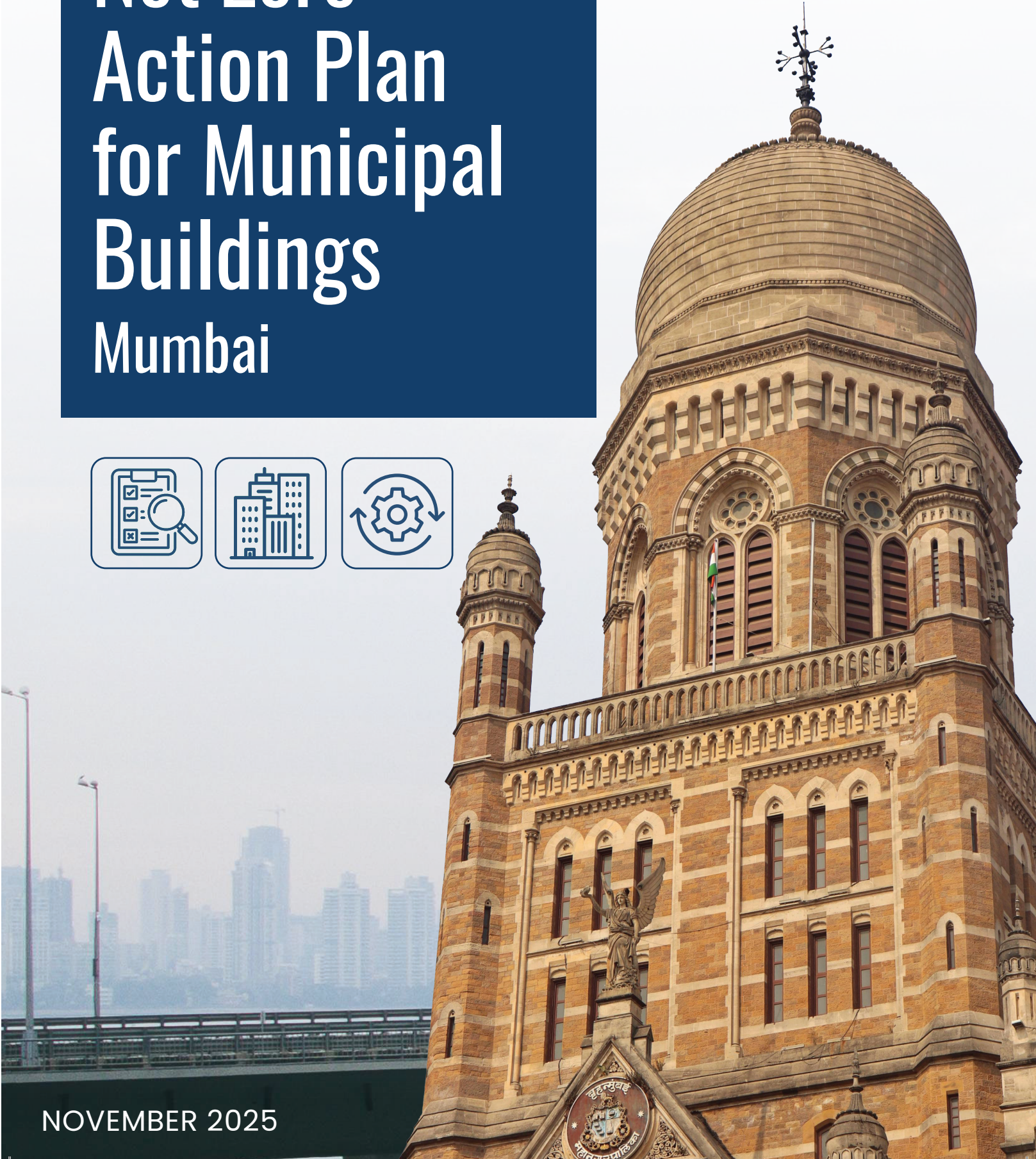




# Net Zero Action Plan for Municipal Buildings Mumbai



NOVEMBER 2025



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This report has been prepared through a collaborative effort between C40 Cities, the Brihanmumbai Municipal Corporation (BMC), and the Alliance for an Energy Efficient Economy (AEEE). It lays the foundation for a Net Zero Municipal Buildings Action Plan by assessing energy consumption and emissions profile of municipal buildings and identifying priority areas for improvements.

**Prepared by: Alliance for an Energy Efficient Economy (AEEE)**

Alliance for an Energy Efficient Economy (AEEE) supports policy implementation and enables the energy efficiency market with a not-for profit motive. AEEE promotes energy efficiency as a resource and collaborates with industry and government to transform the market for energy-efficient products and services, thereby contributing toward meeting India's goals on energy security, clean energy, and climate change.

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**Disclaimer**

The views and analyses are based on a detailed review of the information publicly available or provided to the AEEE team. Every attempt has been made to ensure the correctness of data. Any errors in interpretation are solely of the authors. Readers are encouraged to verify and authors will not accept any responsibility for the consequences of using this data.

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# Acknowledgements

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This report should be referred to as the 'Brihanmumbai Municipal Corporation (BMC) Municipal Building Net Zero Action Plan, November 2025'



# Preface

Mumbai is one of India's largest metropolitan cities. C40's prior engagement on structuring the Paris Agreement aligned Mumbai's Climate Action Plan (MCAP) recognized the buildings sector as a key contributor accounting for 20% of the city's GHG emissions. Public buildings alone represent 7% of electricity consumption, projected to triple by 2050 under a business-as-usual scenario.

Taking cues from MCAP and building up on the commitment by 43 cities in Maharashtra to prepare and implement city-level decarbonization roadmap; C40 supported development of a roadmap for transition of the energy and buildings sector. Launched by the Environment and Climate Change Department of Maharashtra in December 2023; this roadmap was a city-level template that outlined a pathway for supporting energy transition, upscaling energy efficiency, reducing GHG emissions and reliance on fossil fuels, and lowering energy operation costs.

Building on the Maharashtra City Decarbonisation Roadmap, C40 is currently supporting seven (Mumbai, Amravati, Panvel, Nashik, Chandrapur, Navi Mumbai, Thane) out of the 43 cities included in first phase of this work, to develop implementation frameworks and action plans for clean energy and low-carbon buildings. An important initiative in this phase is developing a Net-Zero Municipal Buildings Action Plan. C40, Brihanmumbai Municipal Corporation (BMC), and Alliance for an Energy Efficient Economy (AEEE) have collaborated to assess the current energy and emissions profile of municipal buildings to identify key areas for improvement in this report to further develop the Net Zero Municipal Building Action Plan.



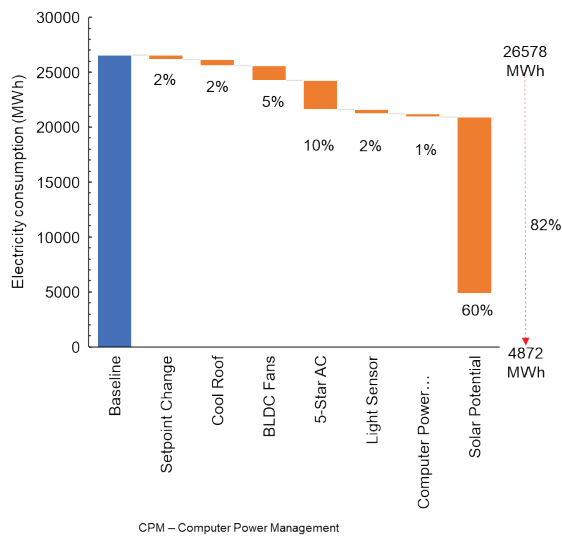
# Executive Summary

The **Net Zero Action Plan for Municipal Buildings** presents a comprehensive framework for the **Brihanmumbai Municipal Corporation (BMC)** to transition its municipal building portfolio toward **net-zero energy and carbon** targets by 2050. The plan addresses both **existing** and **new municipal buildings**, focusing on strategies that combine technical, financial, and governance interventions to achieve measurable emission reductions in alignment with the **Mumbai Climate Action Plan** and **Maharashtra's Net Zero Roadmap by 2050** objectives.

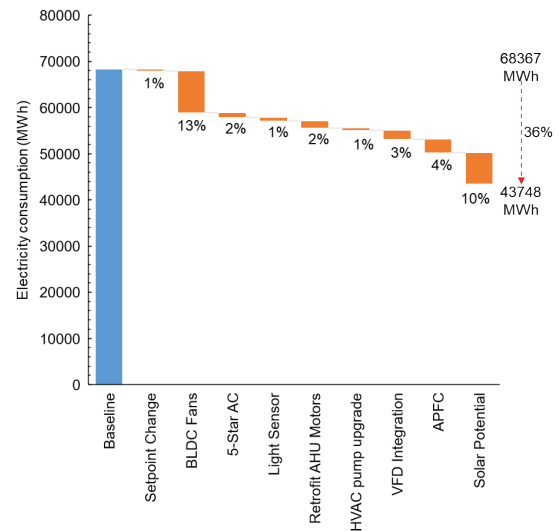
Municipal buildings account for approximately **16.5% of BMC's total electricity consumption**. Within this, **municipal offices, hospitals, and schools (primary and secondary) contribute around 10%, 4%, and 1.2% respectively**. **Auditoriums** have also shown a significant increase in electricity consumption—**rising nearly fourfold between 2021 and 2025**. Given this trend, these **four building typologies—municipal offices, hospitals, schools, and auditoriums—are recommended as the priority focus areas in the current Net Zero Action Plan**. Since the plan covers both existing and new buildings, the approach varies accordingly. For existing buildings, the Net Zero Action Plan Targets Net Zero Energy Buildings through improved operational energy efficiency and integration of renewable energy. For new buildings, the goal is to achieve Net Zero Carbon by reducing both operational and embodied carbon through the use of low-carbon materials, efficient design practices, energy-efficient appliances, rooftop solar PV, and clean energy procurement.

## Net Zero Strategies for Existing Building

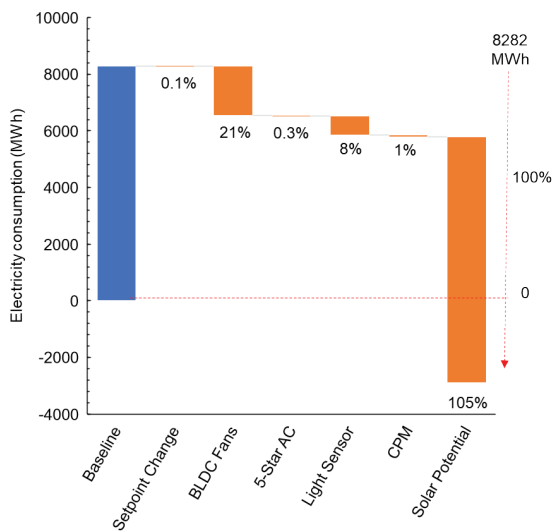
Walkthrough energy audits were conducted for **nine representative buildings** across the identified typologies (3 municipal offices, 2 hospitals, 2 schools, and 2 auditoriums) to identify potential Energy Conservation Measures (ECMs). Energy savings were estimated for each sampled building based on the identified ECMs, and these savings were then extrapolated to estimate the potential impact at the building-stock level for each typology (shown in Figure E.1). The audits indicate that the most effective ECMs include **replacing conventional fans with BEE 5-star rated ceiling fans (such as BLDC models), upgrading inefficient air-conditioning systems to high-efficiency units, and installing rooftop solar PV systems**. The estimated savings across the building typologies show that, if implemented effectively, these measures can significantly reduce current electricity consumption. In some cases—such as schools and auditoriums—the improvements could enable **net-zero energy performance**, while office buildings could achieve **near-net-zero performance**.



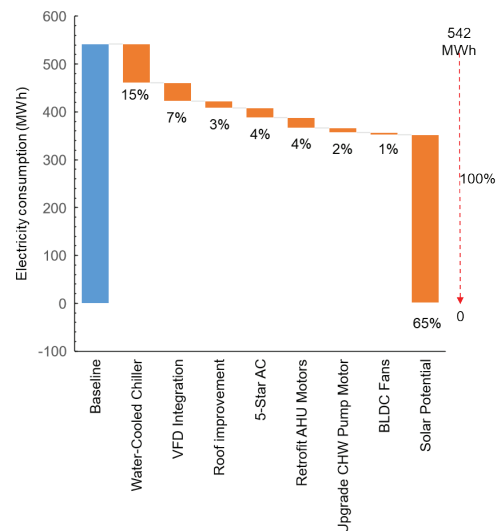
a. Office Buildings



b. Hospital Buildings



c. School Buildings



d. Auditorium

Figure E.1: Estimated savings analysis at the stock level across the municipal building typologies

The analysis indicates that **retrofitting existing inefficient appliances** with energy-efficient alternatives and **installing rooftop solar photo voltaic (PV) systems** are key strategies to reduce energy consumption in existing buildings—and, in some cases, achieve **net zero energy status**.

For certain building typologies, such as **offices** and **hospitals**, where net zero energy cannot be achieved solely through efficiency upgrades and rooftop solar PV, **procuring green power from DISCOM through Green Tariff mechanism** can help bridge the gap and enable them to reach near **net zero energy status**.

Figure E.2 presents the categorisation of the identified ECMs—classified as no-cost, low-cost, medium-cost, and cost-intensive—along with their applicability across different building typologies.

		Details of ECMs	School	Offices	Hospitals	Auditoriums
No Cost		Set point temperature ( 26°C)	✓	✓		
		Computer plug load management	✓	✓		
Low Cost		Installation of occupancy and light sensors	✓	✓	✓	✓
		Replacement of old ceiling fan with BLDC fan	✓	✓	✓	✓
Medium Cost		Replacement of old splitACs with a new 5-star splitAC	✓	✓	✓	✓
		Retrofit IE2 AHU motors with EC-fan blowers		✓	✓	✓
		Replacement of IE2 HVAC pump motor with IE5		✓	✓	✓
Cost Intensive		Installation of the Automatic Power Factor Correction (APFC) device at LT feeder side		✓	✓	✓
		Implementation of HVAC Optimization Software integration with VFD- based control for chillers, pumps, AHU, and cooling tower fans		✓	✓	✓
		Installation of rooftop solar	✓	✓	✓	✓
Low Cost		<b>Passive measures</b>				
		Application of cool roof	✓	✓	✓	✓
		Shading of south windows	✓	✓	✓	✓
		Extra Addition of PU foam panels or a high-R-value false ceiling below the existing sponge and apply reflective coating on the outer GI sheet				✓

Figure E.2: Cost-wise categorization of identified ECMs and their applicability across building typologies

## Net-Zero Strategies for New Buildings

Net zero strategies for new municipal buildings is structured around five key pillars:

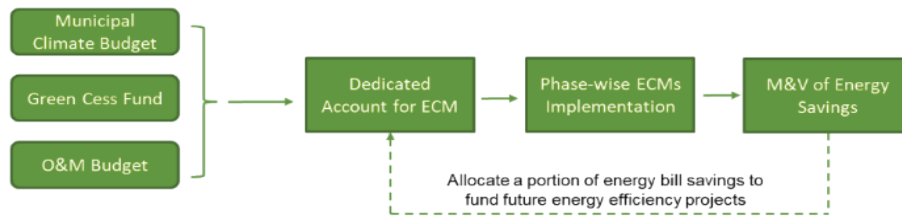
- **Passive Design Strategies** – Optimized building orientation, high-performance envelopes, shading devices, and cool roofs to reduce cooling loads.
- **Active Design Strategies** – Integration of efficient lighting, BLDC fans, 5-star or VRF HVAC systems, and advanced controls for load management.
- **Low-Carbon Materials** – Use of low-emission cements (PPC, PSC, LC3), high-recycled-content steel, and alternative walling materials such as fly ash or Agrocrite blocks.
- **Rooftop Solar Integration** – Early-stage planning to ensure adequate roof strength, orientation, and capacity for on-site rooftop solar PV installation.
- **Clean Energy Procurement** –Negotiation with DISCOMs to procure clean energy under green tariff mechanism.

## Financing Mechanism

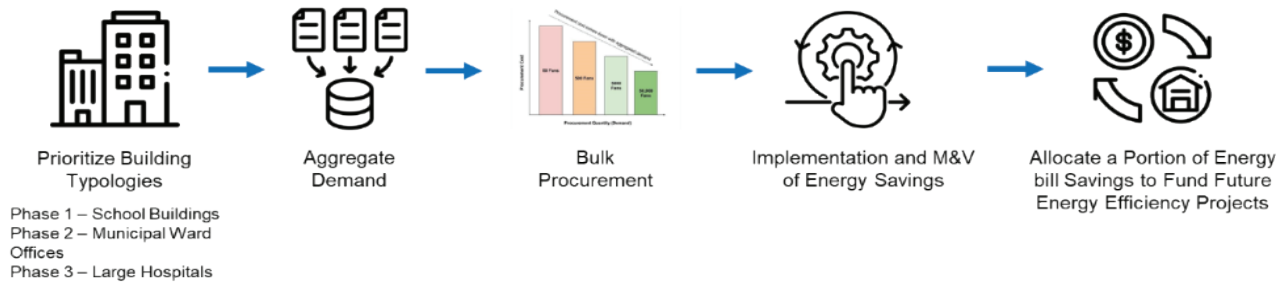
Recognizing fiscal constraints at the municipal level, the net zero action plan proposes diverse **financing mechanisms** tailored to different investment scales such as **self-financing** for low-cost measures (LED retrofits, BEE’s 5-star fans, cool roofs) through the municipal own climate budget, **ESCO-based performance contracting** for medium-cost interventions such as air conditioning units and centralized cooling system upgrades, **RESCO and Cooling-as-a-Service (CaaS) models** for capital-intensive measures like rooftop solar and centralized HVAC retrofits and **innovative financing instruments**, including municipal and green bonds, and concessional loans, for large-scale deployment Figure E.3 shows the proposed financing mechanism which municipal corporation can adopt based on the suitability and applicability of the projects.

## Option 1: Self Financing Mechanism (CAPEX Model)

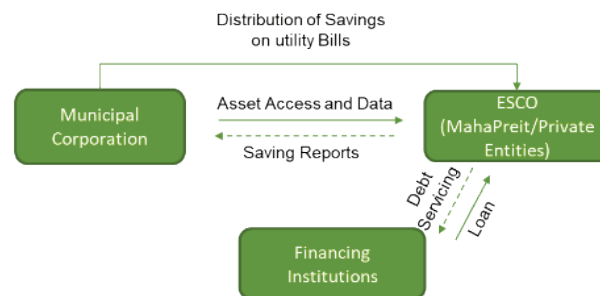
### Self Financing Mechanism



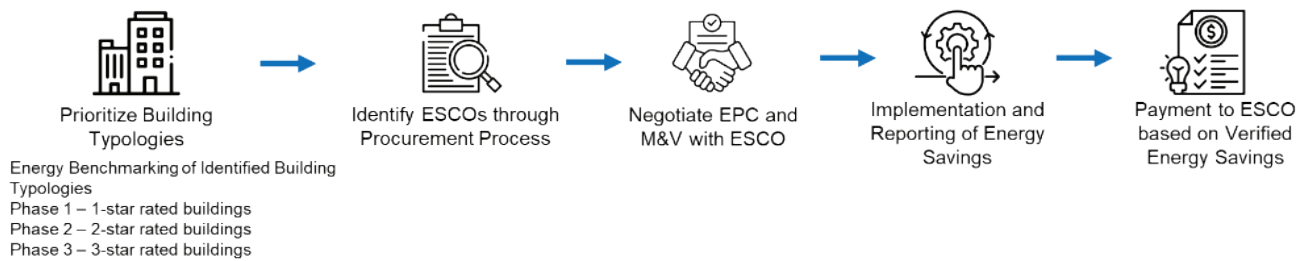
### Implementation Mechanism – Replacement of Inefficient Fan with BEE 5-star Fan



## Option 2: Energy Service Company (ESCO) Mechanism (OPEX Model)



### Implementation Mechanism – Replacement of Inefficient ACs



### Option 3: Renewable Energy Service Company (RESCO) Mechanism (OPEX Model)

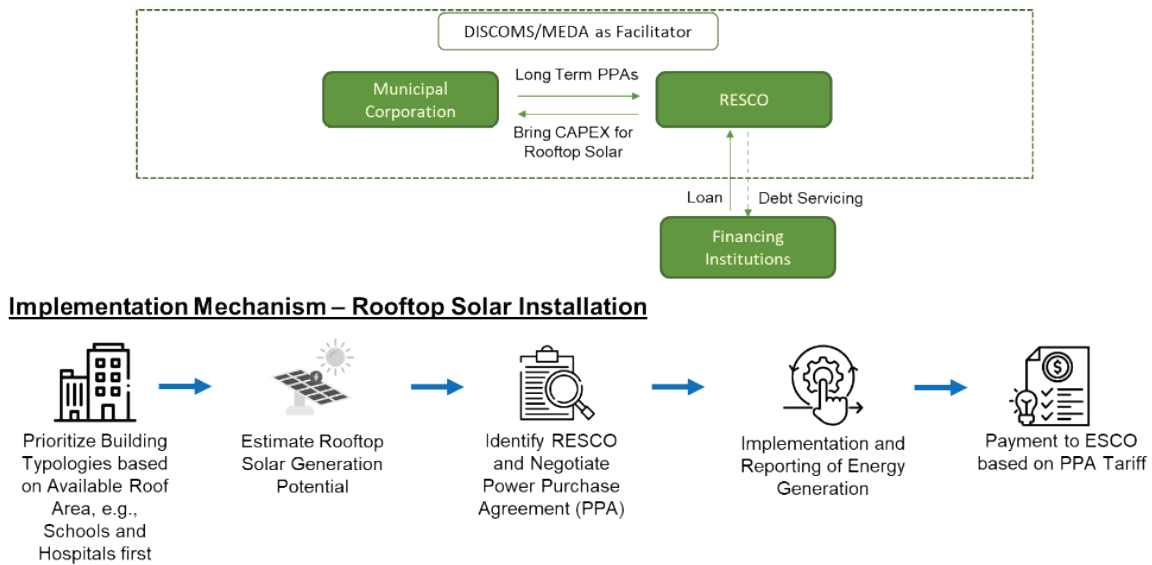


Figure E.3: Proposed financing mechanism for implementation of ECMs

### Governance Structure

The action plan suggests that implementation could be overseen by environment and climate change department, where Mechanical and Electrical (M&E) department will co-ordinate with relevant departments (such as health, education and garden departments) to identify the target buildings and ECMs measures for different building typologies and prepare the procurement plan and **Measurement, Reporting, and Verification (MRV) Framework**. M&E depart will send the project proposal to DMC environment for approval and implementation. Figure E.4 shows the schematic of the proposed governance structure to implement the net zero action plan for the municipal buildings.

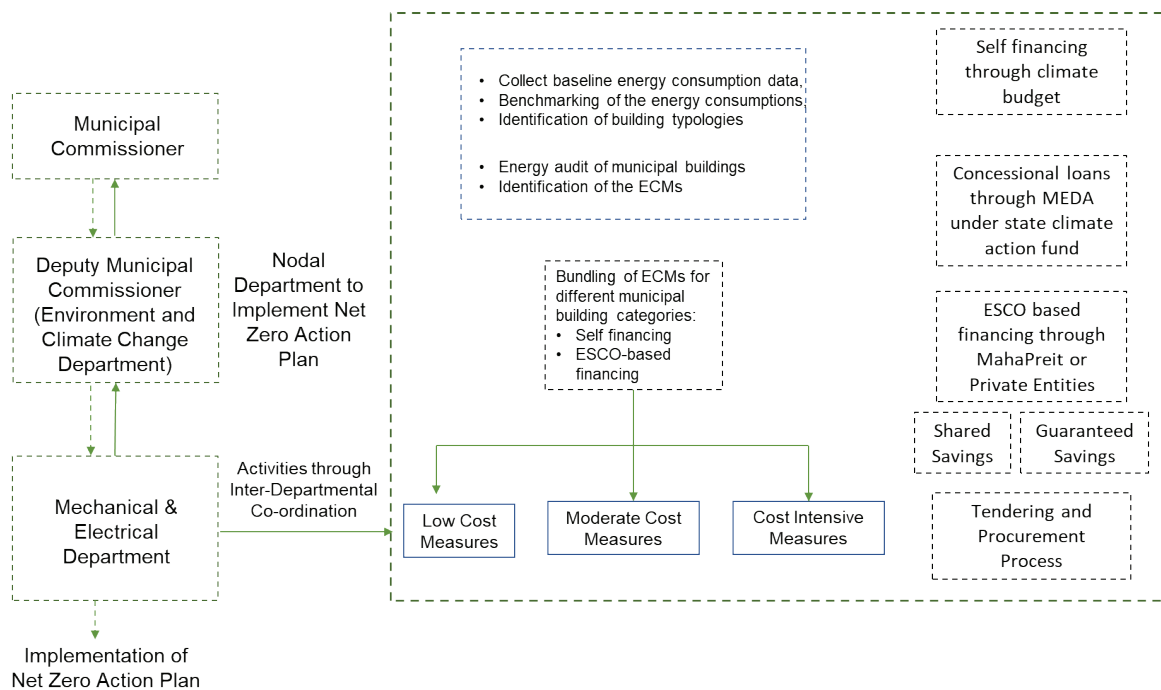


Figure E.4: Proposed governance structure for implementing Net Zero Action Plan

## Roadmap for Net Zero Action Plan

To achieve net-zero municipal buildings, a phased implementation roadmap has been proposed. By 2030, the municipal corporation should complete all baselining activities and identify target buildings—specifically those performing at the equivalent of BEE’s 1-star category—from the prioritised municipal building typologies. These low-performing buildings, based on the Energy Performance Index (EPI), should undergo all recommended no-cost and low-cost ECM implementations.

By 2040, the scope should expand to include buildings performing at the equivalent of BEE’s 2-star and 3-star levels, with the aim of bringing at least 50% of the existing building portfolio under the net-zero action plan through energy-efficient appliance retrofits and rooftop solar PV deployment.

By 2050, the target is to bring all existing municipal buildings, along with new constructions, under full net-zero action plan coverage. Figure E.5 presents the roadmap for the proposed net-zero action plan.

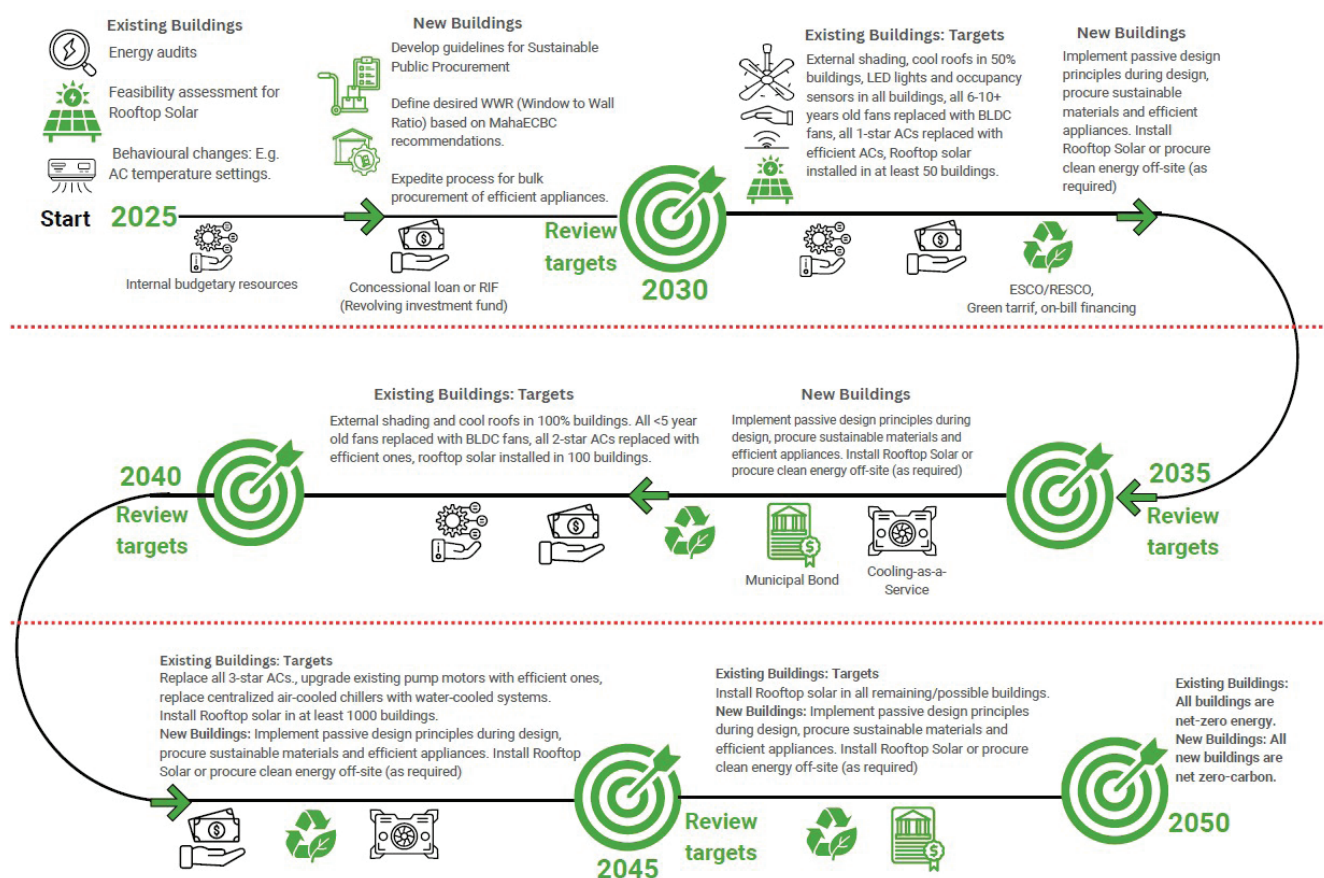
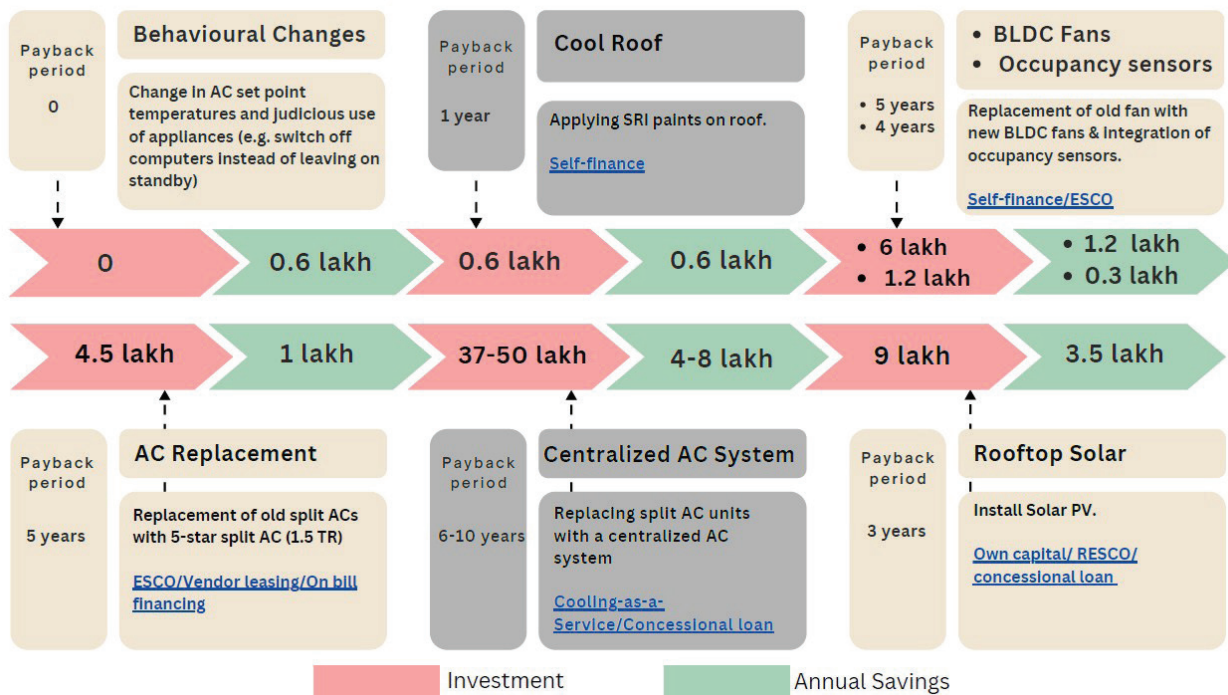


Figure E.5: Net Zero Action Plan roadmap

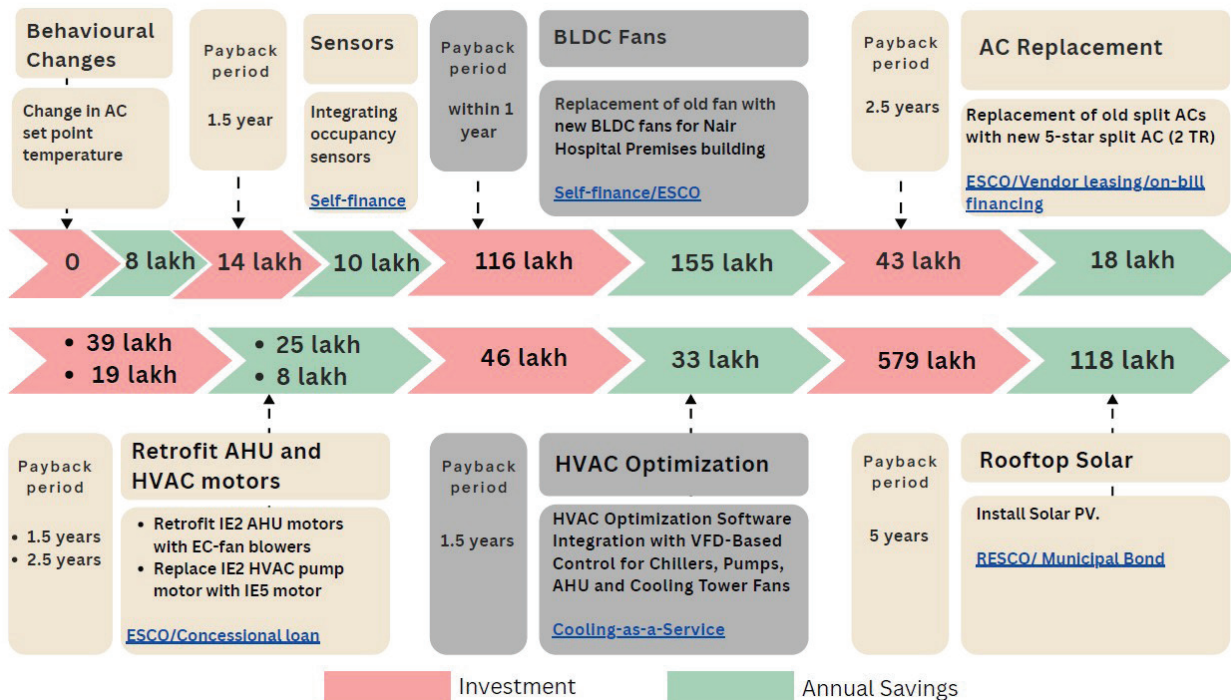
## Pilot Building Identification to Kick-Start the Net Zero Action Plan

To kickstart the net-zero action plan, two pilot buildings have been identified—one from the municipal office category (RC Ward Municipal Office) and one from the hospital category (Nair Hospital). A cost analysis of the identified ECMs has been carried out based on prevailing market rates, and the associated energy savings have been estimated for each measure. Figure E.6 presents

the cost–benefit analysis of the ECMs for both buildings, along with potential financing mechanisms that can be adopted for their implementation.



a. RC Ward Municipal Office



b. Nair Hospital Building

Figure E.6: Cost–benefit analysis of identified ECMs for pilot buildings to kick-start the Net Zero Action Plan



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