Policy Brief

Future Shift: Integrating Sustainable Initiatives in Functional Buildings

Contents

Authors

- Ar. Namrata Mahal, Manager, GRIHA Council
- Ar. Shubham Chowdhury, Project Officer, GRIHA Council
- Ar. Shaily Mahera, Deputy Manager, GRIHA Council
- Er. Gautam Aswani, Senior Project Officer, GRIHA Council
- Er. Pratidnya Bhuite, Project Officer, GRIHA Council

Reviewers

- Mr Sanjay Seth, Chief Executive Officer, GRIHA Council
- Ms Shabnam Bassi, Secretary, GRIHA Council
- Mr Ajit Sagane, Secretary (Works), Public Works Department, Government of Maharashtra

Abstract

Our planet today is reeling under a climate crisis. Fuelling this catastrophe on a global scale are a multitude of individual factors that often escape our notice as we go about our day to day activities. Buildings in operation play a major role, which is an often unseen contribution toward climate change. Inefficient light fixtures and Heating Ventilation and Air Conditioning (HVAC) systems result in inflated energy consumption and hazardous finishing materials such as high VOC paints affect indoor air quality. Synthetic housekeeping chemicals creeping into local ecosystems and ever increasing volumes of unmanaged solid waste are additional concerns. These concerns, if addressed efficiently, can enact massive paybacks. Being the second most populated country in the world, India contributes to 6% of the world's primary energy consumption, with buildings being a major stakeholder. Moreover, speedy urbanisation and burgeoning population has already put our country under high environmental stress and grave consequences on energy consumption and subsequent carbon emissions are projected. Cities face a series of multifaceted interconnected challenges across different sectors. Managing the ecological footprint of urban spaces is one of the most challenging goals. With a paradigm shift towards the transformation of existing cities into smart ones, polices that incorporate eco-friendly initiatives into functional buildings take centre stage in the quest for sustainability.

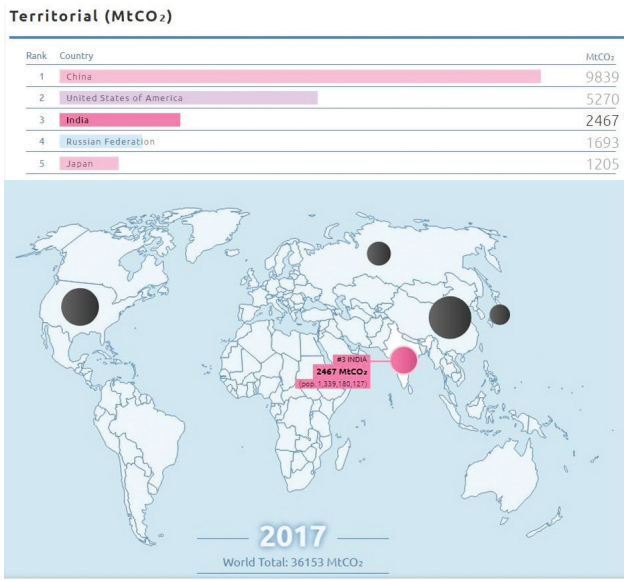
To this end, Green Rating for Integrated Habitat Assessment (GRIHA) Council has collaborated with the Public Works Department (PWD), Government of Maharashtra (GoM) to mainstream sustainable practices in functional buildings through GRIHA rating system that addresses aspects such as energy efficiency, maintenance & housekeeping, water and waste management, indoor environment quality, reducing use of ozone depletion potential materials and

synthetic chemicals, and so on. The policy brief is an outcome of the collective effort taken by GRIHA Council and PWD to ensure that operational public buildings across the state of Maharashtra are compliant with the requirements as prescribed by GRIHA Existing Buildings (EB) rating system- a variant of the national green building rating system.

Background

India is a developing economy growing at a fast pace. During the course, several challenges have been faced, one of them being tagged as the third largest emitter of CO_2 as per the projections made by the Global Carbon Project (GCP). While the bulk of India's building stock is yet to be constructed, the buildings that do exist contribute to nearly 30% of the country's overall energy use, according to several studies. International Energy Outlook (IEO)2017, projects that delivered energy consumption for residential and commercial buildings in India is expected to upsurge by an average of 2.7% per year between 2015 and 2040, more than twice the global average increase. Moreover, the production of electricity through burning fossil fuels produces greenhouse gases as well, that contribute towards climate change.

India is poised on the threshold of a staggering increase in negative environmental impacts in the coming years if current projections for economic growth hold true. This has well-been acknowledged by the country, considering which the government has come out with various policies to mitigate climate change. However, data deficient inventories lacking in clarity about methodologies and data sources have hampered the design of these effective policies. With India projected

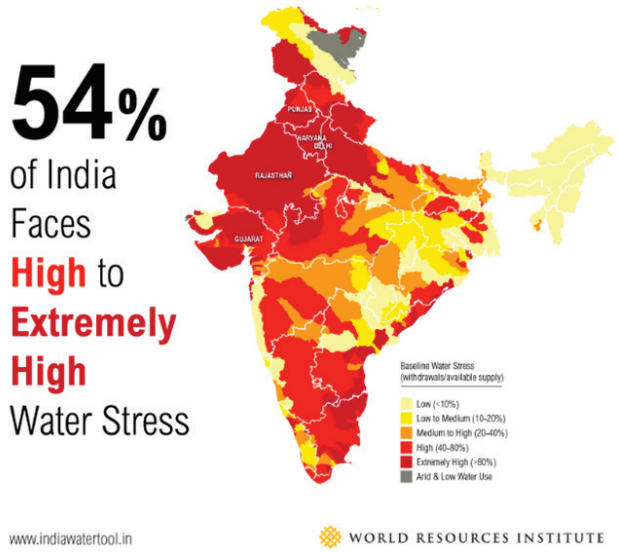


Source: http://www.globalcarbonatlas.org/en/CO2-emissions

to be the world leader by 2040 when it comes to growth in energy consumption by the building sector, a policy designed to mandate the usage of electronics that are rated as per national standards of energy efficiency have the potential to provide energy savings and emission reductions on an unprecedented scale.

Enormous toll has been exerted on the environment right from air & water pollution to global warming, by the negative impacts from use of petroleum-based products such as plastics and chemicals. An astounding amount of such chemicals in form of cleaning products is increasingly used in residential and commercial buildings. Largely non-biodegradable and toxic in nature, cleaning chemicals have widespread effects that are detrimental to the environment and human health. Seepage into soil and ingestion by wildlife allow these toxins to infiltrate the food chain and accumulate in agricultural products and seafood. Besides, contamination of aquifers not only makes the water unsafe for drinking and other uses, but also exterminates organisms that are essential for maintaining healthy aquatic ecosystem. Chemical cleaning agents used to disinfect sanitary ware may eliminate essential microorganisms that contribute toward the decomposition of organic waste. Synthetic chemicals released into the air from refrigerants and interior paints can persist in the environment for decades without immediate visible impact. Depletion of the ozone layer by such man-made chemicals has played a major role in causing a spurt in the occurrence of malignant skin ailments. There are numerous alternatives to harmful cleaning chemicals & interior finishes and with the policy geared toward making a shift in the right direction, the negative effects of these substances can be greatly reduced.

Talking about abysmal state of and challenges in municipal solid waste management (MSWM), the most common is the method of waste disposal. Typically, it is dumped in low-lying places on the outskirts of inhabited areas in a haphazard manner. This has serious environmental impacts like methane emissions and soil degradation. Every year an additional 1200 hectares of land is required to accommodate our growing volumes of waste. Rainfall on these sites readily mixes with toxic liquid matters and eventually infiltrates local water bodies. Garbage contributes to air pollution owing to gases and chemicals evaporating from the waste. Emissions from open air incineration can release toxic substances that contribute to acid rain. Poor waste management is also associated with increased health problems ranging from epidemics of vector-borne or food borne diseases, the effects of which are difficult to quantify because of limited epidemiological studies.



With policies that ensure effective segregation and disposal of waste, not only is a large proportion of recyclable wastes prevented from reaching landfills but the associated health hazards currently faced by rag pickers while sorting through mixed waste are also greatly diminished. GRIHA Council has formulated policy statement that are technically feasible and economically justified, while its impact can be magnified through standards, incentives and efficiency programmes.

Another major challenge in India is the growing water scarcity. It is estimated that 54% of India is under high to extremely high water stress, which is derived based on the baseline for withdrawals and available supply by World Resources Institute (WRI). The study reveals that the reason for this stress is decreasing groundwater wells due to overexploitation of use. To address this subject, GRIHA Council has formulated a policy statement that encourages recycling and reuse to meet the non-potable water requirement and reduce the dependency on the local municipal water supply and/or groundwater. Believing on the principle of 'What gets measured gets managed', the policy statement also encourages mandating water audit and thereby establishing the water performance index for the said building/project.

PWD: Instructions for Maintenance of Buildings

Maintenance of the government buildings is one of the major responsibilities of the Public Works Department. The Government of Maharashtra, under the PWD resolution no. BDG.1085/CR-4/Bldgs.2, dated 15th April 1985, constituted a committee for making an inclusive system for proper planning, monitoring and evaluation of maintenance and repair of buildings. The committee submitted its report in December 1985 and brought out the booklet on 'Instructions for Maintenance of Buildings' containing details such as types of repairs, frequency of repairs, guidelines for inspections & formulation of proposals, duties of maintenance staff and so on. The same is continuously reviewed and updated based on the government instructions issued from time to time. As an exercise, this instructional booklet was studied keeping in mind the GRIHA EB rating framework, such that the policies can be formulated based on the findings presented in the below table.

Policy Statement I: Purchase of BEE star labelled products

The policy intervention is to outline the equipment standards to be used in government buildings with respect to energy efficiency. GRIHA recommends the use of Bureau of Energy Efficiency (BEE) star labelled

Section	Description	PWD: Instructions for Maintenance of Buildings	GRIHA EB rating system
Energy efficiency	**Purchase of Bureau of Energy Efficiency (BEE) star labelled products**	• BEE star rated equipment and/or appliance have not been mentioned.	Maintain and follow a policy of purchasing appliances with at least 3-star BEE rating for all appliances under the mandatory scheme of the BEE star rating programme.
Green procurement	**Purchase and use of environment- friendly cleaning and pest control products and low volatile organic compound (VOC) paints.**	• Termite proofing treatments in building. • Cement paint for exteriors and distemper for interiors has been recommended in the booklet; however VOC content of the same has not been mentioned.	• Use of eco-friendly cleaning and pest control products for housekeeping • Use of low VOC interior paints • Use of low VOC adhesives • Use of low VOC sealants

Section	Description	PWD: Instructions for Maintenance of Buildings	GRIHA EB rating system
Maintenance (Mandatory)	**Purchase and use of chlorofluorocarbon (CFC) free refrigerants, CFC and hydrochlorofluorocarbon (HCFC) free insulations and halon free fire retardant**	• Refrigerant and insulation specification discouraging the use of CFC/HCHC have not been mentioned. • Firefighting equipment as per fire safety manual.	• Use of low ozone depleting potential (ODP) materials. • Use of CFC free refrigerants in all HVAC equipment. • Use of CFCs and HCFCs free insulation material or maintain and follow a phase-out plan for HCFC/ CFC using equipment • Use of halon free firefighting system
Waste management	**Provision of infrastructure at source for waste management and segregation.**	• Waste segregation aspect has not been captured.	• Segregation of waste at source • Provision of different storage areas for different wastes • Contractual tie ups with authorized recyclers • Treatment and reuse of organic waste on site.
Water management	**Water performance index for demand and supply side management**	• Sanitary fittings, rainwater pipes and external services like cleaning of storm water drains, manhole have been mentioned.	• Water audit • Implementation of rainwater harvesting system (RWH) • Treatment and reuse of wastewater generated on site.

equipment for installation and retrofits. It is required that all the new equipment either by new installation or by retrofits must be minimum 3-star BEE labelled as per applicable year. This policy is suggested for all PWD buildings that are in process of getting rated under the GRIHA standards. All the 10 mandatory categories and 13 voluntary categories of equipment are intended to be followed under this policy (refer the table at the bottom of this page). Equipment that does not come under BEE star labelled standards do not fall under this policy. However, any new categories and/or equipment that BEE includes under its rating standards will automatically apply to this policy as well, and should be followed for all retrofits done after that year.

The policy has been developed and aligned with the work done by BEE, an agency of the Government of India, under the Ministry of Power, created in March 2002 under the provisions of the nation's Energy Conservation Act 2001. The primary objective of the agency is to develop programmes that increase the conservation and efficient use of energy in India.

The Standards and Labeling Scheme (S&L) is one of the main thrust areas of BEE. The objective of the scheme is to provide easy to understand information to the consumers about the energy saving potential and subsequent operational cost saving of the marketed product, so as to make an informed choice. On the high-energy end-use equipment & appliances under this scheme, performance labels are displayed which highlight the minimum energy performance standards. Energy labelling has been one of the most lucrative policy tools for improving energy efficiency and dropping energy cost of appliances/equipment for the end users. The programme has been commercialized in a cooperative and pact driven approach with active participation from all the stakeholders. As of the year of release of this policy brief, following equipments and appliances fall under the mandatory and voluntary categories of the S&L scheme. However, BEE embraces the authority to augment or eliminate any equipment from either category in the future as deemed fit.

Mandatory	Voluntary
Room Air Conditioners	Pump Sets
Frost Free Refrigerator	Ceiling Fans
Tubular Florescent Lamp	LPG Stoves
Distribution Transformer	Washing Machine
Room Air Conditioner (Cassette, Floor Standing Tower, Ceiling Corner AC)	Computer (Notebook/Laptops)
Direct Cool Refrigerator	Ballast (Electronic/Magnetic)
Colour TV	Office Equipment's (Printer, Copier, Scanner, MFD's)

Mandatory	Voluntary
Electric Geysers	Diesel Engine Driven Mono-set Pumps
Variable Capacity Inverter Air Conditioners	Solid State Inverter
LED Lamps	DG Sets
	Chillers
	Microwave Ovens

Brief description: The intent of the policy is to encourage the purchase and use of minimum BEE 3 star labelled products for retrofits as well as new installation of electric/ electronic or any energy consuming devices which BEE rates as of now or brings under its rating standard in future.
Policy intends to: Implement energy efficiency measures for upgradation and modernization of PWD Maharashtra buildings.
Applies to: All PWD government buildings registered under GRIHA Existing Building rating system

Policy Statement II: Use of environmental-friendly cleaning and pest control products for housekeeping and low VOC material in building interiors

The policy window of opportunity is to outline the usage of cleaning chemicals, pesticides and interior finishes with respect to its eco-friendly quotient. The policy may be conceptualized with orientation to studies done on the known hazardous effects of using toxic chemicals, finishes, pesticides and materials for indoor cleaning, ranging from mild to severe, such as toxic chemicals entering the food chain and non-biodegradable chemicals through the waterways ending up in lakes & rivers. Scientific studies have also suggested that the cause of ozone layer lessening is explicitly because of chemicals that contain chlorine and bromine, which eventually lead to malignant melanoma development.

Though the concept of green cleaning is straightforward, navigating through a myriad of often perplexing marketing claims associated with green cleaning products has led to lack of credibility and consumption. The Cleaning Product Right to Know Act of 2017, California, lists chemicals found in cleaning products that have been shown to cause cancer, birth defects, asthma and other serious health effects. Accordingly, to assist consumers to make more informed decisions and product manufactures to produce better products and application methods, varied green cleaning standards from Green Seal, the Environmental Choice Program (ECP) and the GREENGUARD Environmental Institute (GEI) have been established. Green Seal and the ECP, both focus primarily on VOC content, while GEI certification emphaises wholly on VOC emissions from cleaning products and their impact on human exposure. VOC is a well-known toxic substance which is also present in paints, sealants and adhesives, and has a range of both, short- and long-term negative health effects associated, depending on the level of exposure and duration.

The fumes can severely affect the indoor air quality of even a well-ventilated space and they are a major cause of 'sick building syndrome'. Through this policy, use of eco-friendly biodegradable housekeeping and pest control products and low VOC building finishes shall be encouraged, so as to ensure good indoor air quality and reduced risk to humans.

Long-term health effects of VOCs can include:	Short-term health effects of VOCs can include:
Liver damage	Irritaion of the eyes, nose, throat or and/or respiratory tract
Kidney damage	Visual disturbances
Central nervous system damage	Headaches
Certain types of cancer	Loss of coordination
Asthma	Nausea
	Light headaches
	Dizziness
	Allergic skin reaction
	Fatigue
	Memory impairment

Brief description: The intent of the policy is to encourage the purchase and use of environment friendly cleaning and pest control products for housekeeping and low VOC material in building interiors.
Policy intends to: Enhance the user comfort through good indoor air quality and lessen the detrimental impact on the environment through adoption of sustainable practices in the production cycle from procurement of raw material to delivery.
Applies to: All PWD government buildings registered under GRIHA Existing Building rating system.

Policy Statement III: Purchase and use of CFC free refrigerants, CFC and HCFC free insulations and halon free fire retardant

The policy statement has been established to ensure adoption of low ODP materials in PWD operated government buildings. GRIHA mandates that the purchased HVAC system must be CFC free and the insulation used must be CFC and HCFC free, as these chemicals stay longer in the atmosphere and deplete the ozone layer. In case of facilities using HCFC/CFC equipment, it is encouraged to design a phase out plan for such equipment, such that within the strict timelines it is in accordance with the larger objectives of the Montreal Protocol. The members of the United Nations developed the Montreal Protocol, which is an international environmental agreement with universal ratification to protect the earth's ozone layer by eradicating use of ozone depleting substances (ODS), which would else allow increased UV radiation to reach the earth, leading to higher occurrence of skin cancers, aging of skin, eye cataracts, damage to immune systems and affecting the plant & marine life growth. As stated by United Nations Development Programme (UNDP), since the adoption of the protocol in 1987 and as of end 2014, 98% of controlled ODS have been successfully eliminated. The transition from CFCs (high ozone depleting potential) to intermediate HCFCs (with lower ODP) has been commendable. However, the final transition is to switch to alternatives that have zero ODP and are climate friendly. Additionally, in GRIHA, emphasis is also laid on having low ODP fire retardants in the building. Therefore, GRIHA also mandates use of halon free fire fighting equipment in the building. In GRIHA rating system or in any of its variant, non-compliance with any mandatory criterion indicates that the building is ineligible for any rating (1 to 5-star rating system). Through this policy intervention, use of CFC free refrigerants, CFC & HCFC free insulations and halon free fire retardant shall be mandated for government buildings.

Brief description: The intent of the policy is to mandate that all HVAC equipment must be CFC free and all insulation used in the building must be CFC and HCFC free. Whereas, the firefighting equipment must be halon free.
Policy intends to: Use environment friendly equipment and adopt good global practices that are followed in the operation and maintenance of building systems.
Applies to: All PWD government buildings registered under GRIHA Existing Building rating system.

Policy Statement IV: Provision of infrastructure at source for waste management and segregation

This policy statement has been developed to ensure efficient waste management and segregation practices in PWD-operated government buildings. The Solid Waste Management Rules, 2016, released by the Union Ministry of Environment, Forest and Climate Change put emphasis on decentralised solid waste management. Waste would be managed at the source by involving the community in waste segregation and processing by adopting practices of recycling, composting, bio-gas generation and others. GRIHA recommends the practice of waste management and segregation of different types of waste for better solid waste management by incorporating the following good practices:

- Provision of infrastructure which would ensure segregation of bio degradable and non-bio degradable waste at source by installation of multicoloured dustbins at common location or providing different garbage chutes.
- Provision of dedicated, segregated and hygienic storage spaces on the project site to store different wastes before treatment /recycling or handing over to the municipal body/concerned authority.

CFCs 1930s-1990s	HCFCs 1930s-2010s	HFCs 1990s+	New/Natural Compund* 2010s+
Long atmospheric lifetime	Shorter atmospheric lifetime	Shorter atmospheric lifetime	Very short atmospheric lifetime
Strong ozone depletion	Lower ozone depletion	Non-ozone depletion	Non-ozone depletion
Strong global warming	Lower global warming	Lower global warming	Very Low global warming
			*HFOs CO_2 Hydrocarbon

Source: https://dms.hvacpartners.com/docs/1001/Public/0E/ENG_NEWS_3_2.pdf

- Have contractual tie-ups with waste recyclers for safe recycling of recyclable wastes, like metal, paper, plastic, glass, e-waste, etc.
- Implementation of strategies to treat all organic (kitchen and landscape) waste on-site and to convert it into a resource (manure, biogas, etc.) and reuse the same.

Brief description: The intent of the policy is to encourage solid waste segregation and management at source through primary and secondary means and to enhance resource recovery from waste.
Policy intends to: Responsibly manage solid waste within the project boundary and to the extent possible recycle waste to generate resource.
Applies to: All PWD government buildings registered under GRIHA Existing Building rating system.

Policy Statement V: Water performance index for demand & supply side management

With the given background of water stress, the first aspect of the policy statement is to outline the baseline consumption of the building through a water audit and thereby deriving the water performance index. The audit shall provide a more rational and scientific framework that categorizes all the water usages in the built environment and act as a tool to overcome any shortage, leakages, and losses. The audit shall also highlight the possible corrective measures in the given state. Thus, in the GRIHA EB rating system, conducting the detailed water audit demonstrating the water supply, usage, process, systems, and discharge analysis is mandatory. Through this policy, the water audit should be considered to be made mandatory for each government building, and so the water performance index.

The second aspect of the policy statement involves supply-side management through the implementation of rooftop rainwater harvesting system, either for recharging the groundwater or storing for reuse and treating wastewater generated on-site through low or no cost technology. The underlying concept is that water collected from flat roof surfaces could be diverted from running into municipal drains and allowed to percolate into the ground instead, thereby recharging shallow aquifers. Shallow aquifers are water-bearing formations that exist about 10-100 feet underground and in their natural state get replenished during rains. However, due to the presence of impermeable concrete surfaces in urban areas percolation levels have reduced manifold. Water is pumped from these aquifers regularly for domestic use resulting in a steady decline in the water table. Using recharge wells, rainwater can be routed back into these aquifers, enhancing groundwater levels. In the long run, this will mitigate water-logging and flooding during heavy rains and the well itself may retain water for short term usage. The recharge system requires little real estate and consists of four main components – the "catchment" - any paved surface that collects rainwater, the "conveyance" - downpipes or gutters that can carry rainwater to the recharge well, "filtration" - an in-drain filter or silt trap only required to remove debris and silt and the "well" itself. The captured rainwater will take a specific time period to percolate down through the soil depending on site specific conditions. The number of wells required may be determined based on the catchment area, the rate of rainwater runoff and soil infiltration rate. It is recommended that if the Central Ground Water Board (CGWB) norms suggest that the groundwater table is high and groundwater recharging should not be done, the project should not attempt for the same. The following good practices may be incorporated at a policy level in order to ensure maximum impact.

- The implementation of properly designed recharge wells after adequate testing of soil and rainfall levels to ensure that an optimal number of wells are dug.
- The catchment area should be limited to rooftops.
- The digging of recharge wells should be undertaken when the water table is low.
- Location of recharge wells as close as possible to existing bore wells and as far away as possible from soak pits and toilets (at least 20 ft away). The wells should not be in close proximity to the building foundation and basement. No power cables or sewage pipes should pass close to the recharge well.
- Avoidance of placing recharge wells in areas where impenetrable rock is located very close to the surface, as water recharge rates in these zones would be significantly lower.
- Scheduled de-silting of the recharge well at least once every five years.

With respect to the treatment of wastewater generated on site, it is loaded with pathogens, toxins and chemicals. Its treatment aims at reducing the contaminants to acceptable levels so that the water is rendered safe either

for re-use or for discharge, back into the environment. Waste water may be divided into two categories – "grey" water from sources such as kitchens and washing and "black" water, generated from flushing toilets. Cost effective ways to treat waste water include oxidation ponds, septic tanks, root zone treatment and soil biotechnology (SBT). In root zone technology, specific plants absorb the contaminants from sewage while in SBT microbes in the soil perform the same function. Small scale technologies that do not use chemicals or energy but instead mimic natural processes - using a combination of microorganisms, plants and gravel to clean sewage – may be considered ideal. GRIHA recommends the incorporation on any suitable strategy that ensures the effluent discharge standards prescribed by the Central Pollution Control Board (CPCB) are met.

Brief description: The intent of the policy is to encourage the recharge of rainwater wherever possible to replenish depleted groundwater reserves and treat wastewater to a primary level such that it may be reused or returned to the water cycle, through the findings from the water audit.

Policy intends to: Encourage evaluation of the overall water consumption of the building and shift towards water sufficiency through implementation of rainwater harvesting and wastewater treatment system.

Applies to: All PWD government buildings registered under GRIHA Existing Building rating system.

Way Forward

At one end of the spectrum, the gaps and challenges with respect to integrating sustainable practices in functional buildings are multiple and need to be addressed at various levels of planning and governance. Whereas, at the other end, the scattered demonstrated benefits are gaining significance in the light of sustainability. In order to accelerate the results of the latter, the inclusion of the aforementioned policy statements in the maintenance manual of the Public Works Department, Government of Maharashtra, shall endorse the commitment of the department dealing in large number of public buildings used for both, administrative and residential purposes. Besides, it will give confidence to other government departments to initialize such policy interventions to address sustainability at large. The relevant excerpts of the state policy formulated may then be included in the working of the Urban Local Bodies (ULBs), complimenting with the necessary handholding. Strengthening partnerships to achieve the shared goals of sustainability will go a long way in enhancing liveability of Indian cities.

Acknowledgement

This policy brief has been prepared based on the experiences and challenges encountered during the 1st phase of the ongoing PWD-GRIHA Green Building Initiative. We would like to acknowledge the support extended by all the officers of Public Works Department and GRIHA Council. Their valuable inputs in preparing this policy brief have been significant.

Regional office

GRIHA Western Zone,

318, Raheja Arcade, Sector-11, CBD Belapur,
Navi Mumbai - 400614

GRIHA Council

A-260, Bisham Pitamah Marg,

Defence Colony, New Delhi – 110024

011-46444500/24339606

info@grihaindia.org • www.grihaindia.org