# CHAPTER 78

## Implementation of Sustainable Practices in Urban Affordable Housing Scheme and its Scalability

*Pavan Totla[1] and Vaishnavi Vilas Kumbhar[2]*

**ABSTRACT**

The Sangli Miraj Kupwad Municipal Corporation in Maharashtra launched an initiative to foster sustainability practices within community housing through its Five Star Home rating in 2020. This rating system is structured around five key sustainable practices, each earning a distinct star. The first star is for proper segregation and composting of waste generated at home and aims to decrease greenhouse gas emissions & carbon footprint. The second star recognizes efforts in water conservation and reuse, addressing issues like water scarcity & over-exploitation of groundwater. Third star is about Energy saving & conservation of natural resources. The fourth star is for providing shelter for birds and animals, which contributes to biodiversity conservation and ecological balance. Lastly, the fifth star rewards residents who engage in tree plantation and conservation efforts, enhancing $CO_2$ absorption (carbon sink), improving air quality, and preventing soil erosion. This innovative program is designed to encourage residents to adopt eco-friendly practices that mitigate the negative impacts stemming from anthropogenic activities such as deforestation, climate change, and resource depletion. Since 2020 around 300 houses are already rated with the Five Star Home rating. Residents who achieve all five stars were eligible for 4% property tax concession. This initiative can be seamlessly integrated with the Pradhan Mantri Awas Yojana (PMAY) to create a first-of-its-kind initiative for mass affordable and sustainable housing in urban/semi-urban areas. The integration focuses on aligning PMAY's goal of providing affordable housing with eco-friendly practices that promote sustainability, Like Green City Action Plan of Pimpari Chinchwad Municipal Corporation. The success of this integration can be a scalable model for sustainable housing on a larger scale. This initiative not only incentivizes responsible environmental stewardship but also enhances community engagement in creating a more sustainable living environment.

**Keywords:** Sustainable practices; Carbon footprint; Carbon sink; Sustainable housing.

### 1.0 Introduction

Sustainable development in semi-urban areas is vital for addressing environmental issues while encouraging community well-being (James, 2024).

[1]*School of Energy and Environment, NICMAR University, Pune, Maharashtra, India*
[2]*Corresponding author; School of Energy and Environment, NICMAR University, Pune, Maharashtra, India (E-mail: vaishnavikumbhar5665@gmail.com)*

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Recognizing this need, the Sangli Miraj & Kupwad City Municipal Corporation announced the innovative 5 Star Home concept in 2020. The aim of this initiative is to foster community-driven sustainability by encouraging residents to implement eco-friendly practices to help mitigate degradation of environment. As a Junior Environmental Engineer, I was directly associated in the execution of this concept, working closely with the public to ensure its success. The program seeks to create a greener, more sustainable future for semi-urban regions by integrating practical solutions such as waste segregation, water conservation, and biodiversity enhancement. The Five Star Home concept represents how local governments and communities can work together to create impactful, lifelong change by encouraging collective action, individual responsibility and in the face of environmental challenges such initiatives serve as powerful models for progressing sustainability and building resilient communities.

### 1.2 Concept of five-star home

The 5-Star Home concept is an innovative initiative which aims to promote sustainable living practices amongst households. It identifies and rewards households that implement eco-friendly habits and minimise their ecological footprint. Households show their commitment to contribute to creating a sustainable community and environment conservation by achieving 5-Star Home certification. It is required for households to comply with all 5-star criteria to get certified. A verification team comprising of a local body representative, an NGO member, and a technical expert will carry out the verification process. After verification, each households complying with all 5-star criteria will be eligible to get:

- A 5-Star Rating logo for their home, with their name on it
- A 4% tax rebate

In addition to encouraging sustainable living, this certification also offers tangible benefits to households that have a positive environmental impact.

### 1.3 Five star modified sustainability rating for semi urban housing

To get certified as a 5-Star Home, individual households must comply with the following criteria:

**Table 1: Five Star Modified Sustainability Rating for Semi Urban Housing**

| Stars | Criteria |
|---|---|
| Star-1 | Waste Segregation and Composting |
| Star-2 | Water Conservation and Reuse |
| Star-3 | Energy Efficiency and Renewable Energy |
| Star-4 | Biodiversity Conservation |
| Star-5 | Tree Plantation and Conservation |

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*Waste segregation and composting:* To qualify for the first star, it is important for households to segregate waste into organic, recyclable, and non-recyclable categories, compost wet waste, and implement the 3'R's-reduce, reuse, and recycle of waste management. This reduces waste going to landfill, conserves finite resources, and promotes sustainable waste management.

*Water conservation and reuse:* To get the second star, households need to implement water conservation measures like rainwater harvesting, reuse of greywater, or installing low-flow fixtures. These practices lessen water waste, lower dependence on municipal supplies, and promote efficient water usage.

*Energy efficiency and renewable energy:* For the third star, households are supposed to minimise energy consumption by using energy-efficient appliances, turning off devices when not needed, and enhancing natural lighting and ventilation. Using smart technology, LED lighting, and solar panel installation further reduces energy consumption, lowering costs and promoting environmental sustainability.

*Biodiversity conservation:* Installing birdhouses, feeders, or planting bird-friendly trees are ways for households to encourage biodiversity and achieve the fourth star. They can also help maintain ecological balance by giving stray animals food or shelter.

*Tree plantation and conservation:* For 5$^{th}$ star households must plant and maintain a minimum of five trees, using native species that support biodiversity and ecological balance. By planting and preserving trees, households can help mitigate air pollution

## 2.0 Why Sangli Municipal Corporation Felt the Need of Doing this Project?

On October 2, 2020, the Environment and Climate Change Department, Government of Maharashtra, launched the Mazi Vasundhara Abhiyan (Majhi Vasundhara). This program focuses on the five important elements of nature, known as "Panchamahabhuta," which comprise Bhumi (Earth), Vayu (Air), Agni (Energy), and Akash (Enhancement), Jala (Water) (IPER). The prime objective of this initiative is to create awareness among citizens about the effects of climate change and environmental issues while inspiring them to take mindful actions to improve the environment.

It also aims to promote strong climate action at the state level and safeguard sustainable development across Maharashtra. The Mazi Vasundhara Abhiyan acted as the basis for the development of the Five Star Home concept. This state-level initiative provided the essential framework and enthusiasm for local bodies like the Sangli Miraj & Kupwad Municipal Corporation to implement localized sustainability practices. The ideologies and objectives of the Abhiyan inspired the Municipal Corporation to design a concept that could effectively engage citizens at the grassroots level and promote sustainable practices in day-to-day life.

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### 2.1 Actual implementation of five-star home concept

To guarantee maximum participation and efficiency, the Five Star Home concept was implemented using a methodical and structured approach. In order to inform residents about the Five Star Home initiative and emphasize its financial and environmental advantages, large-scale awareness campaigns were first carried out throughout residential areas. These campaigns included social media outreach, community gatherings, and the distribution of educational brochures. A Google form was created to call interested candidates and accelerate the application process. Along with specific questions that aligning the Five Star Home criteria, the form was thoughtfully designed to collect necessary information like name, address, and contact details. These questions evaluated practices like composting waste, collecting rainwater, using solar energy, having at least five plants, and making accommodations for animals and birds. Candidates also had to submit images as evidence that they met each requirement.

**Figure 1: Citizens Receiving 5 Star Home Rating Logo**


After applications were received, a preliminary assessment was carried out using the information provided. Applications were carefully examined by the evaluation team to ensure that the required requirements were met. To enable a methodical verification process, the qualified applications were grouped ward-by-ward across 20 wards after the initial screening was finished. The on-site final assessment was carried out by a special committee of technical experts, representatives from NGOs, and municipal officials. The team was accompanied by a designated sanitary inspector from each ward to verify the applicants' claims and make sure the Five Star standards were being met. The certification process's legitimacy and openness were improved by this multi-tiered assessment procedure. This methodical approach turned out to be very advantageous and effective. Utilizing a digital application form reduced paperwork and expedited data collection, which made application tracking and analysis simpler.

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By facilitating targeted assessments and lowering logistical obstacles, the ward-wise categorization ensured thorough coverage. Additionally, the participation of different stakeholders promoted trust and community engagement, which in turn inspired more locals to actively participate in the project.

### 2.2 Criteria for star awarding star

*Waste Management:* As per 2008 joint paper by NEERI and CPCB assessed the status of Municipal Solid Waste (MSW) Management in metro cities, state capitals, Class I cities, and Class II towns in India. The study reported that per capita waste generation in these areas ranges between 0.2–0.6 kg per day. An analysis of the physical composition of municipal solid waste revealed that 30–45% of the waste is compostable matter, 6–10% consists of recyclables, and the remaining portion is inert matter. Based on household sizes, the average waste generation estimates are as follows:

**Table 2: Waste Generation Estimation**

| Category | Family Size | Average Waste Generation (kg/day) |
|---|---|---|
| Category 1 | 2–4 person (Avg: 3) | 1.5 |
| Category 2 | 4–6 person (Avg: 5) | 2.5 |
| Category 3 | 6–8 person (Avg: 7) | 3.5 |

**Table 3: Water Consumption Estimation**

| Category | Family Size | Average Wastewater Generation (kg/day) |
|---|---|---|
| Category 1 | 2–4 person (Avg: 3) | 3 ×135 |
| Category 2 | 4–6 person (Avg: 5) | 5×135 |
| Category 3 | 6–8 person (Avg: 7) | 7×135 |

To ensure effective waste management and qualify for the First Star rating, individual households are expected to process at least 50% of the total waste generated through composting and recycling. Additionally, 100% segregation of waste into wet, dry, and hazardous categories is mandatory. Households must focus on composting organic waste, recycling dry waste, and adopting the 3Rs—Reduce, Reuse, and Recycle to minimize landfill dependency and promote sustainability.

*Water Conservation and Reuse:* According to IS 1172: 1993, the standard water supply requirement is 150 to 200 liters per person per day (Bureau of Indian Standards (BIS), 1993). However, for low-income groups, the average domestic water consumption under normal conditions in Indian cities is considered to be 135 liters per person per day. By adopting responsible water usage practices, it is possible to reduce per capita water demand to as low as

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92 liters per day. Approximately 90% of the water used is converted into wastewater, which, if treated and reused, can help minimize the demand for fresh water. Additionally, rainwater harvesting can be implemented to store water, further reducing the need for fresh water. To qualify for a 2-star rating, individual households must achieve a 30% reduction in water consumption.

*Energy efficiency and renewable energy:* As per world data info Indians consumes 1,045 units of electricity per person annually. The home is eligible for 3rd star if:

- 50% energy is from renewable energy (Solar panels, solar water heaters, solar bulbs)
- Energy efficient appliances are installed.
- Use of LED lights

*Biodiversity Conservation:* Households are eligible for the 4th star only if they have made at least one provision, such as setting up birdhouses, bird feeders, or a bird-friendly garden, or providing shelter for stray animals, to support local wildlife.

*Tree Plantation and Conservation:* To qualify for the 5th star, households must meet tree plantation criteria: Plant at least 5 trees of indigenous species & ensure these trees are over 4-5 feet tall. Based on conservation of trees, eligibility for 5th star will be checked.

## 3.0 A Scalable Tax Rebate Scheme for the Five Star Home Concept

We got to know about the tax rebate scheme from the Deputy Environmental Engineer of PCMC's Environment Department. By rewarding individual efforts rather than demanding adherence to a full set of requirements, the Pimpri-Chinchwad Municipal Corporation (PCMC) introduced a more flexible tax rebate program that promotes sustainable practices.

Their scheme provides the following concessions:

- 3% tax rebate for on-site composting
- 5% tax rebate for setting up a sewage treatment plant (STP) or water reuse system
- 8% tax rebate for combining composting with an STP
- 8% tax rebate for zero-waste practitioners (who compost wet waste and hand over dry waste to authorized recyclers)
- 10% tax rebate for homes practicing both zero-waste management and STP-based water reuse

**Table 4: A Scalable Tax Rebate Scheme for the Five Star Home Concept**

| Sustainability Criteria | Tax Rebate (%) & Star awarded |
|---|---|
| Waste segregation & composting | 4, 2star |
| Water conservation (rainwater harvesting, wastewater reuse) | 6%, 2star |
| Renewable energy usage (solar panels, solar water heaters) | 2%, 1 star |
| Providing shelter & food sources for birds/animals | 1%, 1 star |
| Tree plantation & biodiversity conservation | 2%, 1 star |
| Full Five Star Home compliance | Additional 2%, 5 stars |

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With no pressure to meet all requirements at once, this model encourages locals to embrace sustainable practices at their own pace. A more scalable and flexible rebate scheme for Sangli's Five Star Home concept inspired by PCMC's model, could be developed as follows:

This structure consents homeowners to earn partial concessions for each sustainable practice executed, ensuring that even small steps taken towards sustainability are encouraged and rewarded. Additionally, the scheme can be supported with:

*Awareness Programs:* To educate citizens about the benefits of each sustainability measure conducting workshops, campaigns, and social media promotions

*Technical Assistance:* Through partnerships with NGOs and private players providing guidance for composting, rainwater harvesting, and renewable energy solutions.

*Green Support Access Initiative:* raising awareness about schemes, programs that offer easy financing options for high-investment initiatives like rainwater harvesting systems, biogas plants, or household composting units, or subsidies like the "Har Ghar Sury Bijali Yojana" for solar panels.

*Green finance:* Through nationalized banks and institutions, it offers financial support for sustainable projects in the form of loans, grants, or subsidies, promoting environmentally friendly initiatives with advantageous terms and incentives.

This revised model would encourage higher participation, as even partial compliance would yield financial benefits, making the initiative more scalable and impactful.

### 3.1 Scenario analysis in different situations of compliance

**Table 5: Scenario Analysis**

| Sr. No | Compliance Criteria | Benefits Provided |
|---|---|---|
| 1 | If complying with 1 criterion | Tax rebate as per Table 4 and 1-star rating |
| 2 | If already complying with 1 criterion and now complying with 1 more criterion | Tax rebate as per Table 4 and 2-star rating |
| 3 | If already complying with 1 criterion and now complying with 2 more criteria | Tax rebate as per Table 4 + 1% additional tax rebate and 3-star rating |
| 4 | If complying with composting, water conservation, and installing a solar panel in one go | Corresponding tax rebate as per Table 4 + 2% additional tax rebate and 3-star rating |
| 5 | If already complying with 4 criteria | Corresponding tax rebate as per Table 4 and 4-star rating |
| 6 | Achieves full compliance with all criteria | Corresponding tax rebate as per Table 4 + 3% additional tax rebate and 5-star rating |
| 7 | In case of non-compliance identified with any criteria during monitoring | Star & tax rebate associated will be removed. |

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## 4.0 Future Scope

### 4.1 Integration of 5-star home concept with PMAY

The recently created rating system's future scope includes the possibility of integrating it with the Pradhan Mantri Awas Yojana (PMAY). The Five Star Home concept has already been successfully applied to 300 homes in Sangli, proving its viability and beneficial effects. The program can be expanded to a much greater number of households nationwide by integrating this idea into PMAY. Homes' affordability, environmental sustainability, and quality will all be guaranteed by this integration. The overall quality of housing will be improved by the focus on sustainable practices like waste management, water conservation, the use of renewable energy, biodiversity preservation, and tree planting.

Better water and energy management systems, better waste disposal facilities, and greener surroundings are all features of homes constructed using this integrated model, which will make living there healthier and more comfortable. Furthermore, using eco-friendly building techniques and energy-efficient materials will increase resilience and durability while lowering long-term maintenance expenses. Additionally, this extensive implementation will support the government's commitment to sustainable development, improve community resilience, and lessen the carbon footprint of urban settlements. Along with improved indoor air quality and higher living standards, homeowners will also experience long-term financial savings from lower energy and water usage.

## 5.0 Challenges in Scaling Up the Five Star Home Concept in Sangli

Although the Five Star Home concept in Sangli was an innovative and well-intended initiative, faced multiple challenges that prevented its large-scale adoption. Some of the main challenges include:

*Lack of Awareness and Public Engagement:* Many people were unaware of the initiative, its benefits, and the criteria required to comply to achieve a Five Star rating. Public engagement campaigns were inadequate, and many people did not fully understand how the initiative could contribute to environmental sustainability and personal economic benefits.

*Rigid Criteria for Tax Rebates:* One major downside was the "all-or-nothing" approach to the tax consession. Residents had to comply with all five sustainability criteria to qualify for the 4% tax rebate. If households fail to meet even one criterion, they were not eligible for any incentive. This discouraged partial participation, as people felt that their efforts in meeting some sustainability standards were not being known.

*Financial Constraints:* Some of the criteria, such as installing roof top solar panels or rainwater harvesting systems, needed an upfront investment. Many homeowners, especially from lower-income groups, found it difficult to make these financial commitments without additional support, such as subsidies or financial incentives.

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*Lack of Consistent Political Will and Support:* Local government entities frequently need to support and commit to sustainable initiatives over the long term. However, the Five Star Home concept was not consistently implemented and promoted due to frequent changes in political leadership and priorities. The development of the program was hindered by the lack of a solid, long-term sustainability vision.

*Limited Monitoring and Enforcement Mechanisms:* Even after a verification committee was established, it was still difficult to guarantee compliance and sustain long-term adherence to the sustainability standards. Due to strict monitoring or a lack of follow-ups, some participants may have started the necessary measures but later stopped.

*Perception of Minimal Direct Benefits:* Adoption of the practices was lower among residents who did not immediately perceive economic benefits. Some believed that the tax refund amount was insufficient given the time and money needed to fulfill all five requirements.

## 6.0 Advantages of the Five Star Home Concept

*Adaptable to both new and existing homes:* In contrast to green building certifications like LEED, IGBC, or GRIHA, which are mainly applicable to newly built structures, the Five Star Home concept can be retrofitted into existing homes, encouraging sustainability for a larger population.

*Affordable and practical solution:* Investing heavily in cutting-edge building materials and technologies is frequently necessary to implement green building initiatives. Five Star Homes, on the other hand, promotes inexpensive, useful improvements like water and composting.

*Encourages incremental and impactful changes:* Five Star Homes provides a phased approach rather than demanding immediate adherence to all sustainability standards. Homeowners can achieve long-term environmental benefits and lessen financial strain by implementing sustainable practices gradually.

*Inclusive for low and middle-income groups:* Although green building certifications are frequently restricted to high-end residential or commercial projects, the Five Star Home concept is designed for typical homeowners, guaranteeing affordability and encouraging broad adoption.

*Promotes simple, low-cost actions:* Low-cost practices include planting native trees, using energy-efficient appliances, rainwater collection, and home composting. These actions have instant environmental benefits without requiring significant financial expenses.

*Supports Biodiversity Conservation:* In addition to improving urban biodiversity, installing water bowls, bird feeders, and tiny green areas costs virtually nothing. This initiative stresses ecological well-being through straightforward actions, in contrast to traditional green building approaches.

*Fosters Community Participation:* The Five Star Home model promotes involvement and information exchange at the local level. This neighborhood-based strategy encourages group action and raises local environmental consciousness.

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**Figure 2: Before & After: Community Led Sustainability Transformations**


*Contributes to Climate Action and Resource Conservation:* Five Star Homes show how individual efforts can significantly mitigate climate change and preserve natural resources by reducing household waste, conserving water, using renewable energy, and promoting biodiversity.

### 6.1 Quantifiable environmental impact of the five-star home concept

Based on calculations from the implementation in 300 homes:

- *Carbon Sequestration:* A total of 1,500 trees were planted, with at least five trees planted by each household. About 22 kg of $CO_2$ are sequestered annually by each mature tree, for a total of 33,000 kg of carbon sequestered annually.
- *Waste Reduction:* An individual produces 0.5 kg of waste daily on average. By encouraging composting, the program reduced the amount of waste dumped in landfills by 50%. With 1,300 people living in the 300 houses, the program kept about 118,625 kg of waste from ending up in landfills each year.
- *Water Conservation:* A 30% decrease in water usage was made possible by rainwater collection and greywater reuse. It was determined that 20,403,500 liters of water were saved annually across all categories.

The concept's potential to be expanded across various regions is enhanced by its affordability, adaptability, and environmental benefits, particularly when local governments

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support it with incentives like tax breaks, subsidies, and financing options. The Five Star Home concept genuinely embodies the idea that significant environmental change starts at home by making sustainability a practical decision rather than a luxury one.

**Table 6: Parametric Model for any Urban Local Body Who Wants to Implement 5 Star Home Concept**

| Sr. No | Parameter | Sangli Corporation Five Star Home | PCMC Tax Rebate Scheme | Parametric Model | |
|---|---|---|---|---|---|
| 1 | Waste Management | Households are expected to process at least 50% of their total waste (No tax rebate is provided for individual criteria unless all four are complied with) | 3% rebate for on-site composting (No specific criteria) | **Criteria** | **Tax Rebate** |
| | | | | 1.Comlying to any one criteria | 1% |
| | | | | 2.Comlying to any two criteria | 2% |
| | | | | 3.Comlying to any three criteria | 3% |
| | | | | 4. Segregation +Composting + Reuse of waste material for home application+To handover dry waste to recycler | 4% |
| 2 | Water Conservation | 30% reduction in water consumption | 5% rebate for implementing water reuse and recycling (STP) | **Criteria** | **Tax Rebate** |
| | | | | 1.Comlying to any one criteria | 2% |
| | | | | 2.Comlying to any two criteria | 4% |
| | | | | 4. Water reuse + Reduction in water consumption + Rainwater harvesting system | 6% |
| 3 | Renewable Energy | 50% of energy sourced from renewable sources and the use of energy-efficient appliances (No tax rebate for individual criteria unless all four are complied with) | No tax rebate provision for renewable energy usage | **Criteria** | **Tax Rebate** |
| | | | | 1. Use of solar water heaters | 1% |
| | | | | 2. Rooftop solar panels | 1% |
| | | | | 3. Water heater + Rooftop solar | 2% |
| 4 | Biodiversity Conservation | Providing shelter for birds and animals for the 4th star (No tax rebate for individual criteria unless all 4 are complied with) | No specific rebate for biodiversity efforts | 1% tax rebate for providing shelter to animals or birds. | |
| 5 | Tree Plantation | Planting a minimum of 5 trees for the fifth star (No tax rebate for individual criteria unless all four are complied with) | No direct rebate for tree plantation | **Criteria** | **Tax Rebate** |
| | | | | 1. Tree plantation (5 plants) | 1% |
| | | | | 2. Tree Plantation (Plants double the no. of family members) | 2% |

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## 7.0 Parametric Model for any Urban Local Body Who Wants to Implement 5 Star Home Concept

- *Waste management criteria*
  - Waste segregation
  - Composting of wet waste
  - Reuse of waste for home application
  - Handover dry waste for recycling
- *Water conservation*
  - Water reuse for gardening or flushing
  - 30% reduction in water consumption
  - Rainwater harvesting system
- *Energy conservation*
  - Use of solar water heater
  - Use of Roof Top Solar
- *Biodiversity conservation*
  - Provision of feeder, houses or water for birds & animals
- *Tree plantation and conservation*
  - Planting atleast 5 tree

For compliance with each criteria 1 star will be awarded. In case of non-compliance noticed during periodic visits, the star awarded & tax rebated will be removed.

## 8.0 Conclusion

Urban local bodies (ULBs) play a key role in achieving Sustainable Development Goals by implementing sustainability practices. The Five Star Home concept is a significant step towards environmental stewardship, but in its implementation, there are several challenges. Through a scalable and parametric model, urban local bodies can ensure increased participation and long-term sustainability. Making it a practical and impactful solution for sustainable urban development by Strengthening financial incentives, awareness programs, and monitoring mechanisms will improve its effectiveness.

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