bye-laws in detail.
PMAY: Affordable Housing	2015	MoHUA, Uttarakhand Avas Avam Vikas Parishad (UAAVP)	Scheme ensuring housing for all – PMAY in urban areas	In total, 9 projects are currently running under UAAVP.
Smart City Mission	2015	UHUDA, Mussoorie Dehradun Development Authority	Drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology	Initiated in 2017, the mission focuses on pan-city solutions for development.
Development of small towns in hill areas		Government of Uttarakhand	Planning in small hill towns to check outmigration from the hill areas	
Uttarakhand Awas Niti - 2018	2018	UHUDA	Ensure housing for EWS and LIG under aegis of PMAY-U	• Individual beneficiary led construction • Benefits to private developers willing to develop EWS and LIG houses as per the scheme • Performance Guarantee (10% of total project cost) levied from the developer, which is refundable upon submission of completion certificate • Representative floor plans for EWS and LIG units, along with minimum basic specifications for construction materials, are provided. • Mandatory to meet requirements of NBC 2016

Source: (TCP, 1973), (UTCP, 2017), (MoHUPA, 2015), (MoUD, 2015)

To conform with RERA, the Uttarakhand Real Estate (Regulation and Development) rules were notified in May 2017. Through RERA, the government aims to restore the faith of buyers in the real estate market and ensure transparency in the transactions. Mandatory disclosures of ongoing projects in Uttarakhand include the original sanctioned plan, layout plan, total amount collected, and project status. RERA makes it easier to keep track of the buyer, promoter, project development, sanctioning plans, and building materials. Developers can use the RERA platform to promote their energy-efficient residential projects and build confidence among the buyers.

The Uttarakhand Building Bye-laws were initially recognised in 2011 and amended in 2015 and 2017 (UTCP, 2017). These bye-laws are for all buildings and development activities within the state and apply to building planning, design, and construction. Table 4 summarises various residential building norms mentioned in the bye-laws, with a focus on climate change and energy efficiency.

Table 4: Uttarakhand Building Bye-laws

Section	Chapter name	Topic	Information	Remarks
3.2	Reforms under ease of doing business	Reforms under ease of doing business	The timelines should be limited to 45 days for the entire life cycle of approvals for construction permits: I. Building Plan Approval is provided within 30 days II. Plinth Inspection is done within seven days of intimation III. Final Occupancy-cum-Completion Certificate is provided within eight days (including inspections)	All agencies/ authorities/ departments concerned with the approval of Building Plans or Occupancy-cum-Completion Certificates shall follow the guidelines to ensure that the process of granting construction permits to users/applicants is smooth and transparent. All departments must provide an online medium to users.
5.4	Site location parameters	Minimum plot area	It mentions plot sizes for various residential buildings w.r.t. location, i.e. plains and hills.	
7.6	Building design norms	Minimum area, size, and height in residential premises	It mentions the minimum required area, size, and height for different rooms in residential premises.	
9.1		Rainwater harvesting	• Except in areas affected by high-water table problems, in all areas under different land-use categories having plot areas of more than 100 m2 in which construction works are admissible, rainwater harvesting/ collection provisions shall be mandatory. • A detailed table is provided in Annexure 2 on the norms and area of buildings.	• All the construction work related to rainwater harvesting shall not be calculated in the FAR. • The detailed proposal of the system shall have to be included in the submitted building plan. • Approval shall only be sanctioned if appropriate provisions are made in the plan, and the occupancy certificate shall be issued after the onsite verification of the same.
9.3		Provisions for rooftop solar PV systems	Installation of Solar Assisted Water Heating Systems shall conform to BIS specification IS 12933. The solar collectors used in the system shall have the BIS certification mark. A detailed table has been provided in Annexure 1 on the categories in residential buildings, area standards, and power generation requirement (same as under MBBL, 2016).	

Section	Chapter name	Topic	Information	Remarks
9.5		Provisions for green rating systems	All Government / State Government / Semi-Government buildings, including those belonging to autonomous bodies like boards, corporations, and public sector undertakings, shall conform to a minimum 4-star GRIHA rating to propagate green building construction. The certificate of compliance is to be submitted every five years. A detailed table has been provided in Annexure 1 on norms for other buildings that comply with rating systems, and buildings that successfully secure ratings from GRIHA / LEED / IGBC / BEE shall be eligible to receive extra FAR free of cost, as stipulated in the bye-laws.	
9.6		Energy conservation	ECBC shall apply to the following building complexes: A. Buildings with conditioned area of more than 500 m2 B. All commercial and non-residential buildings whose built-up area is more than 2000 m2 or plot area more than 1000 m2 C. Buildings such as multiplexes, malls, hospitals, hotels, and convention centres whose total floor area is less than 2000 m2 D. All buildings that have a connected load of 100kW or greater or have contract demand of 120 Kilovolt-Ampere (kVA) or greater The certificate of compliance is to be submitted every five years.	
9.9		Sustainable building materials	Supplementary building materials (derived or processed waste) may be suitably used while constructing a building, in combination with conventional resources: • Panels, hollow slabs, hollow blocks - conservation of materials, less water requirement • Fly ash bricks, gypsum-based walling & roofing panels- recycled use of industrial/agricultural by-products • Fly ash / Autoclaved Aerated Concrete (AAC) panels / Cellular Lightweight Concrete (CLC) panels - ensuring thermal comfort • Use of bamboo & rapidly growing plantation timbers- environmental benefits • Compressed soil earth block and rammed earth walls	
10.1	Provisions for climate-resilient construction – Integration of environmental clearance with sanctions	Environmental conditions for compliance during building approvals	The new building construction proposals are classified in the following three categories: • Category 'A' Buildings: Built-up Area 5,000 – 20,000 m2 • Category 'B' Buildings: Built-up Area 20,000 – 50,000 m2 • Category 'C' Buildings: Built-up Area 50,000 – 1,50,000 m2 These environmental conditions may be suitably integrated into the building permission conditions so that their effective implementation can be ensured by the local authority when sanctioning building plans in their respective urban areas. A detailed table has been provided in Annexure 2, Section 2.3, describing the categories under Environmental Conditions for Building & Construction.	

Source: (UTCP, 2017)

Building approval system in Uttarakhand: As per Uttarakhand bye-laws, there is a set of pre-required norms (layout approval, fire safety, structural safety) for a building approval system. These rules apply to any new or reconstructed building, or any alteration or addition to the existing building where structural changes are implied, such as the construction of columns, beams, or new load-bearing walls, adding new slabs, removing old load-bearing walls, etc. However, permission for activities that do not result in modification of the master plan shall not be required. (UTCP, 2017)

Public Works Department: The Public Works Department (PWD) is the principal Government of Uttarkhand agency responsible for architectural surveys, design, construction, schedule of rates (SoR), improvement, and maintenance of roads & bridges and public buildings. There are 17 circles headed by Superintending Engineers and 72 divisions with Executive Engineers as head of the office, in addition to other

supporting officers/staff spread out across the entire state. SoRs are the rates of different items of works generally executed by the department in different construction or maintenance works. The prevailing market rates for labour and material at the time of SoR preparation are adopted; the Uttarkhand SoRs were last revised in May 2019 (PWD, 2020).

To develop a sustainable habitat, sustainable materials and technologies have to be dealt with more comprehensively. Therefore, there is a need for a document that contains ready guidelines for sustainable technologies and enables the evaluation of material usage based on the sustainability index. In 2014, the CPWD launched guidelines on Sustainable Habitat (CPWD, 2014). The guidelines are based on National Mission on Sustainable Habitat reports developed by Ministry of Urban Development and the draft code on "Approach to Sustainability", as part of NBC 2005. The guidelines are intended to be used by CPWD architects/engineers in daily decision-making processes concerning the use and evaluation of materials and technology based on sustainability parameters.

The proposed index is not an absolute scale. It is merely a set of criteria on which relative judgment can be made between two materials of the same product category with regards to sustainability.

The guidelines have been divided into four parts:

01 Guidelines on **Architectural Design and Layout**

02 **CPWD Sustainability Index and Guidelines for Materials**

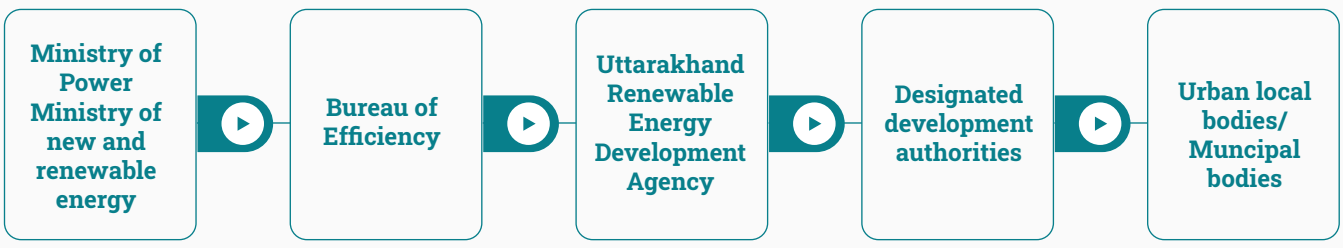
03 Guidelines for **Selection of Equipment for Electrical and Mechanical Services for Sustainable Buildings**

04 Guidelines on **Reuse and Recycling of Construction and Demolition Waste (CPWD, 2014)**

3.3 Institutional energy efficiency framework and policy landscape

The Bureau of Energy Efficiency is a national statutory body established by the Govt. of India to coordinate the implementation of the Energy Conservation Act across the country, whereas UREDA is the State Designated Agency for BEE in Uttarakhand, established in 2002. The role of UREDA is to create general awareness among the population about the importance and benefits of energy conservation measures and institutionalise energy efficiency project implementation in different sectors. UREDA gives instructions to the Area Development Authorities, which, in turn, guide the local bodies to act and implement the codes. The Uttarkhand governance structure for the energy sector is illustrated in Figure 2 below.

Figure 2: Energy sector governance structure in Uttarkhand; Source: (UREDA, 2008)



3.3.1 Energy efficiency programmes in Uttarakhand

In Uttarakhand, the execution and operation of various schemes based on unconventional energy resources are handled by UREDA through local bodies and the district administration. Since 2008, UREDA has also been taking the lead on energy conservation activities as a BEE state nodal agency (UREDA, 2020). Three major policies related to the housing sector are in place, focusing on energy supply, implementation of solar water heaters, and building code regulations. Table 5 presents the state-level mechanisms in this sector.

Table 5: State level energy policies and regulations

Policy	Year	Authority	Application	Remarks
Renewable Energy Policy	2008	UREDA	To provide decentralised energy supply to agriculture, industry, commercial, and household sectors.	
Uttarakhand Regrading Efficient Use of Energy and Its Conservation Directions	2013		The use of solar water heating systems will be mandatory.	Applicable to all housing complexes established by group housing societies and residential buildings built on a plot of size 500 square yards and above, falling within the limits of municipal bodies in the state. The load-bearing capacity of the roof shall be at least 50 kilogrammes (kg)/ m2.
			Promotion of energy-efficient building design using the ECBC	The new buildings to be constructed in the government/ government-aided sector will incorporate energy-efficient building design concepts based on the ECBC, including renewable energy technologies.
Uttarakhand Energy Conservation Building Code	2017		Applicable to all buildings or complexes that have a connected load of 50 kW or greater or a contract demand of 60 kW or greater, or if the plot area of the building is more than 500 m^2, with minimum 500 m^2 as built-up area (excluding the basement), and that are intended to be used for commercial purposes	The code does not cover buildings intended for private residential purposes only.

Source: (UREDA, 2008), (UREDA, 2013), (UREDA, 2017)

The state also established the Energy Conservation Fund in 2010, amending it in 2013, to carry out energy conservation and awareness programmes as per BEE's guidelines. The state can use a portion of the funds to carry out activities not listed in the BEE's guidelines.

3.3.2 Energy Conservation Building Code (Commercial)

The state ECBC was developed by amending the central ECBC according to the local context of Uttarakhand. ECBC 2007 was notified in Uttarakhand in 2013. For the latest version of ECBC-2017, UREDA amended and notified the code. The amended code is named as UK-ECBC 2017. The fundamental changes made in the ECBC are covered in Table 4. To comply with the Code, a building needs to meet the following two requirements:

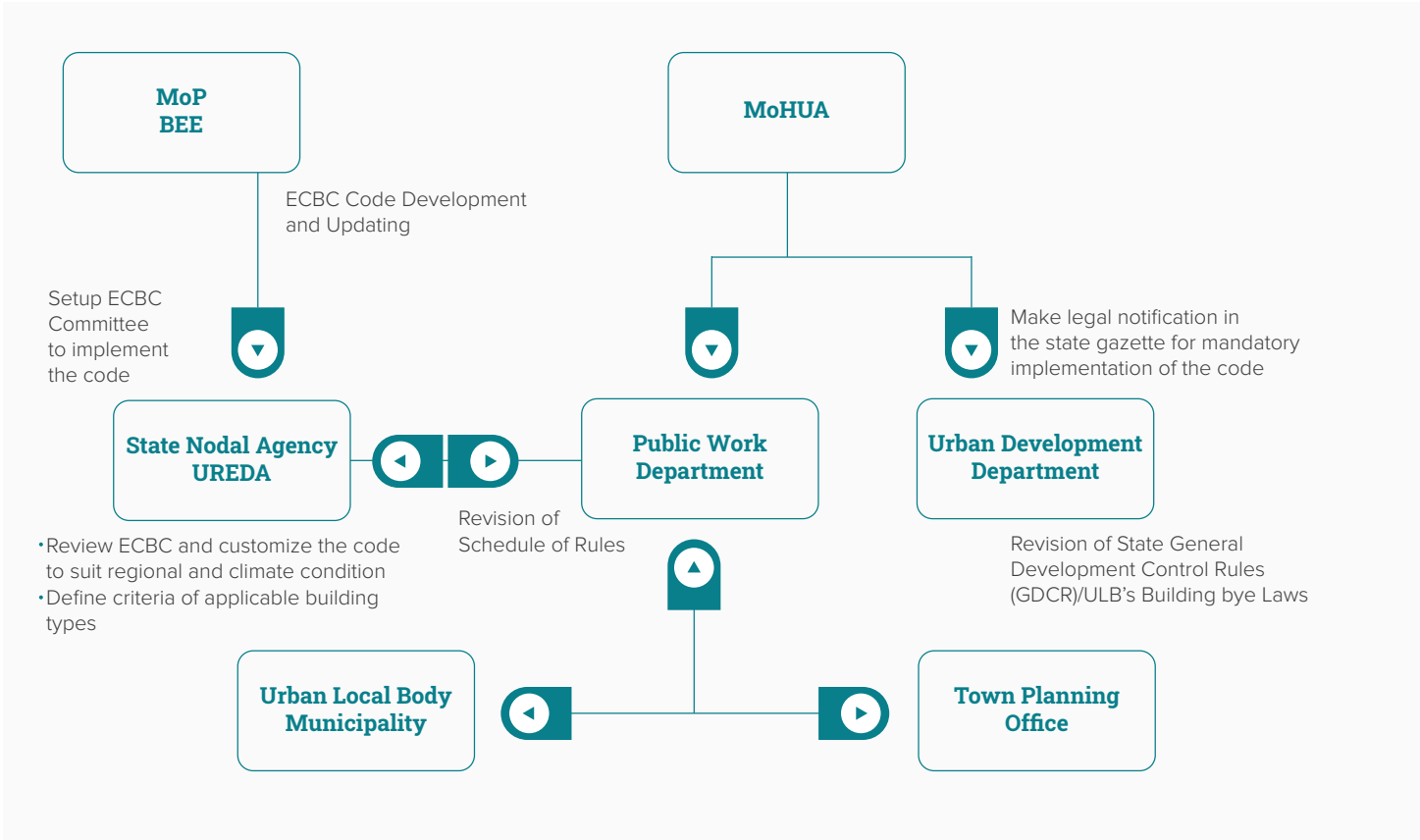
- Comply with the mandatory requirements as per the code
- Determine the Energy Performance Index (EPI) Ratio, which must be less than or equal to 1.

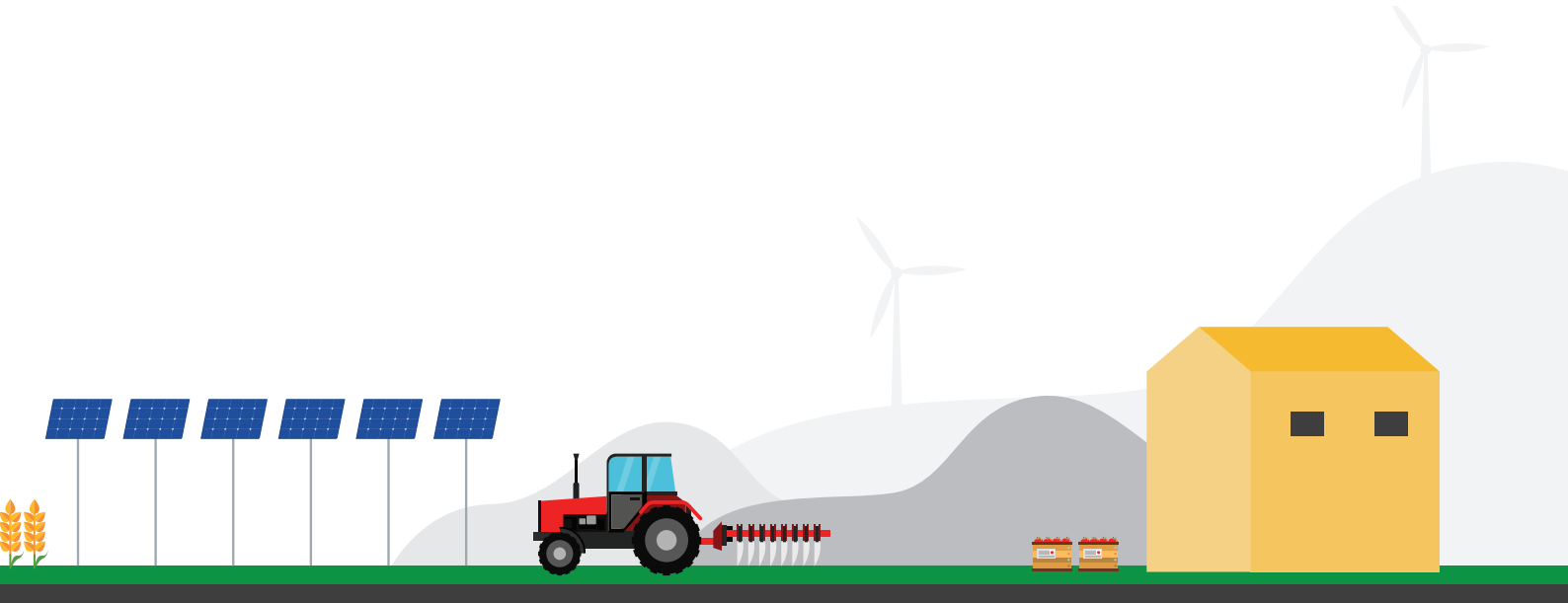
Administrative requirements, including permitting requirements, enforcement, interpretations, claims of exemption, approved calculation methods, and rights of appeal, are specified by the authority having jurisdiction. In the Uttarakhand Building Bye-laws, UREDA is the Nodal Agency for the issuance of an ECBC compliance certificate (UREDA, 2017).

Documentation of compliance is essential for a smooth approval process and can be provided in the form of drawings, technical data, specifications, material brochures, calculations, reports, and any other supporting material. As per the ECBC, construction drawings and specifications must show all pertinent data and features of the building, equipment, and systems in sufficient detail to permit the authority having jurisdiction to verify that the building complies with the requirements of this code. The following details about the building shall be included: Building Envelope, Heating, Ventilation, and Air Conditioning, Lighting, Electrical Power, and Renewable Energy.

The process for ECBC amendment and notification in the state is depicted in Figure 3.

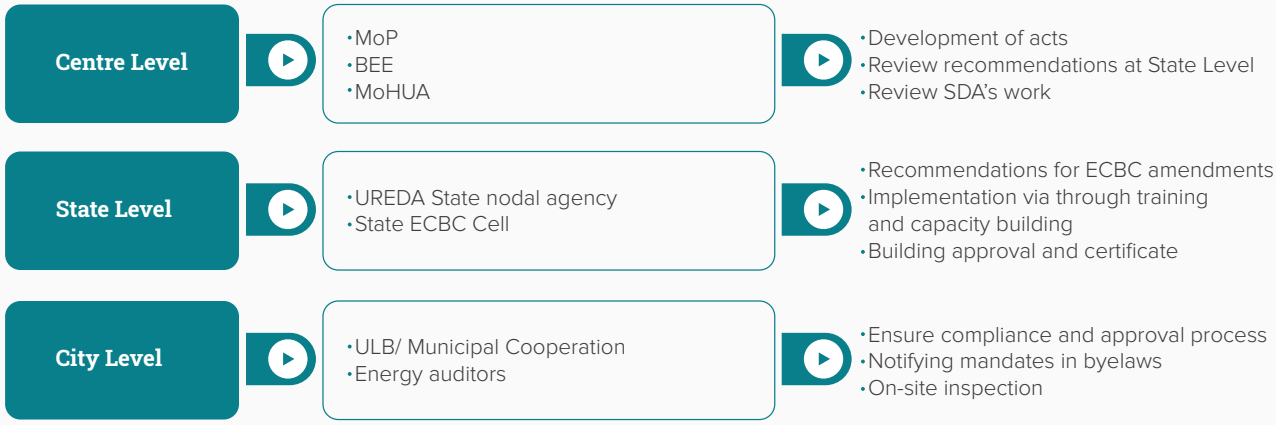
Figure 3: ECBC amendment and notification process in Uttarakhand; Source: (UREDA, 2017)





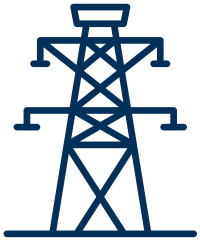
There are multiple authorities involved in the incorporation of the ECBC at the central, state, and city level, with different functions in this process, as shown in Figure 4.

Figure 4: Stakeholders & their roles in ECBC incorporation; Source: (UREDA, 2017)



24*7 Power for All

In 2015, the Govt. of India and Govt. of Uttarakhand released a roadmap to provide "24X7 power for all" households, industries, commercial needs, public needs, and any other entities (MoP, 2015). Due to the transmission and distribution (T&D) losses, the state faces power disruptions in both rural and urban areas. The aim was to reduce the T&D losses to 13.7% by 2019 and 9% by 2030. To meet the objectives under this roadmap, the state has also committed to promoting clean and renewable energy sources and energy efficiency measures. The proposed activities laid out in this roadmap related to energy conservation are limited to installation of LEDs in govt./ public buildings, energy-efficient equipment in ULB buildings, and solar water heating systems. However, there are no specified measures or allocated funds for energy efficiency initiatives in the residential sector.



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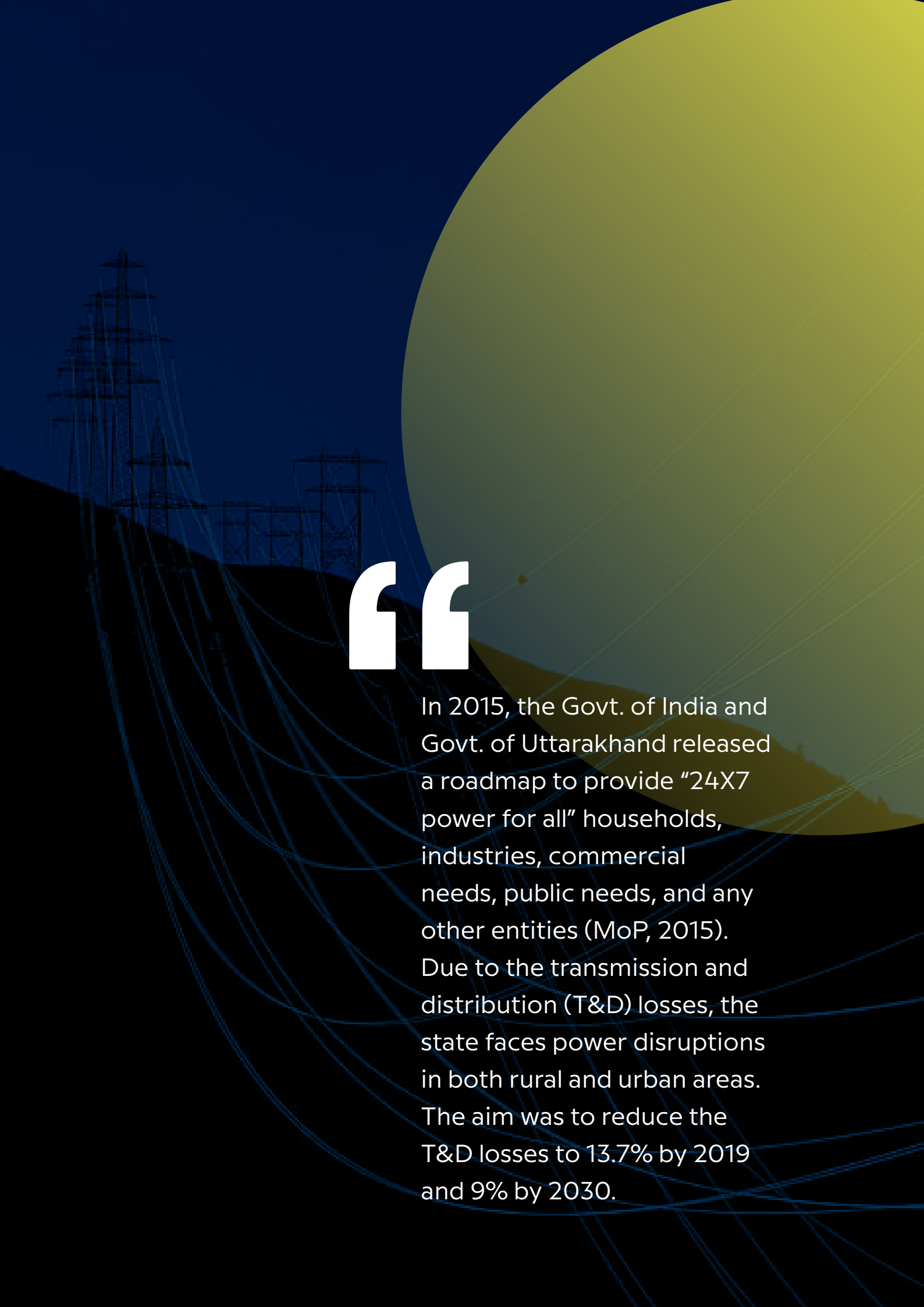
Tariff Policy

The Uttarakhand Electricity Regulatory Commission (UERC) approved the Tariff Order UPCL for FY 2019-20 in February 2019 (Uttrakhand Electricity Regulatory Commission, 2019). There is a marginal increase of 10 paise/ unit for domestic consumers consuming up to 100 units, and, no increment in the fixed charges. However, there is a nominal increase in both fixed costs and energy charges for consumption beyond 100 units per month. The average tariff increase for the domestic category is around 3.83 %. With increasing per capita consumption and household electricity consumption, the consumers will have to spend more on energy bills.

Uttarakhand initially worked to provide distributed energy supply to multiple sectors, including the residential sector,in 2008. Furthermore, the state mandated the use of solar water heating systems in 2013. The Building Bye-laws, 2011 (amended in 2017) are aligned with the Model Building Bye-laws, 2016 proposed at the central level and modified as per the state requirements. The Model Building Bye-Laws have included nearly all of the necessary codes, including NBC, ECBC, green building ratings, etc., in their norms. The state also promotes the use of energy-efficient building design using the ECBC, which is only applicable to commercial buildings. Keeping sustainable development in focus, the bye-laws provide guidelines for various measures like rainwater harvesting, groundwater recharging, rooftop solar PV systems, green rating systems, energy conservation, sustainable building materials, and environmental conditions for compliance during building approvals. However, ENS and its implementation strategy have not been mainstreamed into any of the state policies.



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04

CHALLENGES AND OPPORTUNITIES IN THE CURRENT POLICY SCENARIO

Uttarakhand developed its vision for 2030, to conserve the biodiversity in the state, maximise the amount of renewable energy generation, drive economic growth while doubling the rate of energy efficiency improvements, and provide housing, health, electricity, education, and other amenities to the growing population in the state.

Uttarakhand is one of the most proactive states in the Indian Himalayan Region, as it has formulated and developed its State Action Plan on Climate Change, Uttarakhand Solar Energy Policy, and Uttarakhand Renewable Energy Policy. It has also institutionalised the State Climate Centre and developed its vision for 2030, to conserve the biodiversity in the state, maximise the amount of renewable energy generation, drive economic growth while doubling the rate of energy efficiency improvements, and provide housing, health, electricity, education, and other amenities to the growing population in the state. It is one of the states that has notified the ECBC 2017 for commercial buildings, made solar rooftop PV systems for water heating mandatory, and developed a housing policy.

So far, the primary emphasis has been on improving the energy efficiency of commercial buildings and considering the present contribution of the residential sector to the overall state electricity consumption and its growth rate. It is imperative to further integrate energy efficiency aspects into the current policy landscape to facilitate low-carbon development.

Below are some specific areas where interventions to mainstream energy efficiency in the residential sector can be leveraged.

1. Urban Planning

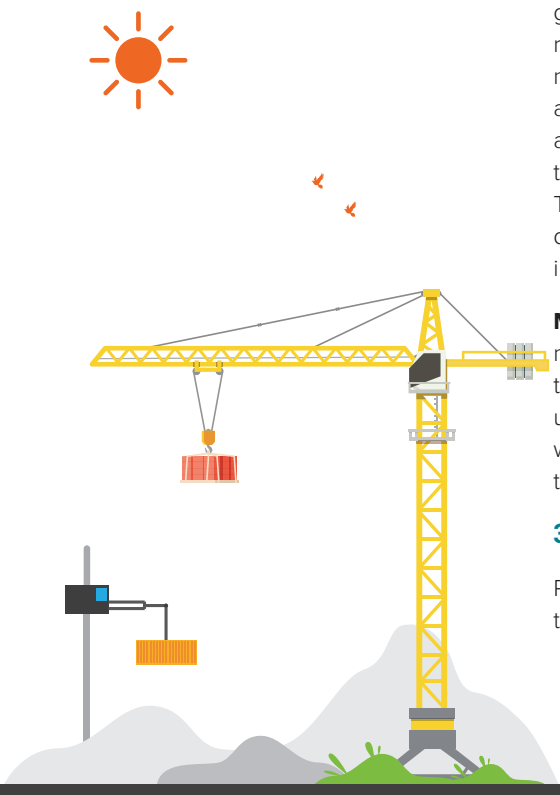
Layout and building design: Chapter III, Sections 8 and 9 of the Uttarakhand (UP Urban Planning and Development Act, 1973) Amendment Act, 2013 elaborates on the preparation of the master plan and zonal development plan for the development area, and Chapter III, Sections 10 and 11, Adoption & Modification Order, specifies that the master or zonal plan should be submitted after its preparation to the state government for approval. Under this section, the state authority can make climate change considerations and resilience integration mandatory criteria in the preparation and approval process of the master plans. Furthermore, the land use planning of the area can be evaluated to ensure climate responsiveness in future urban development.

2. Building Bye-laws and SoRs

Material for building construction: The use of local materials will support the local economy, as well as reduce the negative impacts of transportation. CPWD has already published an SOR for new innovative and sustainable construction technologies. A handbook of locally available materials can be prepared for Uttarakhand that includes information on thermo-physical properties, reuse, upgrade, recycled content, embodied energy, emissions intensity, toxicity, sustainability, safety, etc. In addition, Chapter 11, Section 9 of NBC, 2016 (Approach to Sustainability; Materials) specifies various such parameters to be updated for materials. A list of recommended sustainable alternatives by PWD can be provided to facilitate sustainable construction. For example, traditional efficient building materials (earth blocks, cool roofs, wood, recycled steel, low-E windows) are cost-effective and environmentally friendly, as they involve the use of materials that are locally available, reducing the cost and energy consumed in transportation.

Part II, CPWD Guidelines for Sustainable Habitat (Sustainability Index and Guidelines for Materials) provides several such parameters, along with their weightage in a sustainability index to inform decision-making on materials.

Mainstreaming Eco-Niwas Samhita in the Building Bye-laws: The ECBC-Residential (ECBC-R) implementation is still at a very nascent stage in India. However, it is crucial for the state governments to adopt and implement the code in order to avoid the lock-in inefficiencies due to the new construction that is going to happen over the next 4-5 years. Along with government departments, technical experts are likely to play a key role in the overall implementation – first, in terms of creating technical awareness, and second, in terms of design and construction of ENS compliant housing. Code adoption, i.e. notification and amendment, falls under the purview of the state government. In general, State Development Authorities (SDAs), along with UDDs, have the collective responsibility for code adoption. While the SDA or UDD can solely undertake code notification, amendment of the code and its incorporation into other building design and construction guidelines (bye-laws, Town and Country Planning Department rules and regulations, Public Works Department SoRs, etc.) require a variety of inputs from technical experts. The implementation will be the responsibility of the UDD and ULBs. The inclusion of ENS in building bye-laws will mandate code compliance checks during the building approval process, leading to code enforcement and avoidance of inefficiency lock-in in the new/ upcoming residential projects.



Mainstreaming CPWD's Green Habitat Accomplished Rating (GHAR): CPWD has mandated the inspection and rating of all housing projects under their purview to meet the GHAR. ULBs and UDDs can promote mandatory rating and include this requirement under the rental policy, Awas Niti, and government housing projects. They could also work with private developers to encourage them to adopt the GHAR rating scheme in their projects.

3. Policies and Programmes

Renewable Energy Policy: Enforcement of the Renewable Energy Policy, 2008 has ensured the promotion of clean and renewable energy and decentralised energy supply

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in the housing sector. Furthermore, the use of low energy lighting, energy efficiency in HVAC systems, and solar energy/ LED devices have been incorporated into the bye-laws. Green building rating systems and ECBC-R compliance should be integrated into the overall renewable energy policy.

Solar Energy Policy: The state has a huge potential for solar power capacity, estimated at 16,800 MW, out of which less than 2% has been tapped. While the state has a policy to mainstream solar energy by installing large-scale solar power plants, there is still no focus on off-grid and building-integrated solar power systems. It will be essential for the authorities to promote rooftop solar PV systems, not only for heating water, but also to power heating systems, lighting, and equipment. This will also complement the implementation of the Uttarakhand Action Plan on Climate Change. For effective implementation, a measured and focused effort is needed to promote building-integrated solar PV systems.

Off-grid heating/ cooling systems & thermal comfort: The Renewable Energy Policy and Solar Energy Policy encourage the installation of off-grid heating systems in households; however, the penetration and success of these plans are very subdued. Most of the households depend on fossil-fuel based heating systems for thermal comfort. While thermal comfort is essential to ensuring occupants' health and wellbeing, it is of the utmost importance that the energy supplied to provide this comfort is drawn either from renewable sources or through passive solar design. UREDA will play a crucial role in mainstreaming the installation of off-grid heating systems in the state, and its collaboration with technology/service providers in the micro, small, and medium enterprises (MSME) sector is essential to meeting the demand for such systems, as well as installing them onsite.

Efficient appliances: The government is already promoting star labelled pumps in the agricultural sector, but there is little focus on promoting energy-efficient appliances in the housing sector. Since solar water heating systems are mandatory under the current Uttarkhand building-bye laws, the government should take this opportunity to mandate the use of star-rated solar water systems in the state. Furthermore, consumer focus and market enablement need a push to encourage and mainstream star-rated appliances (under the voluntary scheme) in households. As part of the energy efficiency goals set under the SDGs and Vision 2030, penetration of super-efficient and star-labelled appliances should be incorporated, with short- and medium-term targets, while the long-term target should be to achieve 100% penetration of labelled appliances.

Residential Labelling Programme: To meet the Vision 2030's aim to achieve savings of 25% energy consumption and double the rate of energy efficiency in the state, it is essential to implement policies and programmes to ensure the construction of energy-efficient homes that consume less energy and offset some of the energy demand through onsite renewable energy sources integrated into the house itself. For example, the government should encourage consumers to buy energy-efficient homes. One of the easiest ways could be to inform the buyers about the energy performance of the houses and enable them to compare different homes accordingly in a given district or area. To start with, all government housing projects should get all the dwelling units rated as per the BEE residential label. The UDD could also issue a disclosure policy mandating that the real estate developer show/ declare the housing unit rating in rental agreements or during any real estate transactions.

Passive and sustainable architecture: The CPWD guidelines and BMTPC promote the use of sustainable building construction materials, while the building bye-laws encourage sustainable building design and integration of passive architecture into mainstream design and building construction. Guidelines for passive and sustainable architecture should be mandated under the building bye-laws and SDG targets. This will complement the government's mandate to double the rate of energy efficiency, while simultaneously significantly reducing the residential energy demand.

Environmental clearance: Currently, there are no schemes or guidelines at the central and state level that connect environmental clearance with affordable housing projects, although, in the Building Bye-laws, there are provisions for rainwater harvesting and solar heating systems for housing where the plot area is ≥ 100m2. There is a significant

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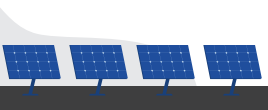

opportunity to amend provisions under schemes to facilitate sustainable construction and low-carbon development. Long-term maintenance and management of these systems must be worked out so that they do not present a challenge to the low-cost dwelling units.

Climate resilience: Climate change considerations and disaster risk reduction should be integrated into the zonal and master plans. The disaster management plans must be prepared under the guidance of area designated authorities and local bodies, to address challenges related to natural disaster. There should be an enhanced understanding of climate vulnerabilities, and strategies should be devised to mitigate them.

Capacity building of architects, planners, and ULBs: For effective implementation of various policies and programmes and enforcement of Acts, a substantial number of trained professionals (architects, developers, contractors, and government officials responsible for due diligence and verification) is required. At present, the budget under the state policy does not cover the training and capacity development of professionals engaged in the residential energy efficiency sector. Furthermore, there is a lack of knowledge sharing among key stakeholders, such as real estate developers, financial institutions, and building approval authorities. Hence, a comprehensive action plan for the capacity building of stakeholders engaged directly in the residential sector needs to be developed and implemented.

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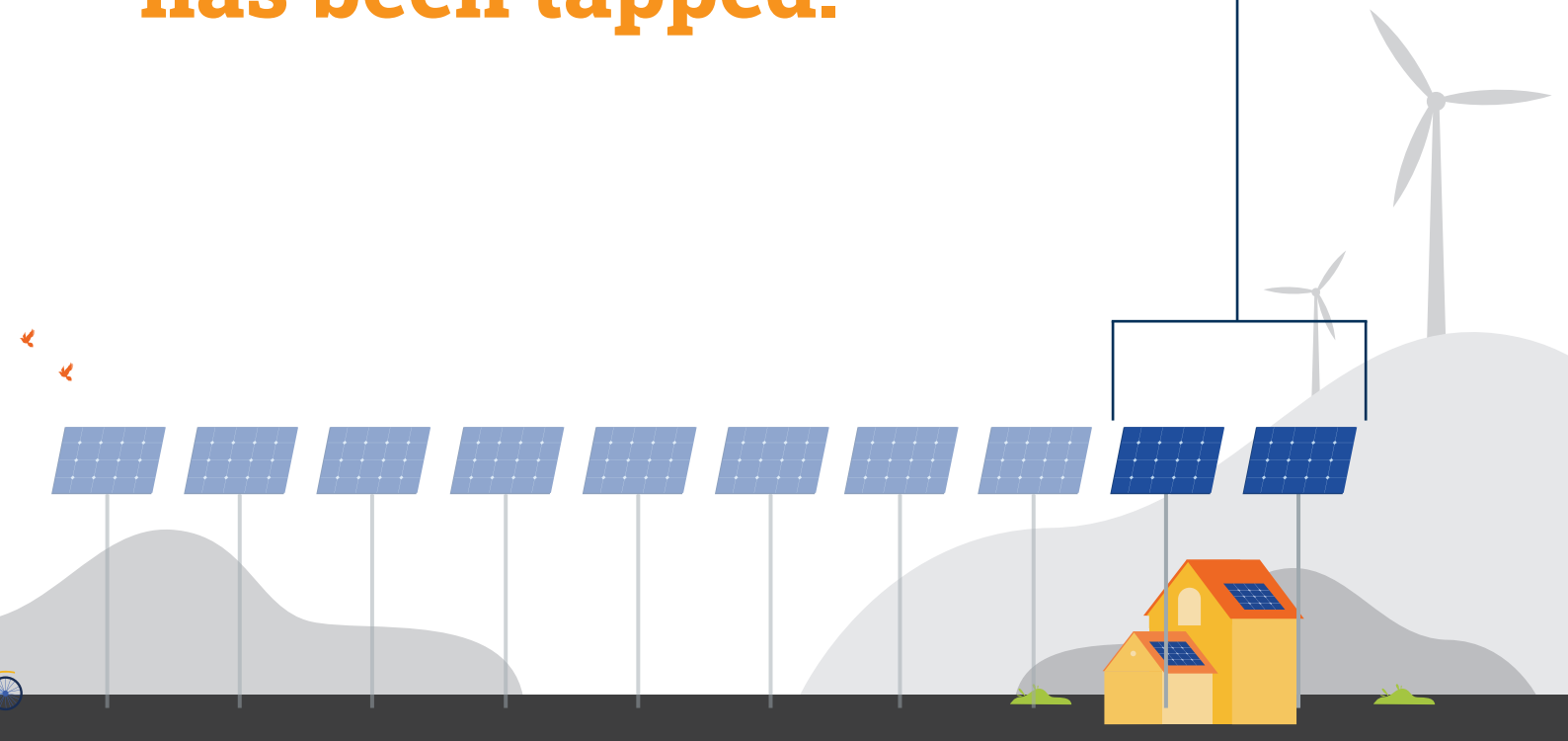


05 CONCLUSION

An energy-efficient residential building stock will contribute to the achievement of various targets in other state policies and programmes such as Uttarakhand: Vision 2030, Uttarakhand State Action Plan on Climate Change, and Uttarakhand Solar Energy Policy 2013, along with the state's target under SDG 7.

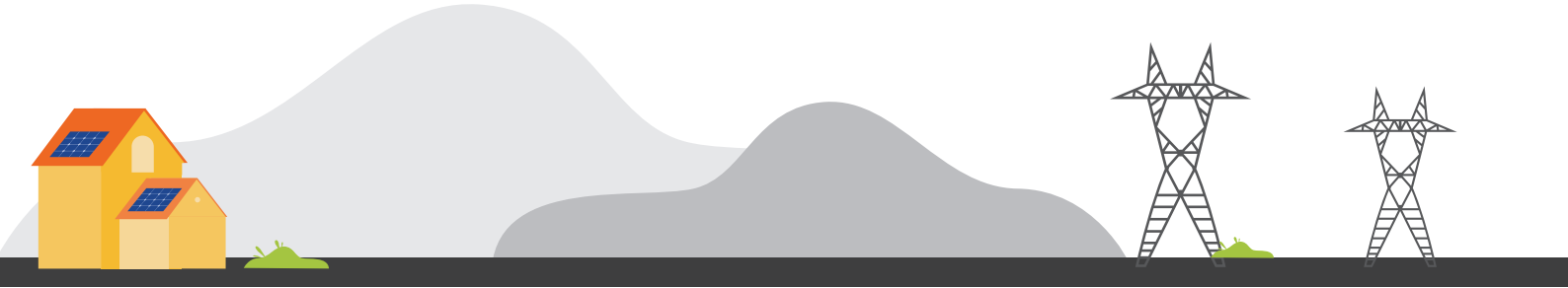
Uttarakhand is one of the fastest developing states, with the highest GSDP, population, literacy rate, and urban development among all states in the Indian Himalayan Region. It also has the highest generation potential for renewable power generation and one of the highest in terms of hydro and solar power generation potential. With the population growth, the state has also seen an increasing demand for housing from all income groups. Due to rapid urbanisation and growing aspirations for a better quality of life, people from the hilly regions and cities/towns at high altitudes are moving into low-lying urban centres like Dehradun and Haridwar. In response, the government has taken a proactive approach to curbing the migration, implementing policies to mainstream urban development in upper regions/ hilly regions of the state. To provide necessary infrastructure like electricity, roads, health care systems, and education, the administration is also taking steps to provide housing for the people under various central and state policies. The increasing built-up area of the residential sector in the state, specifically in the colder regions, requires strategic intervention both in terms of practical and scalable policy programmes, as well as the mainstreaming of climate-responsive, energy-efficient building design and construction. An energy-efficient residential building stock will contribute to the achievement of various targets in other state policies and programmes such as Uttarakhand: Vision 2030, Uttarakhand State Action Plan on Climate Change, and Uttarakhand Solar Energy Policy 2013, along with the state's target under SDG 7. It will also help in mainstreaming green building construction as propagated in the Uttarakhand Building Bye-Laws and support the central government's aim to meet India's NDCs and SDG targets.

The building bye-laws are updated periodically, and norms are being revised to mainstream and propagate sustainable development in buildings and communities. Provisions in the building bye-laws, including the integration of environmental clearance with sanctions, climate-resilient construction, use of sustainable building materials, ECBC and green rating systems (such as that of IGBC), provisions for rainwater harvesting, and solar water heaters, also contribute to the overall energy efficiency objectives and achieving sustainable development. However, certain central government schemes and programmes—e.g. ENS, which provides guidelines for residential buildings in cold climates, CPWD's GHAR rating scheme, the Energy Efficiency Labelling Programme for residential units, passive (solar) architecture, and guidelines for energy-efficient, thermally comfortable houses in cold regions—have not been incorporated into the existing state policies or schemes.

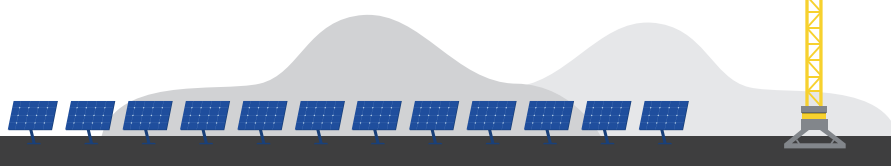
This study done focused on identifying and understanding the possible areas of intervention to streamline and include climate-responsive design and low-carbon development in Uttarkhand's existing policy framework. Table 6 below summarises the key potential areas of intervention and actions for the way forward.

Table 6: Potential entry points to streamline climate-responsive actions in Uttarkhand's residential sector

S. No	Area of intervention	Name of policy/ programme/ act/ rules	Recommended actions for low-carbon development in the existing policy landscape
1	Layout and building design	Uttarakhand (UP Urban Planning and Development Act, 1973) Amendment Act, 2013; Smart City Programme	In Chapter III, under Section 10 and 11, authorities can make climate change considerations and resilience integration mandatory criteria in the preparation and approval process of the master plan.
2	Building construction materials	Uttarakhand Building Bye-Laws and SoR	Adopt CPWD's SoR for new innovative and sustainable construction technologies for Uttarakhand. Develop a handbook of locally available materials in Uttarakhand, which includes information on thermo-physical properties, reuse, upgrade, recycled content, embodied energy, emissions intensity, toxicity, sustainability, and safety, and integrate this info into the SoR, to be adopted by the UDD and PWD.
3	Eco Niwas Samhita	Uttarakhand Building Bye-Laws	Adapt the ENS to the local context of Uttarakhand and make provisions in the building bye-laws (through state notification) to make ENS compliance mandatory for the residential building approval process.
4	Green Habitat Accomplished Rating	Awas Niti, all government housing projects, state-funded housing projects; Dehradun Smart City	Make the GHAR system mandatory (housing inspected and rated by CPWD and implemented by PWD/ ULBs).
5	Solar water heaters	Uttarakhand Solar Energy Policy; Uttarakhand Action Plan on Climate Change; Building Bye-Laws	Install solar water heaters in all residential buildings – mandatory for building approval. Promote and install solar water heaters – UREDA under the Solar Energy Policy. Encourage MSMEs to provide technologies and services through ESCO financing model.



S. No	Area of intervention	Name of policy/ programme/ act/ rules	Recommended actions for low-carbon development in the existing policy landscape
6	Solar (LED) lighting systems	Uttarakhand Solar Energy Policy; Vision 2030; 24X7 Power for all; Uttarakhand Action Plan on Climate Change	Install solar-powered LED lighting system in all residential buildings – mandatory for all government-funded housing projects. Promote and install solar-powered LEDs – UREDA under the Solar Energy Policy. Encourage MSMEs to provide solar LED lighting.
7	Solar-powered (off-grid) heating systems	Uttarakhand Solar Energy Policy; Uttarakhand Action Plan on Climate Change; Smart City Programme	Mainstream and promote solar-powered (off-grid) residential heating systems (pilot projects).
8	Rooftop solar PV	Uttarakhand Renewable Energy Policy; Vision 2030; Awas Niti; Smart City Programme	Make these systems mandatory in all government-funded housing projects and projects under state/ central schemes like PMAY-U, AMRUT.
9	Super-efficient household appliances	Vision 2030; SDG #7 Goal, Uttarakhand Action Plan on Climate Change	Encourage buyers to buy BEE's star labelled appliances. Strict enforcement and market regulations Financial benefits (like a rebate on the interest rate, green loans, discount on maximum retail price (MRP)) for buyers)
10	Thermal comfort and health	Uttarakhand Action Plan on Climate Change; Vision 2030; SDG Goals	Include "Ensure Thermal Comfort for All and wellbeing" as indicator under the UAPCC, SDG, and Vision 2030.
11	Capacity building and training	SDG Goals; Uttarakhand Action Plan on Climate Change	Allocate funds for capacity building of state authorities, officials, architects, planners, and developers, specifically on energy efficiency and sustainability.
12	Energy efficiency label for residential units	Vision 2030; Uttarakhand Action Plan on Climate Change	Promote energy-efficient homes and provide financial incentives to buyers. Pilot projects for residential label programme
13	Passive and climate-responsive architecture	Uttarakhand Action Plan on Climate Change; Vision 2030	(Mandatory) design recommendations and model design strategy should be included in Awas Niti & Building Bye-Laws and adopted by the UDD. Mainstream energy efficiency and net-zero design strategy in various government projects. University student education and training
14	Environmental services for residential buildings	Building Bye-Laws; Smart City Programme	Guidelines for low-carbon/ net-zero/ energy-efficient residential building design
15	Climate-resilient residential buildings	Uttarakhand Action Plan on Climate Change; Building Bye-laws	Guidelines for resilient and climate-responsive design



5.1 Way forward

The review of the policy landscape in this report highlights the need for a roadmap/ guideline to mainstream low-carbon development in the residential sector. It is also envisaged that such a roadmap would guide other colder regions in the Himalayan ecosystem in adopting sustainable and low-carbon residential sector development strategies. Overall, it would support the National Mission on Himalayan Studie's goals by addressing cross-cutting issues in major urban centres in Uttarakhand. Drawing from the lessons learned during the stakeholder consultation roundtable (comprising architects, practitioners, and govt. officials from Uttarakhand) and policy mapping, the team envisages the following way forward to meet the project objective:

- With support from various government officials and stakeholder consultations, the team will prepare a set of guidelines and roadmap comprising recommendations to drive low-carbon development and energy efficiency in the urban residential sector in Uttarakhand.
- The team will implement the guidelines created and demonstrate their performance through a pilot project in the state of Uttarakhand in collaboration with a potential builder or developer.
- The guidelines will be incorporated in the existing administrative setting of the construction approval process of Uttarakhand to ensure higher implementation and achieve the overall agenda of thermal comfort for all.

> The building bye-laws are updated periodically, and norms are being revised to mainstream and propagate sustainable development in buildings and communities.

06
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07
ANNEXURES

7.1 Annexure 1

This annexure further describes certain sections of the Model Building Bye-laws, 2016.

7.1.1 Green buildings and sustainability provisions

All buildings on various plot sizes above 100 m2 shall comply with the green norms and conform to the requirements mandatory for sanction, as mentioned. These provisions are not specific to any rating system and are not intended to provide a single metric indication of overall building performance. The green building provisions for various plot sizes are indicated in Table 7 below.

Table 7: Green building provisions for various plot sizes under MBBL

Plot Category	Applicable plot area (m2)	Provisions for residential sector	Parameters
1	Up to 100	Nil	1. Water Conservation and Management • Rainwater Harvesting • Low Water Consumption Plumbing Fixtures • Wastewater Recycling and Reuse • Reduction of Hardscape 2. Solar Energy Utilisation • Installation of Solar Photovoltaic Panels • Installation of Solar Assisted Water Heating Systems 3. Energy Efficiency • Low Energy Lighting Fixtures • Energy Efficiency in HVAC Systems • Solar Energy/ LED Lighting in Common Areas 4. Waste Management • Segregation of Waste • Organic Waste Management
2	100 to 500	1(a), 2(a), 2(b), 4(a)	
	500 to 1000	1(a), 1(c), 2(b), 3(c), 4(a)	
	1000 to 3000	1(a), 1(c), 1(d), 2(a), 2(b), 3(b), 3(c), 4(a)	
3	Above 3000	1(a), 1(b), 1(c), 1(d), 2(a), 2(b), 3(a),3(b), 3(c), 4(a), 4(b)	

Source: (MoHUA, 2016)

The schemes/ projects formulated based on provisions given in the master plan/ zonal development plan will require approval based on the following standards/certification: EIA/ ECC (as per MoEFCC), NBC (latest), ECBC 2007 or latest, BEE Star Rating/ LEED/IGBC/ GRIHA or TERI Certification.

The prevailing provisions of the above shall be applicable. However, if there is any modification in the same, the modified provisions shall become automatically applicable.

7.1.2 Rooftop solar PV installation and power generation

Provisions for rooftop solar PV installation under MBBL are summarised in Table 8:

Table 8: Provisions for rooftop solar PV installation under MBBL

Plot Category	Type of housing	Provisions for residential sector	Parameters
1	Plotted Housing	For High Income Group (HIG) plots and above	Minimum 5% of connected load or 20 W/ft2 for "available roof space" **, whichever is less.
2	Group Housing	All proposals, as per Group Housing Norms	Minimum 5% of connected load or 20 W/ft2 for "available roof space", whichever is less.

* Area provisions on rooftop shall be 12 m2 /per 1 kW peak

** "available roof area" = 70% of the total roof size, considering 30% area is reserved for residents' amenities.

Source: (MoHUA, 2016)

7.2 Annexure 2

This annexure further describes certain sections of the Model Building Bye-laws for Uttarakhand.

7.2.1 Rainwater harvesting

Except in areas affected by high-water table problems, in all areas under different land-use having plot areas of more than 100 m2 in which construction works are admissible, rainwater harvesting/ collection provisions shall be mandatory. Provisions for rainwater harvesting under the bye-laws are summarised in Table 9.

Table 9: Provisions for rainwater harvesting under bye-laws

Total built-up area (in m2)	Rainwater harvesting collection norms
Up to 250 m2	Minimum 2.0 cubic metre (m3) tank
Above 250 m2 and up to 400 m2	Minimum 3.5 m3 tank
Above 400 m2	For every increase in 50 m2 plot area or partial area thereof, additional provision of minimum 0.5 m3

Source: (UTCP, 2017)

7.2.2 Environmental conditions for compliance during building approvals in Uttarakhand

The new building construction proposals are classified in the following 3 categories:

- Conditions for Category 'A' Buildings: Built-up Area 5,000 – 20,000 m2
- Conditions for Category 'B' Buildings: Built-up Area 20,000 – 50,000 m2
- Conditions for Category 'C' Buildings: Built-up Area 50,000 – 1,50,000 m2

These environmental conditions may be suitably integrated into the building permission conditions so that their effective implementation can be ensured by the local authorities when sanctioning building plans in their respective urban areas. Provisions for environmental conditions for compliance during building approvals under the bye-laws are given in Table 10.

Table 10: Environmental condition provisions for compliance during building approvals under bye-laws

Type	**Category**	
	Water conservation: rainwater harvesting and ground water recharge	**Energy**
Category A	The unpaved area shall be more than or equal to 20% of the recreational open spaces.	In common areas, LED / solar lights must be provided.
Category B	The unpaved area shall be more than or equal to 20% of the recreational open spaces.	In common areas, LED / solar lights must be provided. At least 1% of the connected applied load shall be generated from renewable energy sources.
Category C	The unpaved area shall be more than or equal to 20% of the recreational open spaces. The groundwater shall not be withdrawn without approval from the competent authority. Use of potable water in construction should be minimised. Low flow fixtures and sensors must be used to promote water conservation. Separation of grey and black water should be done through the use of a dual plumbing system.	At least 1% of the connected applied load shall be generated from renewable energy sources. Solar water heaters of minimum capacity of 10 litres / 4 persons (2.5 litres per capita) shall be installed. Use of fly-ash bricks as building material in construction Application of passive solar design concept in buildings, using architectural design approaches that minimise energy consumption by integrating conventional energy-efficient devices with passive design elements, such as building orientation, landscaping, efficient building envelopes, appropriate fenestration, increased day lighting design, and thermal mass.

Type	Category	
	Water conservation: rainwater harvesting and ground water recharge	Energy
		Optimisation of the use of energy systems in buildings to maintain specific indoor conditions conducive to the building's functional requirements, by following mandatory compliance measures (for all applicable buildings) as recommended in the ECBC, 2017

Source: (UTCP, 2017)

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