LODHA
NET ZERO URBAN
ACCELERATOR

Gateway to India's Dymaxion

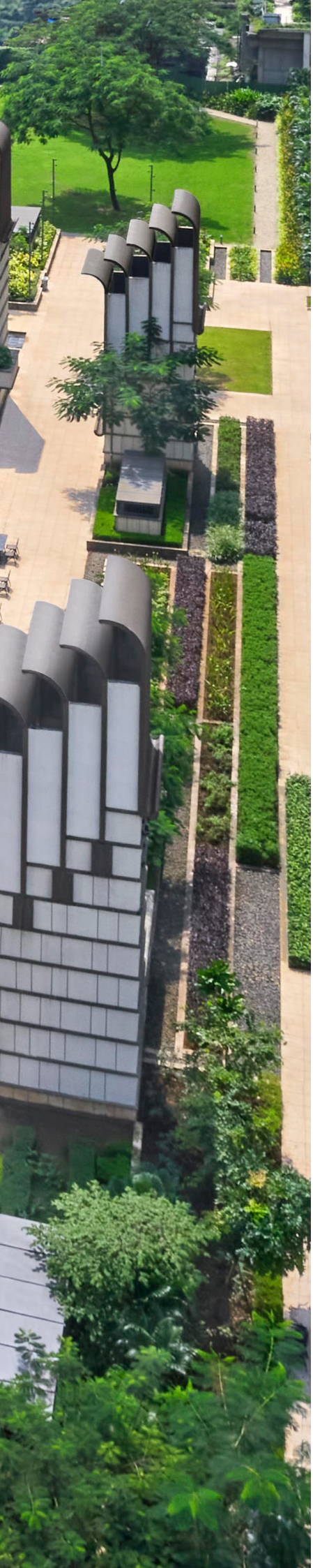
KNOWLEDGE PARTNER

RMI INDIA FOUNDATION

Maximum gain of advantage from minimal energy input

Transforming the built environment is critical to achieving India's ambitious net-zero climate targets announced by the Hon'ble Prime Minister at COP26. Gateway to India's Dymaxion is a publication indicative of India's cultural prowess represented in its buildings and its embrace of a commitment towards a sustainable future. Together, this document encapsulates the spirit of innovative, collaborative, efficient, futuristic, and sustainable growth that India aspires to in its built environments. With India's building stock set to double in the next two decades, the sector has significant responsibility and opportunity to reduce greenhouse gas emissions. Recognising the sector's pivotal role, Lodha and RMI India Foundation established the Net-Zero Urban Accelerator in July 2022. This initiative is not merely a response to the climate challenge, it's a vision to redefine urban development and lead India's transition towards net-zero by 2070.

The Accelerator focuses on enhancing resilience, health, affordability and access to energy services for all by developing actionable initiatives under five focus areas: Embodied Carbon, Passive and Active Cooling Solutions, Equipment Efficiency, Clean Energy and Clean Mobility. The flagship Palava City project by Lodha serves as a unique living laboratory for the Accelerator that can host as well as promotes experiments and innovations by leading industry players, experts, policymakers, and occupants to build integrative sustainable solutions at the city scale. It will also be a resource hub and a go-to platform for industry and policymakers charting India's decarbonisation journey.



Why the built environment?

Buildings and infrastructure leave an imprint on the planet that could last for decades, which is why smart and sustainable buildings are key to ensure a better life for us, and for generations to come. The IPCC report indicates that, to stay within the 1.5°C limit, global greenhouse gas (GHG) emissions need to be reduced by at least 43% by 2030, compared to 2019 levels, and by at least 60% by 2035. This decade is crucial for achieving these targets.

The built environment generates over 40% of annual global CO_2 emissions.

Of those total emissions, building operations are responsible for 27% annually, while building and infrastructure materials and construction (typically referred to as embodied carbon) are responsible for an additional 13% annually.

Built Environment Global CO_2 Emissions

28%
Building Operations

6%
Buildings Construction – Concrete, Aluminium and Steel

9%
Other Building Materials and Construction Industry

34%
Final Energy Demand

Lodha Net Zero Urban Accelerator

With a vision of 'Building a Better Life', Lodha is committed to reducing emissions significantly to ensure we leave a net positive impact on the environment. To achieve this goal, in partnership with RMI India Foundation, we launched the Lodha Net Zero Urban Accelerator in July 2022. It is a pioneering initiative with a goal to make net-zero the new normal for the built environment, thereby accelerating and maximising the building sector's contribution to India's 2070 net-zero emissions target.

10M+
Kilometres of shared mobility enabled

2M+
Kilometres enabled with EV charging

95%
Lodha's operational energy consumption transitioned to RE

35%
More efficient: Average operational EPI of 41kWh/m²/year recorded


1.5–2°C
Cooler than neighbouring areas: Accelerator's Living Lab—Palava City
25%
Reduction in embodied carbon emissions from greener concrete mixes
4X
Super-efficient fan adoption, compared to India's average of SE fan penetration
30%
Less energy consumption in Palava homes than a similar conventional home
.2M
Bicycle rides enabled

LODHA
NET ZERO URBAN
ACCELERATOR

KNOWLEDGE PARTNER

RMI
INDIA
FOUNDATION

Net Zero Urban Accelerator Yearbook

YEAR 1: PATHWAYS TO PROGRESS

Authors

Lodha

Aun Abdullah
Dr. Prasad Marepalli

RMI India Foundation

Sai Sri Harsha Pallerlamudi
Tarun Garg
Akhil Singhal

RMI

Marshall Abramczyk
Brett Bridgeland
Rebecca Esau
Arjun Gupta
Satyam Maharaj
Raghav Muralidharan
Victor Olgyay
Nuvodita Singh
Shijoy Varughese

Authors listed alphabetically by last name

Acknowledgements

Raghav Anand, Independent Contributor
Arin Kerstein, RMI
Prabal Muttoo, RMI
Atul Patil, Lodha
Amey Phadke, Lodha
Priyal Sangal, Independent Contributor
Deep Zanzrukia, Lodha

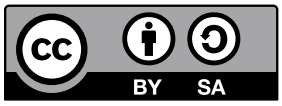
Authors listed alphabetically by last name

Contacts

For more information, contact sustainability@lodhagroup.com.

Copyrights and Citation

Gateway to India's Dymaxion, Lodha, RMI India Foundation and RMI, India, September 2023. www.lodhagroup.in/netzerourbanaccelerator/rmi-lodha-sustainability-conclave



ABOUT LODHA

Lodha is among the largest real estate developer in India that delivers with scale since 1980s. Core business of Lodha Group is residential real estate development with a focus on affordable and mid-income housing. The Group also has a growing industrial & logistics park business where in a short span of time, it has scaled up and made its mark with JVs already signed with marquee investors. Lodha Group has delivered more than 85 million square feet of real estate and is currently developing ~95 million square feet under its ongoing and planned portfolio. The Group has approximately 4400 acres of land beyond its ongoing and planned portfolio which will be utilised in developing further Residential, Commercial and Industrial & Logistics spaces. Thriving at building the world's finest developments, Lodha has created several iconic landmarks across the MMR notable among which are The World Towers, Lodha Altamount, Lodha Park, Lodha New Cuffe Parade and Palava City.

ABOUT RMI INDIA FOUNDATION

RMI Energy Solutions India Foundation ("RMI India Foundation")'s mission is to support the transformation of India's economy into a clean, thriving, and inclusive energy future. This mission is in line with the country's bold ambition to achieve a net-zero emissions economy by 2070. We aim to drive impact on the ground through deep research and rigorous analysis, which informs the development of sustainable clean energy policies and programmes across the country to enhance the lives and livelihoods of all Indians.

ABOUT RMI

RMI is an independent nonprofit founded in 1982 that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and NGOs to identify and scale energy system interventions that will cut greenhouse gas emissions at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing. RMI has been supporting India's mobility and energy transformation since 2016.

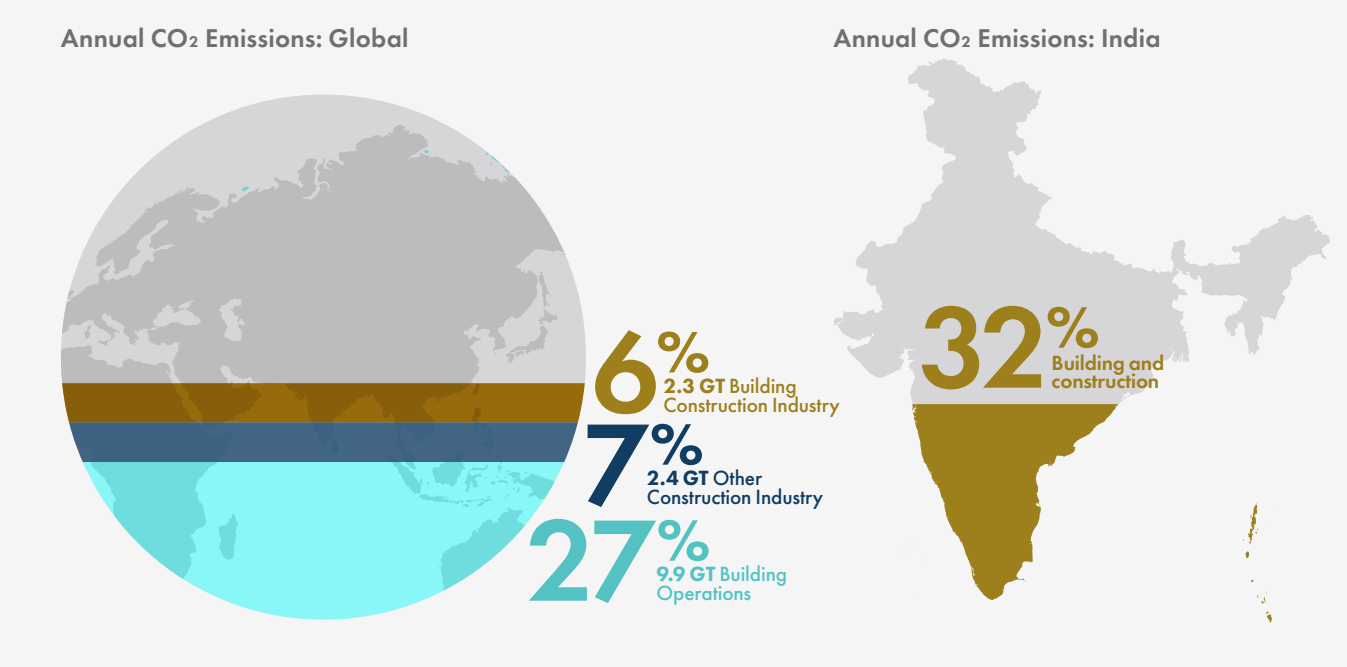
Table of Contents

Executive Summary

Rising global greenhouse gas (GHG) emissions has led to worsening the impact of global warming. These emissions expose us to severe weather anomalies and potentially harmful consequences for both the economy and society. Notably, over 40% of the world's GHG emissions originate from the built environment.

Building operations constitute roughly one-third of India's total energy consumption. Additionally, around 10% of the nation's energy is dedicated to manufacturing building materials and constructing new edifices. Without implementation of policies, market penetration of embodied carbon materials, energy efficient appliances and technlogical disruption, projections suggest that the buildings sector's energy consumption could surpass the current usage by 2050 by three times, leading to an almost quadrupled increase in carbon emissions.

EXHIBIT ES1 **WHY BUILT ENVIRONMENT?**



An integrated or whole-system approach that emphasises embodied carbon, operational carbon, clean mobility and clean energy has the potential to slash carbon emissions from

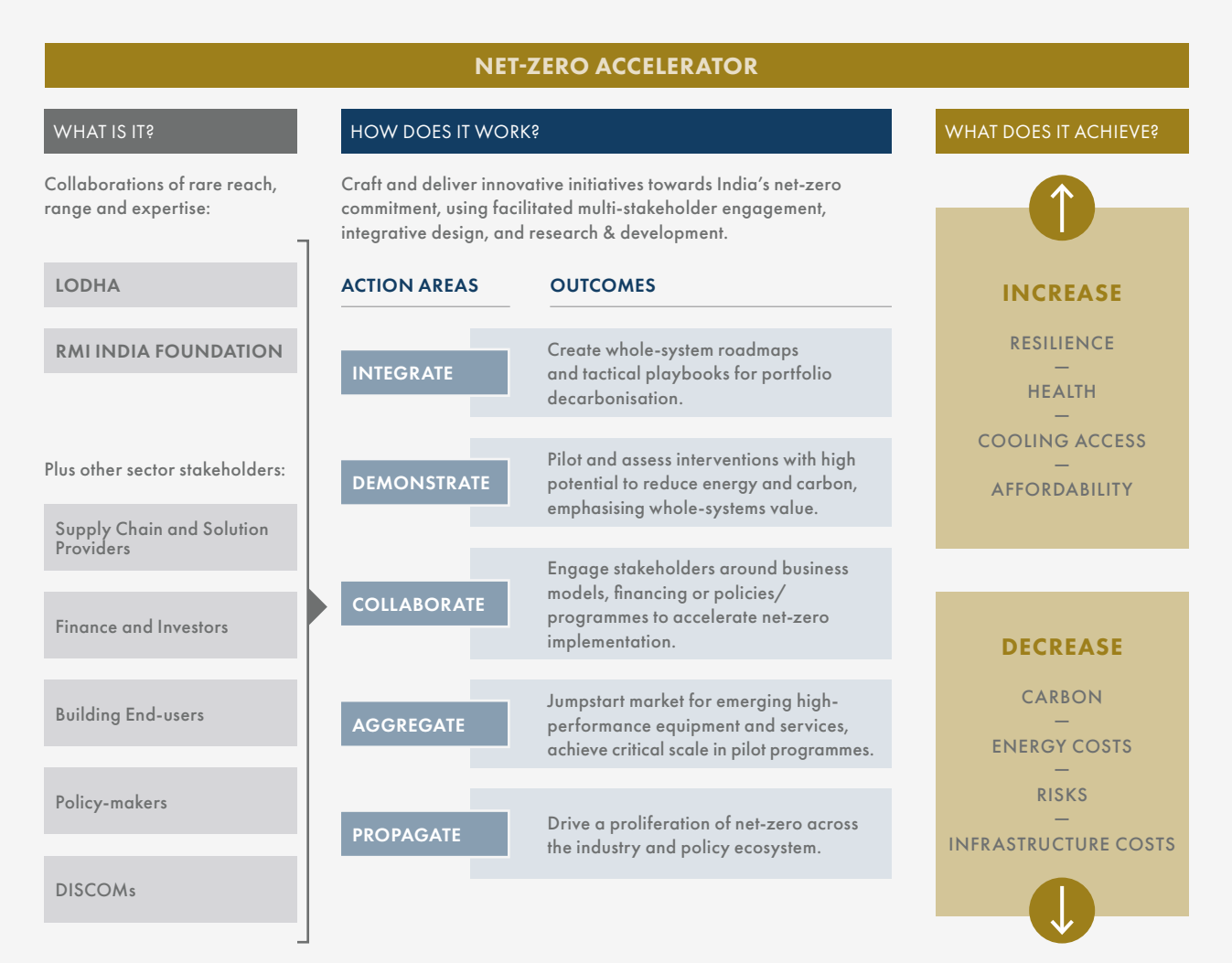
buildings by a significant 600 million tonnes by 2030, as per an NIUA report. The report also suggests that the buildings sector can reduce carbon emissions intensity by 45% by 2030 compared with that in 2005, in line with the NDC. Such substantial possibilities present a favourable opportunity to initiate sector decarbonisation in close collaboration with prominent developers and government entities.

As the largest real estate developer in India, Lodha possesses a distinct capability to conceive extensive city-scale projects that comprehensively integrate all aspects of the built environment in a sustainable fashion and represent a market-shaping scale. Recognising the immense opportunity to reduce carbon emissions by utilising low-embodied-carbon materials, passive design strategies, highly efficient cooling interventions and widespread adoption of electric vehicles (EVs) and renewable energy (RE) within the built environment, Lodha, in collaboration with RMI India Foundation as its knowledge partner, established the Net Zero Urban Accelerator in July 2022.

The Lodha Net Zero Urban Accelerator is a pioneering initiative with a goal to make net-zero the new normal for the built environment, thereby accelerating and maximising the building sector's contribution to India's 2070 net-zero emissions target. The Accelerator focuses on enhancing resilience, health, affordability and access to energy services for all by developing actionable initiatives in five key areas: embodied carbon, passive design solutions, efficient equipment, clean energy and clean mobility. Palava — Lodha's flagship city development — is India's first integrated greenfield smart city and a template for sustainable urbanisation. The Accelerator will leverage this unique opportunity, with Palava serving as a unique living laboratory and lighthouse example.

The Accelerator brings together industry, experts, policymakers, academia and occupants to build integrative sustainable solutions at the city scale and serves as a resource hub and go-to platform for charting India's decarbonisation journey. The engagement will involve technologies, business models, financing, policies and programmes to accelerate net-zero implementation. This model can generate scalable solutions to propel India's burgeoning built environment towards zero carbon.

EXHIBIT ES2 **ACTION LEVERS OF THE ACCELERATOR**



1 **Integrate**

Create a whole-system roadmap to achieve net-zero emissions, calibrated within Lodha's portfolio across Scopes 1, 2, 3, and 4.

2 **Demonstrate**

Pilot and assess tactical interventions with high potential to reduce energy consumption and carbon emissions in new developments. Tactics may be across various scales — city, neighbourhood, building, household and equipment.

3 **Collaborate**

Engage stakeholders to identify new business models, financing innovations or targeted policies/programmes to accelerate net-zero implementation with replicability and scalability potential across India's built environment.

4

Aggregate

Energise markets by organising bulk demand for leading-edge equipment, materials or services, improving availability and de-risking new products for all major stakeholders.

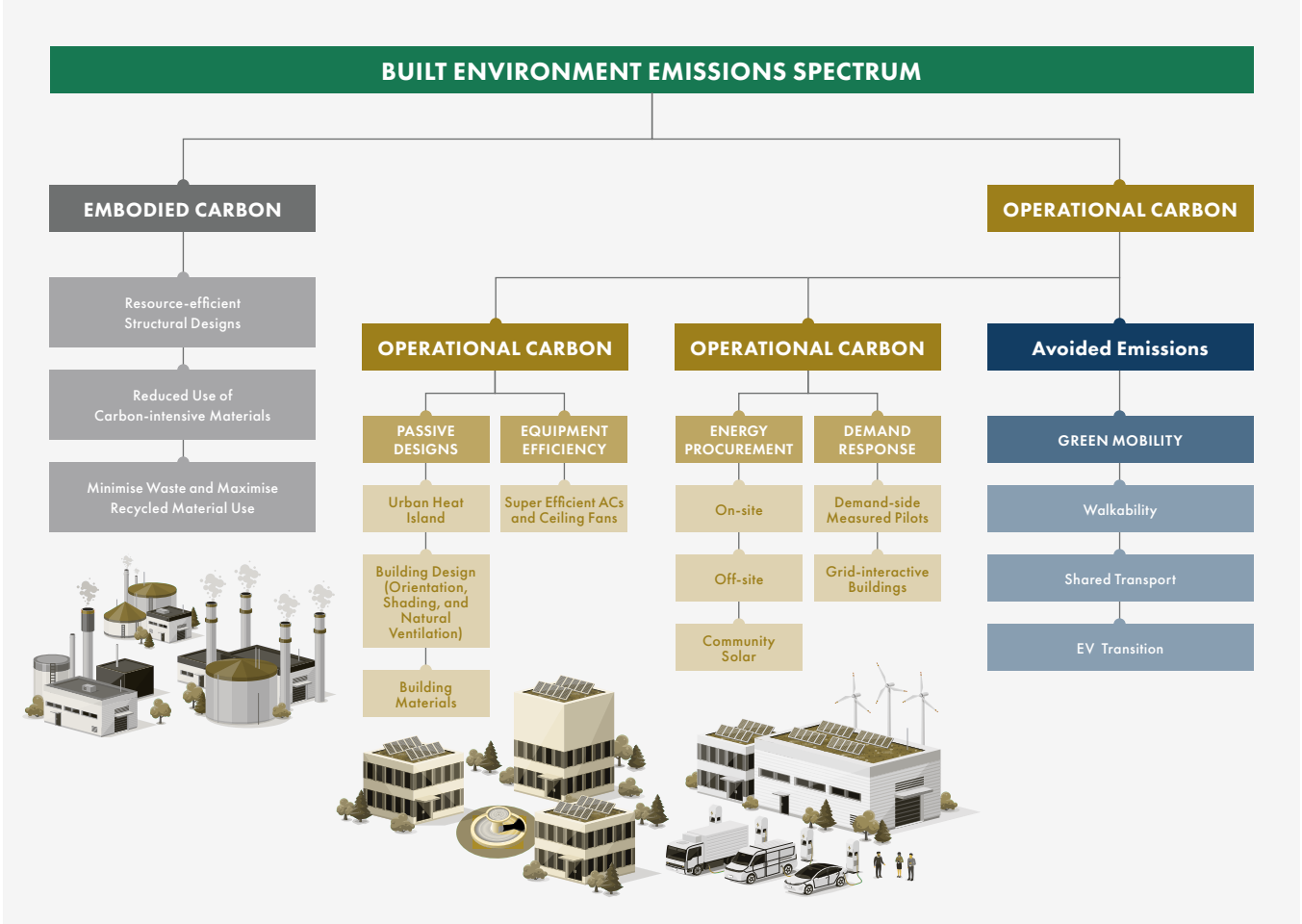
5

Propagate

Drive the proliferation of net-zero commitments by industry players and policymakers across India's built environment sector.

The Accelerator's overall vision is to create and sustain a market for thermally comfortable net-zero-carbon built environment in India. The Accelerator focuses on the entire emissions spectrum of the built environment, as shown in the exhibit on the previous page.

EXHIBIT ES3 **BUILDING EMISSIONS SPECTRUM**



The Accelerator is aimed at normalising net-zero for new developments by 2030 by evolving the way we design, construct and operate buildings. The following exhibit includes a broad range of integrated solutions to minimise embodied carbon through cost-effective low-embodied-carbon design decisions and material selection, reduce energy demand through passive measures and super-efficient equipment, serve the reduced energy demand efficiently through demand flexibility and clean energy and balance any residual emissions with equivalent reduction through carbon capture and offsets.

EXHIBIT ES4 **ANNUAL GHG EMISSIONS REDUCTION OPTIONS**

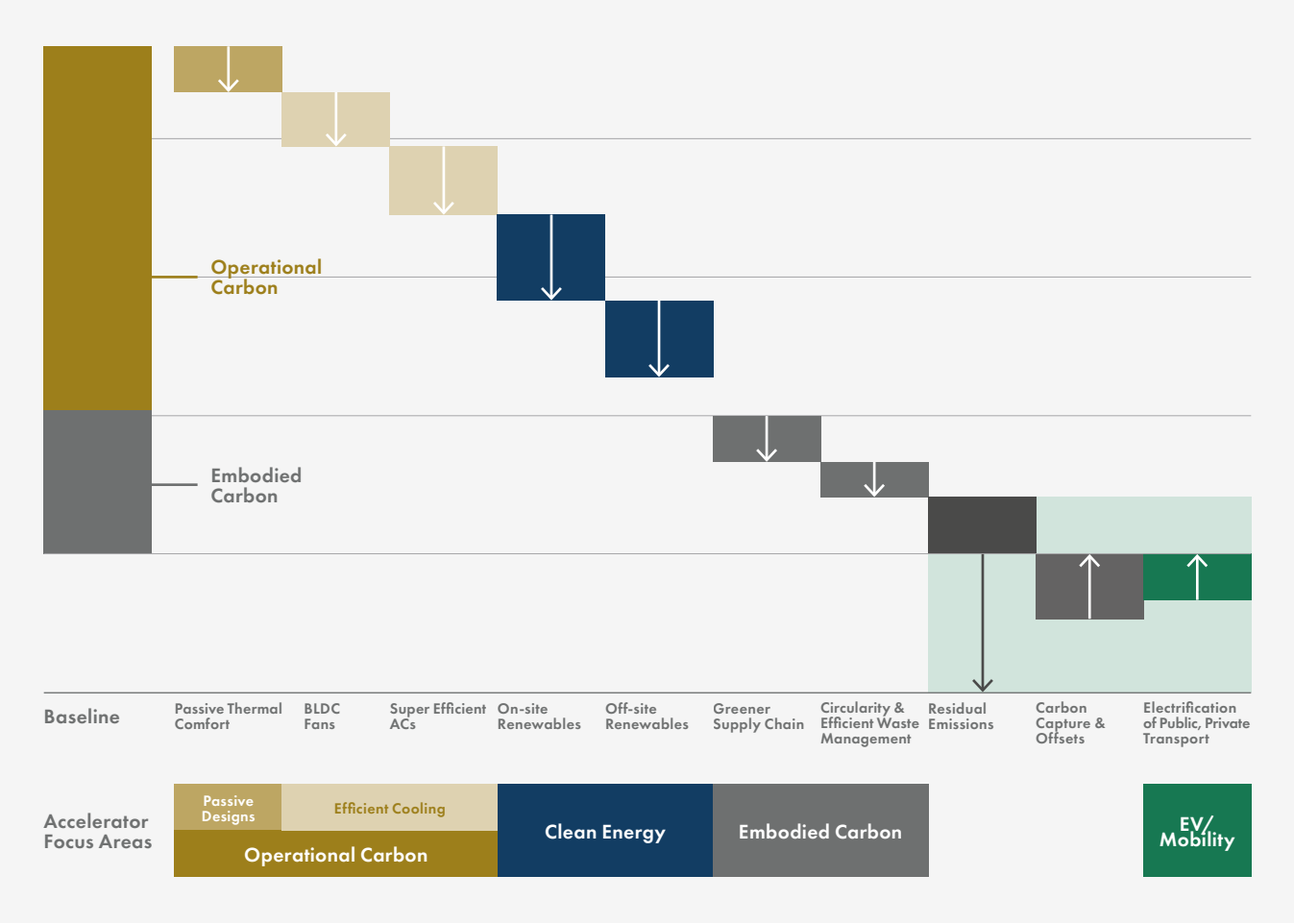


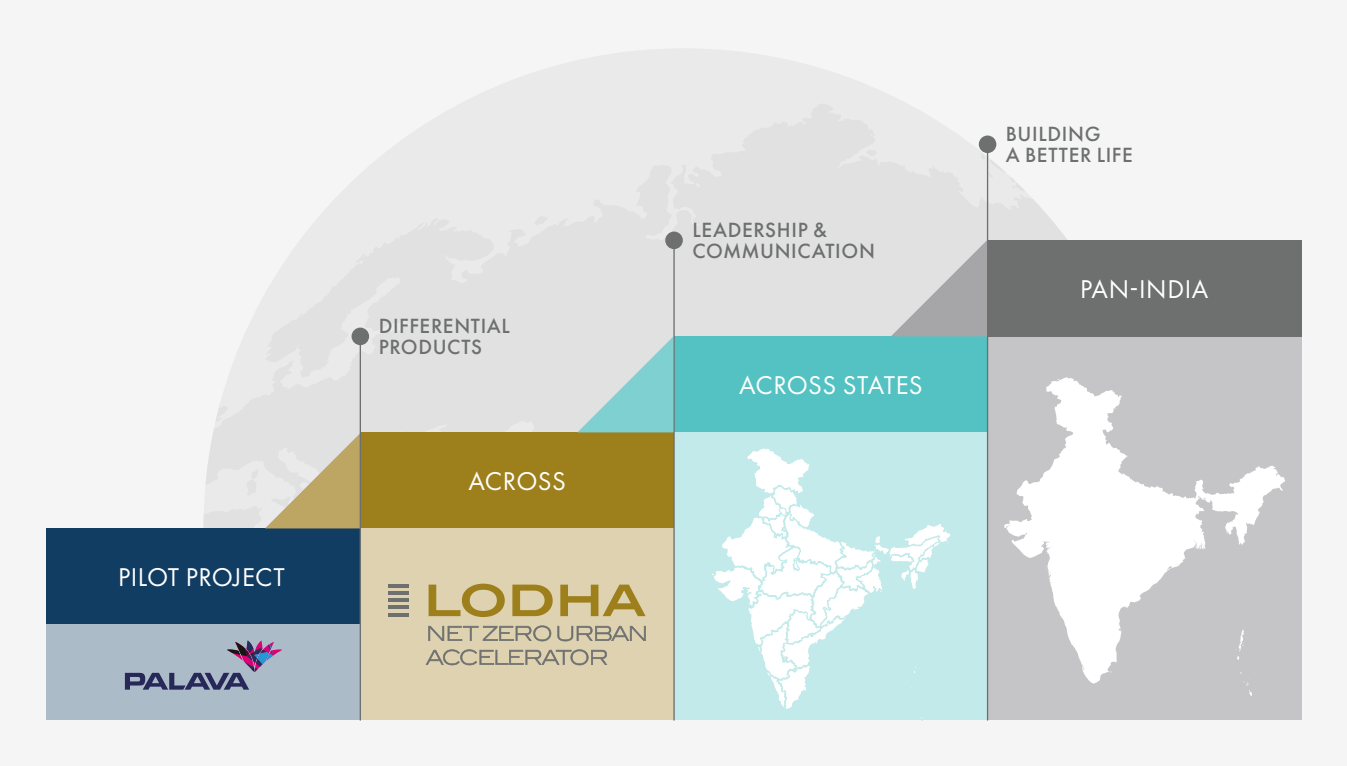
*Image not to scale; for representational purposes only

The efforts of Palava's 'living lab' will be expanded by creating specialised products, solutions and strategies targeting the designated focus domains. These distinctive programmes will be extended to other Lodha projects and the insights gained will reshape the market at the regional and national levels. This will lead the wider ecosystem to join forces and commit to the required change, supported by awareness initiatives, training and capacity-building programmes.

SCALING SOLUTIONS

For scaling, it is important to transform the supply chain of materials and technologies. A supply chain is only as strong as its weakest link, and it is critical to create a cascade of sustainable practices that flows smoothly throughout the supply chain.

EXHIBIT ES5 **SCALING VISION AND ROADMAP**



SUPPLY CHAIN TRANSFORMATION

Until entities at the foundational level of the hierarchy begin producing sustainable and climate-conscious products/components, the shift to low-carbon development will remain unrealised. This transformation requires measures at both the supply and demand sides.

Supply-side

- Industry players and manufacturers need to invest in R&D and scale the provisioning of energy-efficient, climate-resilient and low-carbon alternatives.

- This pivot requires training and capacity enhancement, incentives and promotion of peer-to-peer and field learning initiatives.

Demand-side

- Developers need to incorporate sustainable practices such as designing energy-efficient and climate-resilient buildings.

- Energy-efficient and low embodied carbon products must be procured to drive the demand for sustainable alternatives and transform the built environment.

- It is essential to collaborate with innovators to co-create/improve low-carbon alternatives by offering a platform for iterative adjustments and product/solution adaptation to real-world conditions and deploy economies of scale to tunnel through the initial cost barrier.

In addition to suppliers and procurers, industry associations possess a distinctive influence over primary and secondary procurers and suppliers. Given that their members often hold significant industry roles, they will play a pivotal part in the decarbonisation of the built environment.

Thus, aligned with the vision to accelerate the decarbonisation of the built environment, the Accelerator worked in the identified thematic areas. The updates from the first year are summarised for each thematic in the subsequent section.

EMBODIED CARBON

Within the four walls of our buildings is an often overlooked source of carbon emissions, commonly referred to as embodied carbon (EC) — the millions of tons of indirect emissions associated with procurement, manufacturing, construction use and end-of-life disposal of materials over the life cycle of a building.

- India's buildings sector emits nearly 500 million metric tons of carbon dioxide (CO_2e) in embodied carbon annually.

- Urbanisation, combined with the overall growth in India's population, is projected to add 416 million people to urban areas by 2050, nearly doubling the size of India's building stock in the next two decades.

- The surge is linked to around 250 ancillary industries associated with the real estate industry and could escalate the associated embodied carbon emissions drastically.

To navigate this pivotal convergence of urbanisation and emissions growth, it is essential to balance development with environmental stewardship by establishing pathways to decarbonise building design, construction and material supply chains.

Lodha actively pursues a whole-system approach to reduce EC in its building developments by outlining an array of strategies spanning design, procurement and construction.

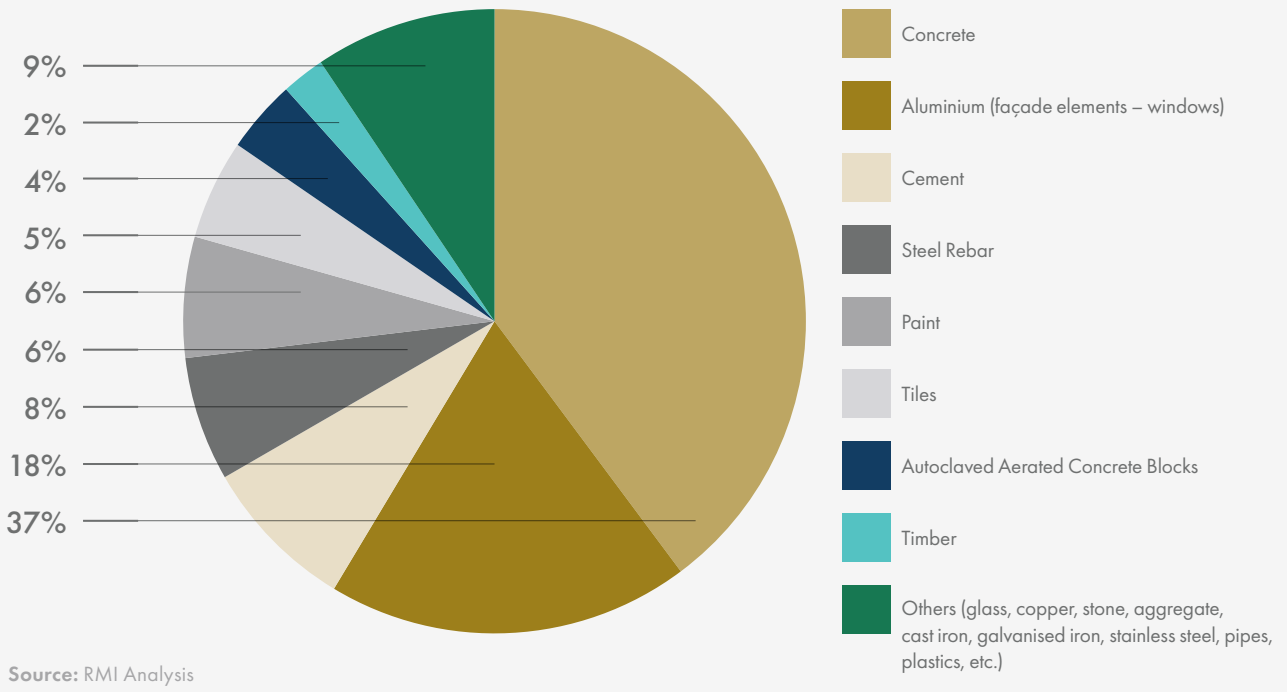
- Establishing a baseline of EC in building construction is an essential first step in measuring the success of EC reduction strategies.

- The Accelerator has conducted a comprehensive baselining study including the major material categories used in a typical multifamily building. It provides valuable data to identify high-impact opportunities to reduce the EC footprint of Lodha's portfolio by 5% and specifically concrete by 10% year-on-year contingent on the accomplishments and strategies of its supply chain partners.

- The analysis indicates an EC footprint of 387 $kgCO_2e/m^2$, as depicted in Exhibit ES4, which is notably modest compared with global benchmarks, and indicates that cement, concrete and steel rebar contribute up to 50% of the EC emissions, establishing them as a key focus area for carbon reduction.

Lodha systematically explores the usage of low-carbon concrete mixes and alternate cementitious materials such as LC3 by critically assessing the buildability and cost implications through pilots. Subsequently, strategies will be developed to reduce the EC footprint of steel, glass, aluminium and other building materials.

EXHIBIT ES6 **EC MATERIAL FOOTPRINT CONCRETE STRUCTURE (APPROX. 387 KG CO_2e/m^2)**



Source: RMI Analysis

Stakeholder consultations with material suppliers

To better understand the challenges and opportunities related to producing and adopting low-carbon products in the construction industry, the Accelerator team conducted stakeholder consultations with several cement and concrete manufacturers. To sum up the discussions with supply chain partners, barriers to the production and adoption of low-carbon products include emissions-related data scarcity, perceived uncertainty around field performance, limited policy push and demand-side market signals, low awareness of market-ready low-EC products, supply-chain challenges and evolving regulatory and green building certification targets concerning EC.

Action pathways — Embodied Carbon

Given the cost, risk and durability of alternative low-embodied carbon infrastructure, stakeholders are understandably cautious about adopting new practices. The Accelerator aims for the following:

- Bridge the information gap by conducting similar benchmarking analysis, incorporating third-party verification for other common typologies (such as composite, precast and industrial warehouses) and identifying the highest-impact materials for lowering EC.

- Systematically explore the usage of low-carbon concrete mixes and alternate cementitious materials such as LC3 by critically assessing the buildability and cost implications through pilots. Subsequently, strategies will be developed to reduce the EC footprint of steel, glass, aluminium and other building materials.

- Facilitate the generation of evidence, foster cross-border partnerships and signal tangible demand to accelerate the production and adoption of low-carbon building materials in India.

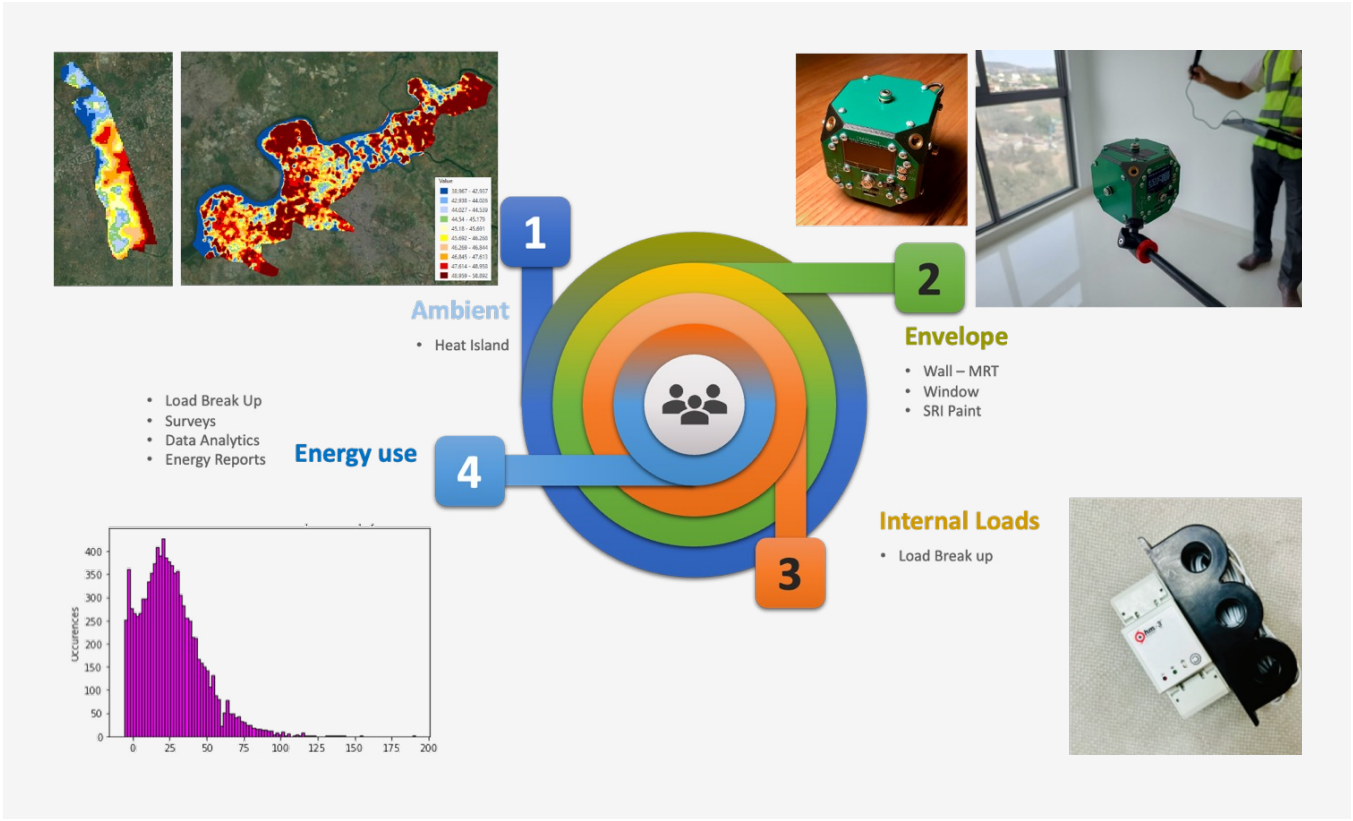
REDUCED ENERGY AND COOLING REQUIREMENT TO ACHIEVE THERMAL COMFORT

The dilemma of escalating global temperatures is evidenced by the fact that the 10 hottest years in recorded history have all been after 2010. In 2022, the surface temperature surpassed the 20th-century average of 57.0°F (13.9°C) by 1.55°F (0.86°C). Addressing the repercussions of mounting temperatures will necessitate significant endeavours and energy investments to ensure the thermal comfort of billions of individuals in urban areas and residences.

As the world's most populous nation, India is grappling with swift urbanisation intertwined with heightened economic affluence. This confluence is on the brink of triggering a notable upswing in energy requisites, prominently stemming from the constructed landscape, with cooling and thermal comfort demands constituting a significant portion.

These initiatives are aimed at providing thermal comfort to millions of people by benchmarking residential energy profile based on field measurements and prioritising performance improvement measures across energy-impacting layers, namely, ambient, envelope, internal loads and user behavior, as shown in Exhibit ES5.

EXHIBIT ES7 **ACCELERATOR'S WORK TO REDUCE ENERGY CONSUMPTION AT PALAVA**



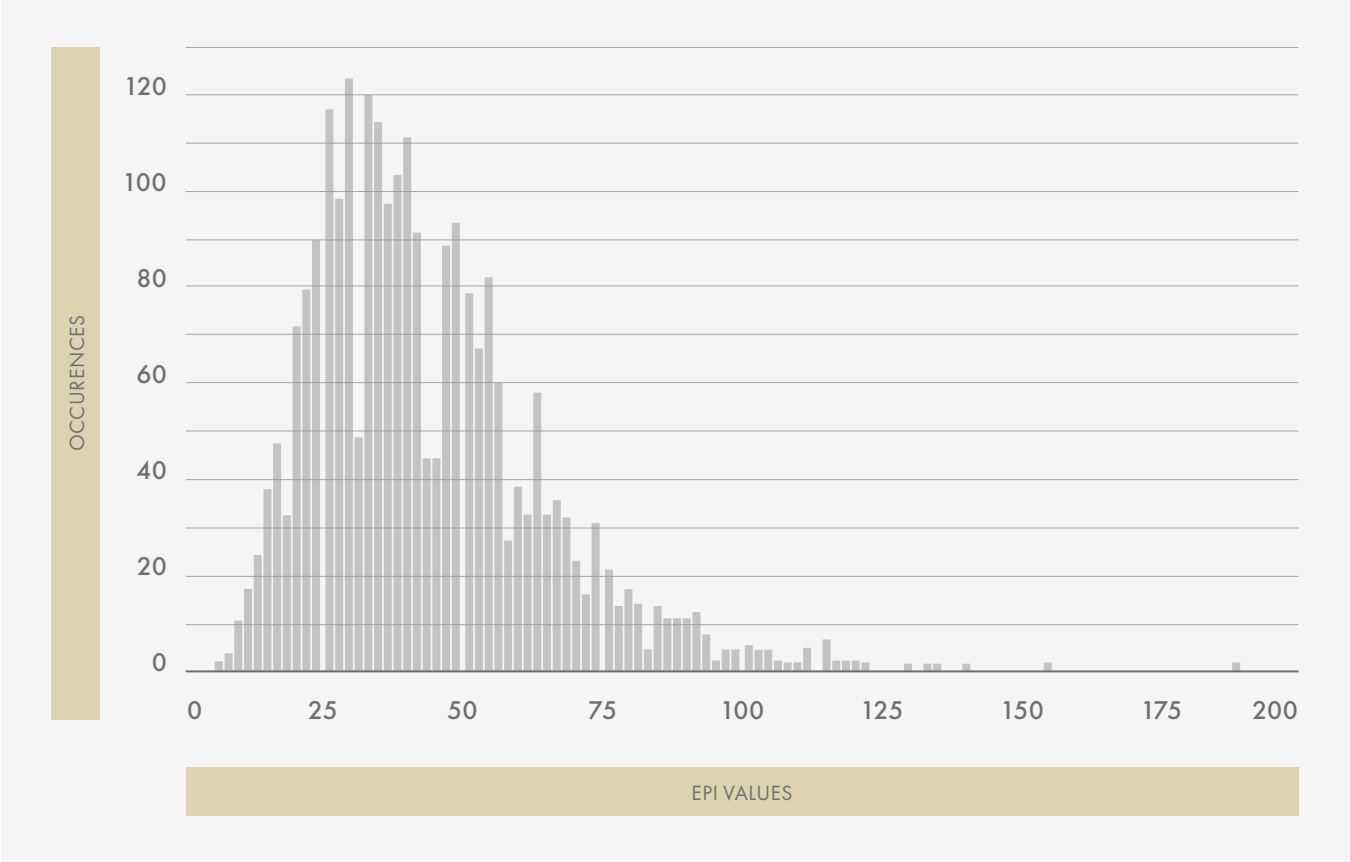
Energy use intensity

Energy use was analysed based on energy consumption data of around 10,000 households in Palava.

- The median EPI value was found to be 41Kwh/sm/year, which is 35% lesser energy than the industry benchmark for residential buildings in hot and humid climates, which may partly indicate energy-efficient design and equipment.

- Palava has 100% penetration of room air-conditioners (RACs) and reflects new construction patterns and expectations of access to cooling, contrasting the average household RAC penetration of under 10% in Indian population.

EXHIBIT ES8 **ACCELERATOR'S WORK TO REDUCE ENERGY CONSUMPTION AT PALAVA**



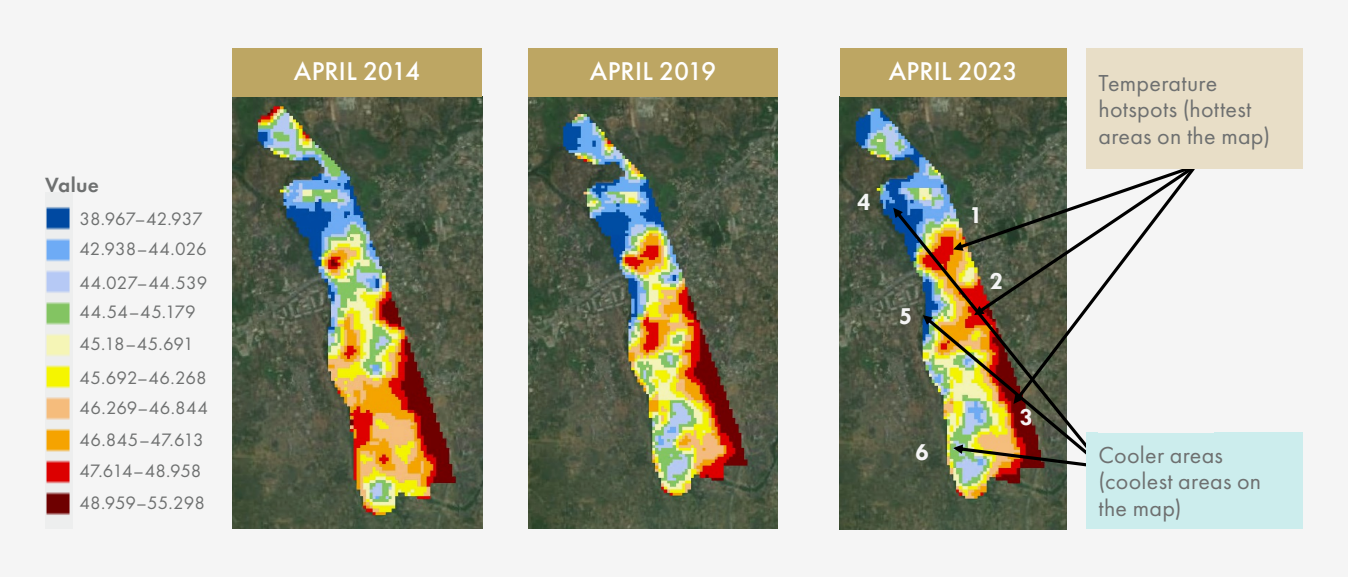
In the coming year, the Accelerator will focus on collecting more baseline data through surveys and behaviour studies and energy data disaggregation measurements. This data will be used to evaluate and propose physical and behavioural energy efficiency interventions. The Accelerator will subsequently inform policy discourse for driving actions on building and equipment performance.

URBAN HEAT ASSESSMENT

The Accelerator mapped the hotspots in a sector in Palava and assessed the historic data available from land surface temperature (LST) images. Initial findings suggest that Palava has cooled much faster than its neighbouring areas and a downward trend is expected in the future.Currently, Palava is around 1.5 – 2 degrees cooler than its neighbouring areas. This can be attributed to urban cooling strategies such as green cover and reflective roofs adopted in Palava.

The study will be further substantiated using on-site measurements and validating the urban cooling strategies implemented in Palava. The study results will inform future adaptation strategies such as cool roofs, smart surfaces and nature-based solutions to bring down the rising temperature within the communities and reduce cooling demand.

EXHIBIT ES9 **PHASE I — PALAVA LST**



Source: Landsat 7 and 8 imagery

PASSIVE SOLUTIONS AND NEXT-GENERATION COOLING TECHNOLOGIES

The Accelerator raises awareness about the advantages of both passive and active cooling systems, validates the efficacy of next-generation cooling solutions and fosters a market for these technologies.

In the current year of the Accelerator, experiments are being conducted using passive cooling techniques, and the real world performance of next-generation cooling solutions, including 5X RACs and BLDC fans, is being assessed. These initiatives are driven by the broad aim of accumulating empirical data on the effectiveness of useful solutions, thus instilling confidence among diverse stakeholders and facilitating their broad-scale adoption.

1

Passive solutions

The Accelerator has commenced testing the performance of advanced glass. In the first round, it assessed how the utilisation of high-performance glass (U value of 2.9W/m²/°K and shading coefficient of –0.34) compares with traditional glass (U value of 5.8W/m²/°K and shading coefficient of 0.82) in influencing indoor temperatures. Preliminary tests confirmed the ability to reduce daytime peak air temperatures in test spaces. Passive solutions such as cool roofs, additional glazing options, shading, solar chimneys, radiant cooling and ventilation, among a host of other passive solutions, will be explored in the second year of the Accelerator's journey.

2

Super-efficient air-conditioners (ACs)

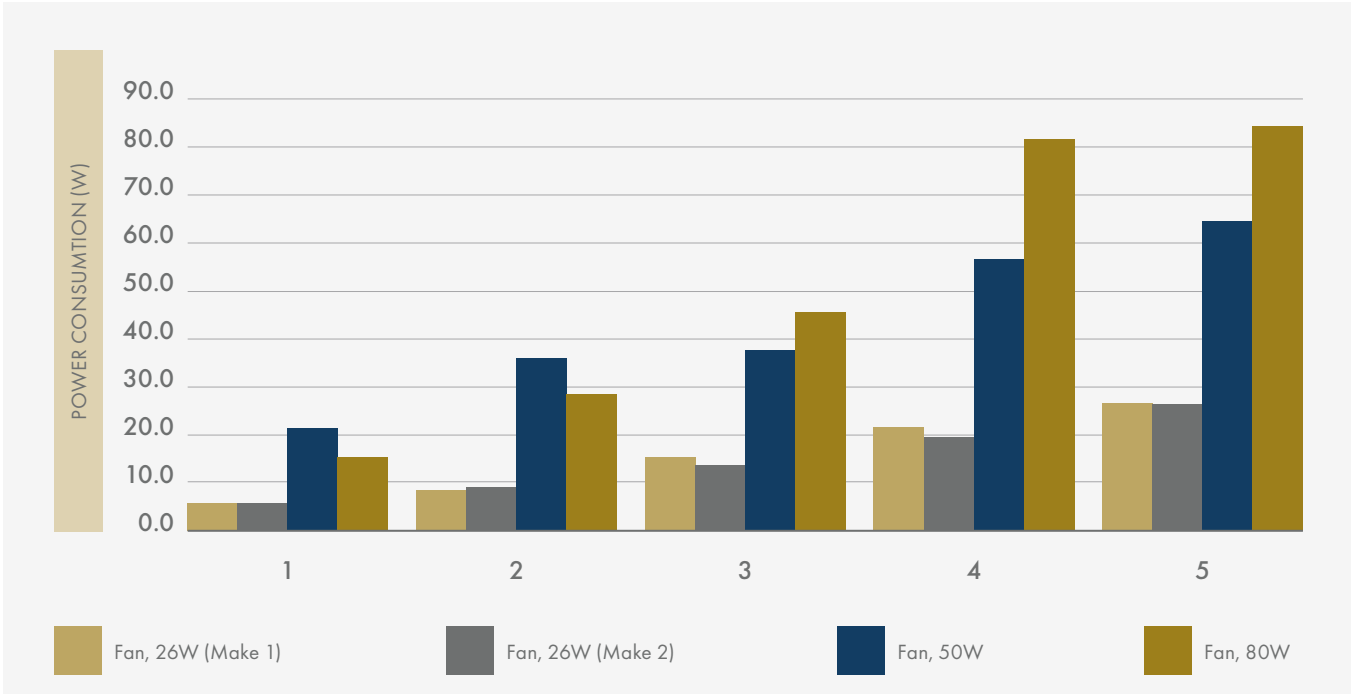
The Accelerator is currently evaluating the real-world performance of 5X ACs developed as part of the global cooling prize initiative. This evaluation is anticipated to be completed in the second year of the Accelerator programme.

3

Ceiling fans

The on-ground performance of various fans of different wattages (four of each wattage), ranging from 70W fans to super-efficient 28W BLDC ceiling fans, was analysed. The Accelerator showcased and generated credible evidence of energy savings, enabling procurement decision-making for new installations and retrofits of BLDC fans in new developments and existing spaces where fans were pre-installed by Lodha.

EXHIBIT ES10 **POWER (W) AT VARIOUS FAN SPEEDS**



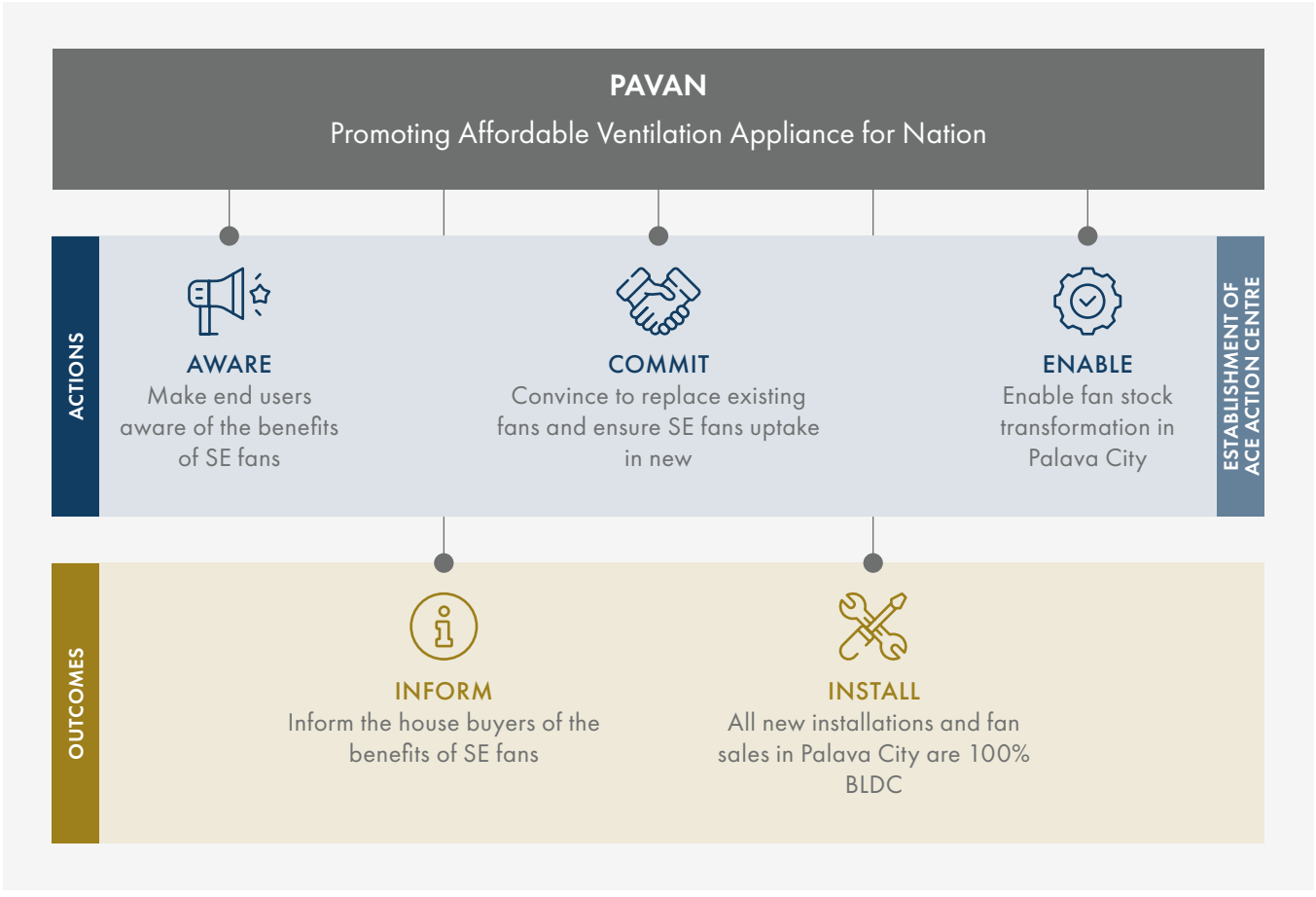
The Accelerator projects an overall energy savings potential of 13GWh annually if the expected households within Palava coming up in the next 10 years opt for BLDC fans instead of conventional fans.

Action Pathways - Reduced energy consumption and thermal comfort

Awareness: To swiftly address cooling challenges, the Accelerator proposes **Mission PAVAN** (Promoting Affordable Ventilation Appliance for Nation). The on-ground **ACE (Aware, Commit, Enable)** Action Centre associated with this mission will focus on three key areas:

1. Creating awareness among residents,
2. Demonstrating commitment from various stakeholders, including but not limited to residents, manufacturers, and Lodha, and
3. Facilitating on-ground implementations and installations, pushing market transformation towards SE technologies.

EXHIBIT ES11 **PAVAN – PROMOTING AFFORDABLE VENTILATION APPLIANCE FOR THE NATION**



Technology: The Accelerator is actively assessing the real-world performance of 5X air conditioners from the Global Cooling Prize initiative, with results expected in the second year of the programme.

Market Strategies: The Accelerator envisions deploying a blend of passive strategies and super-efficient appliances, notably fans and ACs. The strategies include:

- Encouraging bulk procurement by real estate developers and government bodies,
- Leveraging preferred pricing and negotiations,
- Innovating distribution through avenues such as company kiosks and
- Showcasing the benefits of cutting-edge technologies through targeted outreach.

The goal is to curate replicable strategies that inspire wider adoption among developers and governmental bodies.

CLEAN ENERGY

India's goal of achieving 50% non-fossil-fuel-based power generation by 2030 and deploying 50GW of RE annually until 2027–28 to meet this goal is undoubtedly ambitious. Accelerating consumer adoption of RE will play a vital role in India's efforts to meet its 2030 targets.

Nearly 36% of India's existing electricity demand can be attributed to the commercial and industrial (C&I) sector. Of the C&I sector's total electricity demand, less than 10% is currently sourced from RE. This implies that there is scope to decarbonise at least 90% of C&I's electricity demand, which could add about 450GW of RE capacity. Along with C&I consumers, residential consumers, who represent 30% of the country's existing electricity demand, have a strong incentive to adopt RE. This is because RE (especially solar) is one of the most economical sources of electricity available in the country today, offering consumers the opportunity to save on electricity bills.

Multiple pathways — short-term and long-term — can be explored to procure RE. For instance, long-term procurement models include on-site (capex, third-party PPA) and off-site (open access via third-party PPA, group captive, green energy open access) deployment models. New models such as virtual power purchase agreements (VPPAs) and community solar are also emerging. Short-term power procurement models include green tariff, green term ahead market (GTAM), RE certificates (RECs) and P2P trading.

Consultations with RE developers

Following the identification and clustering of the annual electricity demand across various Lodha sites (amounting to over 15 million units) at the portfolio level, India's leading RE developers were consulted to identify the least-cost RE pathways for individual sites based on the existing policy and regulatory framework in Maharashtra. These pathways include on-site solar generation and open access via third-party and group captive mechanisms. The on-site RE generation potential of Lodha's city-scale development 'Palava' was also identified.

The potential for integrating grid-interactive building elements such as battery storage and demand response is being explored at a sample captive building to further minimise electricity costs.

Action pathway — Clean Energy

- The Accelerator would focus on sharing knowledge around RE pathways for consumers across categories, leading to electricity savings.
- The Accelerator will help unlock novel RE procurement pathways such as green energy open access and community solar that can be tapped by MSME and residential consumers, respectively. This will include engaging with multiple stakeholders, including RE developers, consumers and the regulatory ecosystem. Palava has the potential to become a testbed to pilot and pioneer community solar for domestic consumers.
- The Accelerator aims to identify the potential for grid interactive building elements within the Lodha portfolio via technology assessments and pilots to optimise electricity costs and present the learnings with the wide commercial and industrial consumer ecosystem.

CLEAN MOBILITY

Globally, the transport sector accounts for 23% of the total GHG emissions responsible for climate change. Therefore, decarbonisation by transitioning to a clean mobility future is the key goal of governments across the world. In India, the transport sector contributes to 14% of all scope 1 carbon dioxide (CO_2) emissions, of which nearly 90% are from road-based transport.[i] Therefore, a crucial pathway to achieving India's net-zero target by 2070 is the decarbonisation of road transport.

i Scope 1 emissions are direct emissions from sources controlled or owned by an organisation.

The three-pronged approach to decarbonise focuses on eliminating the transport need by adopting the 5-10-15 walkability principle, enabling shared transport and improving overall energy efficiency and transitioning to low- and zero-emission vehicles.

One of the approaches to achieve a clean mobility future is to transition the transport sector to EVs.

India has established ambitious electrification targets, including ensuring that 30% of the private cars, 70% of the commercial vehicles and 80% of the two- and three-wheelers sold by 2030 are EVs. To accelerate the transition to EVs, the Government of India provides incentives for EVs through policy mechanisms such as the Faster Adoption and Manufacturing of Electric and Hybrid Vehicles (FAME) phases I and II. Additionally, 26 state governments have announced EV policies with state-specific targets, additional incentives and other policy levers to create an enabling environment for EV adoption. As a result, 5.3% of all vehicles sold in 2022–23 were electric.

Charging infrastructure critical to ensure accelerated EV adoption

Globally, the lack of charging and swapping infrastructure is one of the biggest barriers to EV adoption. Therefore, charging infrastructure must be deployed in anticipation of growth in EV sales. EVs can be charged privately at home or using publicly available charging. The distribution of charger type should reflect the local context.

Built environments characterised by the availability of space to park at each residence can place high reliance on home chargers. Built environments with high-density housing (e.g., apartments) and limited access to home chargers at parking spaces can rely more on public charging. Another key characteristic of the built environment is the mode of transport. As charging solutions vary by vehicle segment, the charger deployment strategy should match the mobility patterns and vehicle segments in operation by the population.

Charging infrastructure deployment in India

As of August 2023, 9,113 public charging stations were operational across India (translating to a public charger-to-EV ratio of 1:182). Among states, Maharashtra has the highest number of public charging stations (2,494), followed by Delhi (1,627). To support the deployment of charging and infrastructure in cities and on highways, the government

allocated ₹1,000 crore under FAME II and notified other supportive mechanisms such as mandating 20% of the parking capacity in new buildings to be EV-ready.[ii]

While several measures were put in place to encourage the widespread deployment of accessible and affordable charging infrastructure, challenges such as technology standardisation hindering innovation; limited availability of land and grid capacity for new EV loads; high land acquisition costs; limited consumer awareness for charging point installation, maintenance and use; ambiguous regulatory requirements for developers and charge point operators; limited business model flexibility; and financial incentives to support infrastructure installation remain.

Palava township as a testbed for proof points

The vision for Palava is '***to enable a phased, timebound, sustainable and inclusive transition of all two- and four-wheelers, including legacy internal combustion vehicles, to electric in the Palava township by 2045. Palava will be a replicable model for townships in India and across the world.***'

Palava can act as an ideal testbed to develop the required proof points to overcome the challenges pertaining to deploying charging infrastructure. For this, a charging and swapping infrastructure deployment plan (hereinafter called the 'action plan') is being developed. The action plan will be a roadmap for the phased installation of charging infrastructure in Palava.

Vehicle electrification targets

To understand the charging requirements of Palava, vehicle electrification targets were established for two scenarios: business-as-usual (BAU) and aggressive. The electrification targets were assessed based on the following:

- Electrification trends in Mumbai, a city with a similar demographic to Palava.
- EV penetration in countries leading the EV transition and contextualised to India.
- Lodha's net-zero targets.

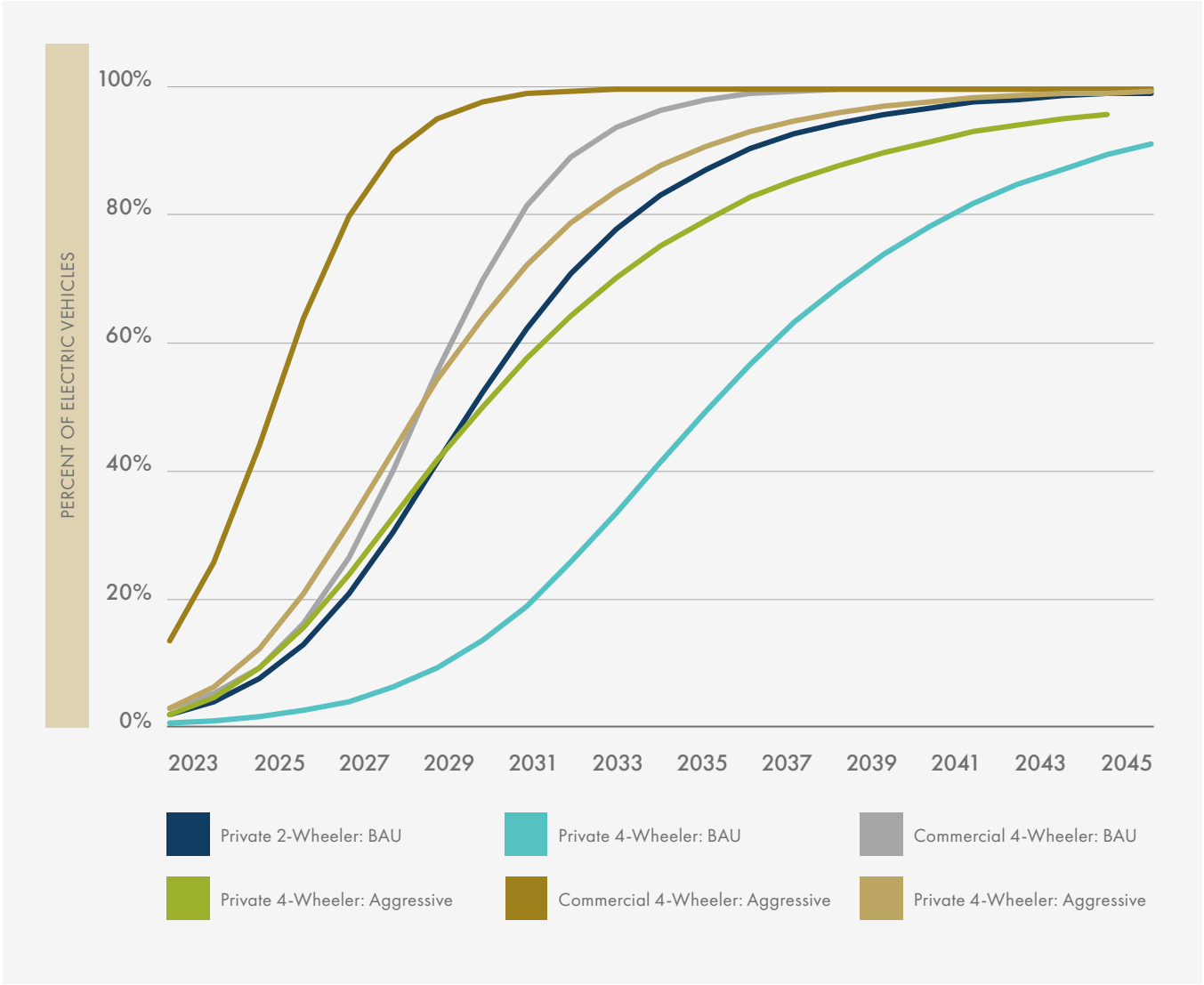
Palava-specific parameters, including projected occupancy, vehicle ownership trends and resident profiles, were also considered.

---

ii As per India's building bylaws (2016), charging infrastructure shall be provided on 20% of the vehicle holding capacity/ parking capacity of the premise. The building premise must have capacity for the additional power load with a safety factor of 1.25. EV-ready parking spots shall be equipped with all conduit, wiring and panel capacity, and require only the installation of the EV charger. EV-ready buildings include the installation of dedicated branch circuit(s), circuit breakers and other electrical components.

The EV penetration targets and Palava-specific parameters form the basis to assess charger requirements, including type and count. Exhibti ES6 summarises the EV penetration targets for Palava's priority segments.

EXHIBIT ES12 **ELECTRIFICATION TARGETS FOR AGGRESSIVE AND BAU SCENARIOS**



Source: RMI India Foundation

CHARGER DEPLOYMENT TARGETS

Based on the vehicle electrification goals, charger deployment targets were set to balance the charging needs of EV owners and other considerations, such as optimising energy consumption and managing costs and new load. The targets also prioritise accessible shared public chargers. Private chargers may be provided in specific instances if pre-set requirements are met. The cumulative type and number of chargers are provided in Exhibit ES2:[iii]

- By 2035, accounting for Palava's urban design and vehicle ownership patterns and mobility needs of its residents, 10 public chargers and 16 private chargers would be required for every 100 parking spaces in the aggressive scenario.

- In the aggressive electrification scenario, 57% of the public chargers would be LEV AC (3.3kW), 17% would be DC 001 (15kW) and 18% would be CCS (50kW).

- In the BAU electrification scenario, 59% of the public chargers will be LEV AC (3.3kW), 15% will be DC 001 (15kW) and 19% will be CCS (50kW).

Action pathway — Green Mobility

A key aim of deploying charging infrastructure in Palava is to develop proof points and capture lessons learned through deployment to help the ecosystem understand and overcome barriers to charging infrastructure deployment.

This process will answer the following:

- What measures must be taken to ensure regulatory compliance when installing charging stations?

- What are the commercial implications of adhering to regulatory requirements pertaining to making parking spaces in buildings EV-ready?

- How is the balance between public and home chargers to optimise costs determined? Should developers prefer one over the other?

---

iii LEV: Light Electric Vehicles
AC: Alternating Current
kW: kilowatt
DC: Direct Current
CCS: Combined Charging System

To facilitate learning within the ecosystem, Lodha will report on the progress, capture and disseminate critical knowledge with all stakeholders and facilitate the development of solutions to promote scaling of charging infrastructure deployment in Palava and beyond.

THE ROAD AHEAD: NET ZERO URBAN ACCELERATOR

In essence, the Accelerator will focus on driving a systemic change for the decarbonisation of the built environment. This shift will be driven through various approaches, including the implementation of change models centred on policies, market transformation, business models and technology advancement supported by financial initiatives. To ensure a holistic transformation, it is imperative for the Accelerator to concentrate on initiatives such as consumer awareness campaigns, behaviour change initiatives, educational programmes, capacity enhancement, strategic partnerships and thought leadership. Looking ahead, the Accelerator, through its five focus areas, will address the following pivotal questions to create and sustain the market for thermally comfortable net-zero carbon homes in India.

1

Testing and innovation

How will various solutions available in India and globally be tested to establish real-world performance and generate evidence supported by data to instill confidence among various stakeholders for its adoption?

2

Policy

How can the Accelerator shape policy frameworks and foster demand and long-term viability for the selected net-zero solutions?

3

Industry supply chain

In what ways can the Accelerator revolutionise the industry's supply chain with the broad goal of encompassing all essential stakeholders within the manufacturing ecosystem of the built environment?

4

Just transition

How can the Net Zero Urban Accelerator be optimised to not only achieve its environmental goals but also generate sustainable livelihood opportunities?

The Accelerator is a forum for collecting invaluable insights from pertinent stakeholders, substantiating and fine-tuning the Accelerator's forthcoming courses of action. As part

of its progression, the Accelerator aims to incorporate interaction with supply-chain leaders, policymakers, developers and solution providers, fostering their rare reach, range and expertise. The Accelerator will design, implement and scale innovative decarbonisation initiatives to jumpstart market transformation to maximise the building sector's contribution to India's 2030 NDC targets.

Of the thematic areas identified within the built environment, the Accelerator has not only work on areas illustrated below in its inaugural year but also plans to continue its focus on these and expand its activities in the future (See Exhibit below).

EXHIBIT ES13 **SNAPSHOT OF COMPLETED, ONGOING AND PLANNED ACTIVITIES OF THE ACCELERATOR**

INDIA 2030 GOALS	• Reduce the emissions intensity of its **GDP by 45% by 2030, relative to 2005 levels** • Achieve about **50 percent cumulative electric power** installed capacity from non-fossil fuel-based energy resources by 2030 • The **buildings sector has the potential to cut carbon emissions intensity by 45% by 2030** compared with that in 2005, in line with India's NDCs. • To support this, the Accelerator aims to demonstrate and mainstream feasible, innovative, and scalable decarbonisation solutions across the built environment spectrum.
EMBODIED CARBON	
Accelerator 2023 Goals	30% reduction from a baseline of 387 KgCO/m²*
Propogate	Engage with policy makers, experts, supply chain leaders, contractors and recyclers to help scale low-embodied carbon building materials while fostering awareness about embodied carbon and facilitating capacity building.
Aggregate	Explore possible partnerships for demand aggregation and provide the demand signals to the supply side to mainstream low-carbon products.
Collaborate	Collaborate with innovators to co-create/improve low-carbon alternatives by offering a platform for iterative adjustments and product/solution adaptation to real-world conditions.
Demonstrate	Deploy low-EC alternative pilots and evaluate material performance and supply-chain capability. *Current focus: Low-carbon concrete mixes with GGB5 and LC3.*
Integrate	A comprehensive baselining of EC and prioritising action based on the emission intensity and decarbonisation impact of materials is identified.
REDUCED ENERGY CONSUMPTION	
Accelerator 2023 Goals	33% reduction in residential energy usage linked to thermal comfort and water heating form a baseline of 33 KWh/m²
Propogate	Deliver scalable passive thermal comfort solutions for millions of affordable homes in India. Create awareness and enable 100% adoption of superefficient RACS, Fans and appliances across Lodha's projects
Aggregate	Aggregate demand from consumers for energy-efficient homes and equipment through data-backed awareness programs.

Collaborate	Co-creating with manufacturers to deliver market-ready RAC units and other super-efficient equipment and develop commercially viable solutions for mass adoption.
Demonstrate	Field testing of super-efficient RACS (through GCP) and Fans and informing the captive users about the benefits. *Current focus: Global Cooling Prize AC units, BLDC fans, high performance façade, evaporative cooling and radiant cooling.*
Integrate	Benchmark residential energy profile based on field measurements and prioritise performance improvement measures across energy-impacting layers, namely ambient, envelope, internal loads, and user behavior.
CLEAN ENERGY	
Accelerator 2023 Goals	Enable 100% RE transition for Lodha's residents using various RE procurement pathways
Propogate	Disseminate learning through RE procurement handbooks and deliver a blueprint of achieving a comprehensive RE transition.
Aggregate	Enable aggregation and integration of energy demand and generation for accelerated RE adoption.
Collaborate	Collaborate with policymakers and RE developers to adopt novel least-cost RE transition models for various use cases.
Demonstrate	Deploy various RE procurement pathways in all energy use cases for Lodha's own operations and for its residents. *Current focus: Rooftop Solar, Open Access, Net Metering and Community Solar.*
Integrate	Assessment of Lodha's electricity demand on the portfolio level. Feasibility assessment for Community Solar projects.
AVOIDING EMISSIONS	
Accelerator 2023 Goals	Enable 100% electrification of shared transportation in Palava and catalyse the adoption of private 4W (50%), and 2W (64%) electric vehicles.
Propogate	Deliver a city-scale replicable model for non-motorised/electrified transportation.
Aggregate	Aggregate the various modes of mobility (motorised and non-motorised) to reduce transportation emissions, and integrate with the infrastructure plans of the larger Metropolitan region.
Collaborate	Collaborate with the policymakers, charging infra providers and residents to tailor-make solutions in this evolving e-mobility landscape.
Demonstrate	E-bus pilot and phased deployment of public- and private-charging infrastructure. *Current focus: Walkability, Bikeability, E-buses and EV charging infrastructure.*
Integrate	Baselining modal breakup of private and public transportation and assessing routes for e-buses, and a progressive charging infrastructure roadmap.

* 2022 Lodha EC baseline for a multi-family high-rise reinforced concrete residential building, respresentingthe bulk of expected urbanisation in India.

References

1. Kumar, Megha et al. “Decarbonizing India’s road transport: a meta-analysis of road transport emissions models.” International Council For Clean Transportation, 2022. Accessed August 22, 2023. https://theicct.org/wp-content/uploads/2022/05/Meta-study-India-transport_final.pdf.
2. Climate Trends. “Full Report Digital with Spreads.” Accessed August 22, 2023. https://climatetrends.in/wp-content/uploads/2023/02/full-report-digital-with-spreads.pdf.

3. “Lok Sabha – Setting up of EV Charging Stations – 08 Aug.” India Environment Portal. Accessed August 22, 2023. http://www.indiaenvironmentportal.org.in/files/file/monsoon_session_2023/Lok%20Sabha-Setting%20up%20of%20EV%20Charging%20Stations-08%20Aug.pdf.

4. Ibid.


MORE
COMING SOON
STAY TUNED

Gateway to India's Dymaxion

Net Zero Urban
Accelerator Yearbook

LODHA
NET ZERO URBAN
ACCELERATOR

KNOWLEDGE PARTNER

RMI INDIA FOUNDATION