GRIHA's IMPACTFUL 50

BEYOND GREEN BUILDING BLOCKS

GRIHA

A GRIHA council publication

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Advisory team

Mr. Sanjay Seth
Ms. Shabnam Bassi
Mr. Akash Deep
Ms. Shaily Mahera

Devlopment team

Sheen Pandita
Mohak Jain

FOREWORD

Dr. Vibha Dhawan

President,
GRIHA Council

Director general ,
The Energy & Resource Institute

Dear Readers,

The building industry, while driving economic growth and development, stands as one of the largest contributors to global emissions. In response, energy-efficient and sustainability rating systems are continually evolving, with a shared goal of achieving net-zero emissions.

India's fast-growing economy and burgeoning population have propelled a significant rise in emissions over recent decades. Yet, this is not a challenge confined to one nation—it is a global concern. Around the world, sustainability rating systems have established comprehensive frameworks to evaluate the environmental performance of buildings, addressing critical aspects such as energy and water efficiency, waste management, materials and resource optimization, occupant comfort, and health.

In India, the Green Building Rating for Integrated Habitat Assessment (GRIHA) has been a pioneering force since its inception in 2007. It provides a robust mechanism to assess building projects against nationally defined sustainability benchmarks, evaluating their environmental performance holistically throughout their life cycle.

With the global building stock projected to grow exponentially, material and resource consumption—and their environmental repercussions—are poised to escalate. This makes it imperative for clean energy transitions to disrupt traditional economic models that depend on rising material demand and production, which are major drivers of carbon emissions. In this context, building rating systems like GRIHA play a pivotal role in offering transparent and effective evaluation mechanisms to advance sustainable practices in the construction sector.

This book presents 50 exemplary GRIHA-rated projects across India, showcasing innovative approaches to site planning, passive design strategies, efficient landscaping, and cost-effective architectural measures. These case studies emphasize the optimization of resources and reduction of carbon emissions, serving as a valuable repository of knowledge for professionals in the built environment. More importantly, they stand as a testament to the progress being made toward sustainable and eco-friendly practices in India's construction industry.

I am delighted to witness GRIHA's growing impact in accelerating the adoption of green practices in both new and existing buildings across the nation, contributing to a more sustainable future. I extend my heartfelt congratulations to my colleagues at the GRIHA Council for curating this inspiring collection of case studies, which I believe will guide and inspire many in the journey toward sustainable development.

Here's to building a greener tomorrow!

PREFACE

Mr. Sanjay Seth

Vice President-cum-Chief Executive Officer,
GRIHA Council

Senior Director,
The Energy & Resource Institute

Dear Friends and Colleagues,

Buildings and construction account for nearly 40% of global carbon emissions, driven by operational processes such as lighting, cooling, and heating, as well as the production and transport of materials. Recognizing this, the United Nations highlights buildings and construction as critical tools for promoting sustainable consumption and production patterns.

The global urgency to address the carbon footprint of the built environment was underscored at the 26th Conference of Parties (CoP26) in Glasgow, where India presented its ambitious "Panchamrit" commitments. These targets include achieving net-zero emissions by 2070, reducing projected carbon emissions by 1 billion tons by 2030, meeting 50% of energy needs through renewables, and reaching 500 GW of non-fossil energy capacity. These milestones demonstrate India's determination to lead by example in the global fight against climate change.

In this context, green building certifications like GRIHA (Green Rating for Integrated Habitat Assessment) play a pivotal role. They provide a framework to assess and improve the environmental performance of buildings over their life cycle, while also acting as benchmarks for sustainable investment and innovation.

By promoting resource efficiency, occupant comfort, and reduced operational costs, GRIHA empowers stakeholders—designers, investors, manufacturers, government bodies, and NGOs—to accelerate decarbonization and adopt best practices in sustainability.

GRIHA, as an indigenous rating system, seamlessly integrates scientific advancements with traditional knowledge to create cost-effective and culturally relevant solutions. Highlighted in India's INDC (Intended Nationally Determined Contributions) as a tool for greenhouse gas (GHG) mitigation, GRIHA continues to influence national policies and enjoys strong support from public and private entities alike. The inclusion of social dimensions in its framework sets it apart, ensuring that the built environment fosters inclusivity, accessibility, and community well-being.

This coffee table book showcases 50 exemplary GRIHA-rated projects from across India, illustrating how resource optimization, carbon reduction, and innovative strategies contribute to sustainable building practices. Each case study highlights the tangible benefits of integrating advanced technologies and sustainable operational practices, while also proving that sustainability is both achievable and economically viable.
We hope this publication serves as an inspiration and a guide for building owners, developers, and policymakers to adopt greener practices in both new and existing projects. These case studies demonstrate the significant impact that buildings can have in shaping a more sustainable, inclusive, and resilient future.
I extend my sincere gratitude to all those who contributed to this publication and look forward to continued efforts in showcasing the transformative potential of sustainable construction.

Together, let us advance toward our shared goal of environmental stewardship and sustainability

ACKNOWLEDGEMENT

Ms. Shabnam Bassi

Deputy CEO-Cum-Secretary,
GRIHA Council

Director,
The Energy & Resource Institute

Dear Reader,

It gives me great pleasure to introduce “Beyond Green Building Blocks: GRIHA’s Impactful 50” — a Coffee Table Book that celebrates the milestones of sustainable architecture and responsible construction across India. This publication is not merely a compilation of buildings; it is a tribute to the shared vision, relentless innovation, and unwavering commitment of an entire ecosystem of changemakers who are reshaping the future of our built environment.

This book brings together 50 exemplary projects that reflect the breadth and depth of green building practices. Each of these projects, certified under the GRIHA rating system, tells a unique story of how sustainable design can be seamlessly integrated into the diverse social, climatic, and economic contexts of our country.

This achievement would not have been possible without the thoughtful collaboration and sincere efforts of a wide range of stakeholders. I extend my heartfelt gratitude to our esteemed clients, facility managers, green building consultants, architects, engineers, and developers.

I also wish to express my profound appreciation to the incredible teams at GRIHA and TERI. Your relentless dedication, precision in technical evaluations, and passion for sustainability have driven the successful realization of this ambitious endeavour. The hours spent curating, compiling, and verifying details have translated into a product that not only informs but also inspires. This book stands as a reflection of your professional excellence and your belief in the transformative power of sustainable development.

A special word of thanks is reserved for Dr. Vibha Dhawan, Director General of TERI, whose visionary leadership and steadfast support continue to be the foundation of the GRIHA Council's progress. Her encouragement, insight, and unflagging belief in the cause of green buildings have made this publication possible and continue to guide our efforts as we work toward a more sustainable and equitable future.

To everyone who contributed to this project, thank you for your dedication to sustainability and your invaluable role in shaping a greener, more sustainable future.

CONTENTS

INTRODUCTION

WHAT ARE GREEN BUILIDNGS?

Green buildings, also known as sustainable or eco-friendly constructions, are designed to minimize environmental impact and enhance resource efficiency throughout the building's lifecycle. By focusing on energy efficiency, water conservation, and the use of sustainable materials, green buildings address the pressing challenges of climate change and environmental degradation.

Key features include advanced insulation, energy-efficient lighting, and renewable energy integration, which reduce carbon emissions. Techniques like rainwater harvesting and greywater recycling promote water management, while using recycled and locally sourced materials conserves natural resources.

Beyond environmental benefits, green buildings offer economic advantages like lower utility costs and higher property values, as well as healthier, more productive indoor environments. Green buildings represent a comprehensive solution to sustainable development, integrating environmental, economic, and social well-being for a better future.

WHY WE NEED GREEN BUILDINGS?

The rapid pace of urbanization is amplifying resource demands and intensifying the environmental impact of the built environment, positioning sustainable construction as a vital solution to global and national sustainability challenges. Further, green buildings play a critical role in addressing key United Nations Sustainable Development Goals (SDGs), specifically SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

In India, the rapid increase in population and economic growth has placed unprecedented pressure on natural resources, with urban areas particularly strained by the diminishing availability of water and the growing demand for energy. The construction sector is one of the largest consumers of resources, from energy and water to raw materials, and contributes significantly to waste generation and greenhouse gas emissions. This scenario underscores the urgency of adopting green building practices, which can mitigate these pressures while fostering a more sustainable and resilient urban future.

WHY RATE GREEN BUILDINGS ?

Green buildings are essential because they provide an integrated solution to reducing the environmental footprint of the construction sector. They incorporate energy-efficient designs, sustainable water management systems, and the use of eco-friendly materials, while enhancing indoor environmental quality. These buildings not only lower energy consumption and reduce carbon emissions but also promote water conservation through innovations like rainwater harvesting and greywater recycling, helping to address the SDGs at multiple levels.

India's commitment to sustainable development is reflected in the adoption of GRIHA (Green Rating for Integrated Habitat Assessment), the green building rating system, which aligns with global sustainability standards and is integrated into the National Action Plan on Climate Change. GRIHA plays a pivotal role in guiding the building industry towards practices that reduce resource consumption, minimize waste, and promote renewable energy, all while ensuring legal compliance through frameworks like the Energy Conservation Building Code (ECBC) and the Solar Buildings Programme.

Despite the progress, there are challenges in shifting from traditional construction methods to sustainable alternatives. Overcoming these hurdles requires a concerted effort in education, awareness, and the provision of financial incentives. Government policies, subsidies, and collaborations with financial institutions are critical to driving widespread adoption. Green building rating systems, such as GRIHA, provide a structured framework to guide this transition, offering measurable benchmarks and encouraging compliance with sustainable practices. These systems help bridge the gap between policy goals and on-ground implementation, driving accountability across the construction sector. Government policies, subsidies, and collaborations with financial institutions are critical to driving widespread adoption.

In conclusion, green building ratings are a key pathway to sustainable development, directly supporting the SDGs by promoting energy efficiency, water conservation, and responsible resource use, ensuring cities grow sustainably while balancing environmental and economic goals.

ABOUT GRIHA COUNCIL

GRIHA, an acronym for **Green Rating for Integrated Habitat Assessment**, is a Sanskrit word that translates to **"abode."** This rating system has been designed to evaluate and enhance the environmental performance of buildings across their entire life cycle—from construction through operation to demolition. Human habitats, or buildings, have complex interactions with the environment, consuming significant resources such as energy, water, and materials, while also generating waste and emissions. GRIHA's core objective is to reduce resource consumption, waste generation, and the overall ecological footprint of buildings, ensuring that they operate within nationally defined benchmarks for sustainability.

In line with the adage, "what gets measured, gets managed," GRIHA takes a quantitative approach to assess key performance areas such as energy consumption, water usage, waste generation, and the integration of renewable energy systems. By establishing measurable criteria, GRIHA enables building professionals to manage and mitigate environmental impacts effectively, striving to optimize resource efficiency throughout the building's life cycle.

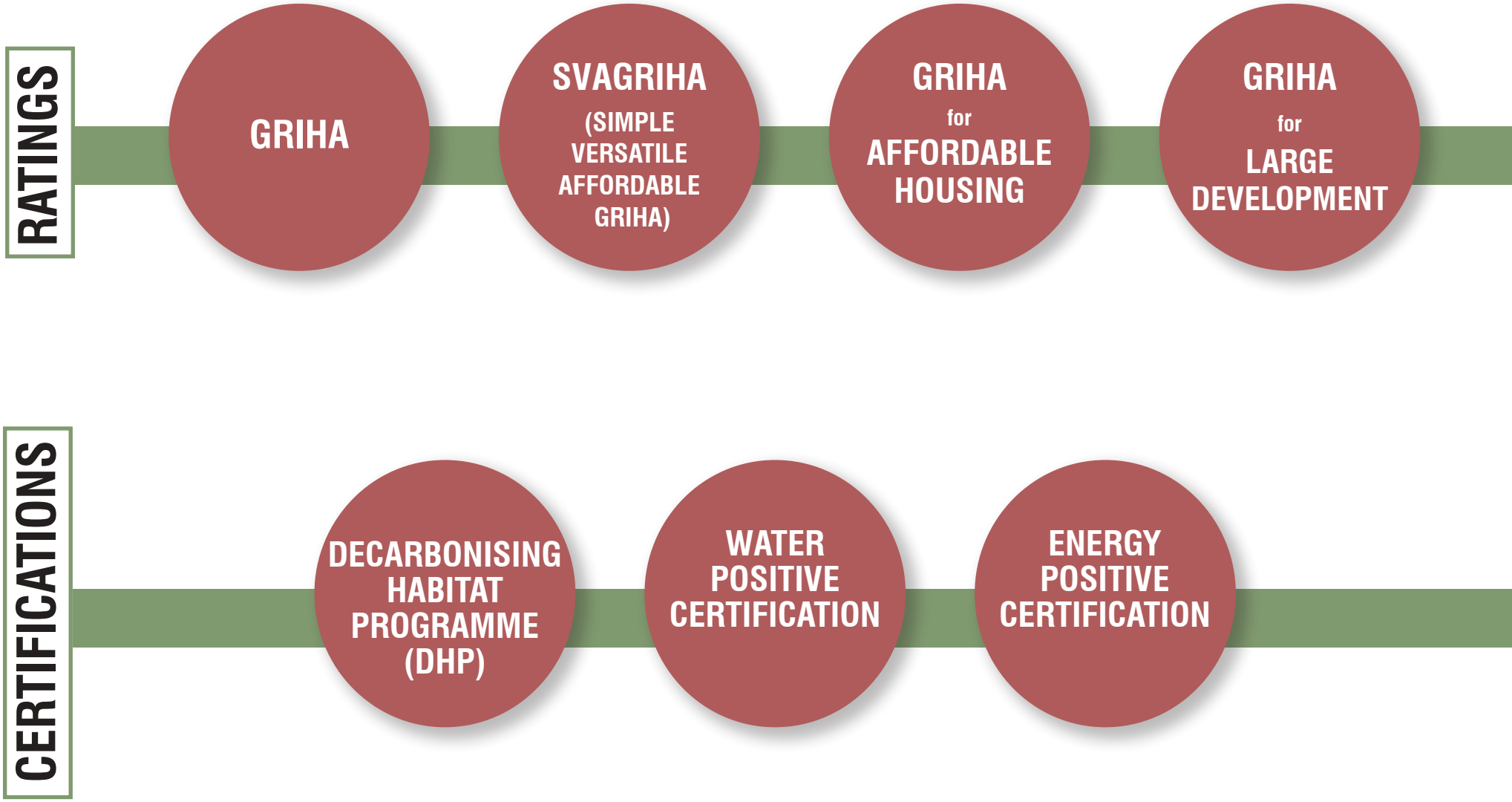
As a nationally recognized rating tool, GRIHA provides a structured framework for evaluating a building's environmental impact against defined benchmarks. It offers a holistic view, covering critical aspects such as energy efficiency, water conservation, waste management, and indoor environmental quality. The system not only promotes adherence to accepted national and international energy and environmental standards but also encourages the adoption of emerging technologies and best practices in sustainable construction. By balancing established practices with innovative concepts, GRIHA sets the benchmark for what constitutes a truly sustainable, green building.

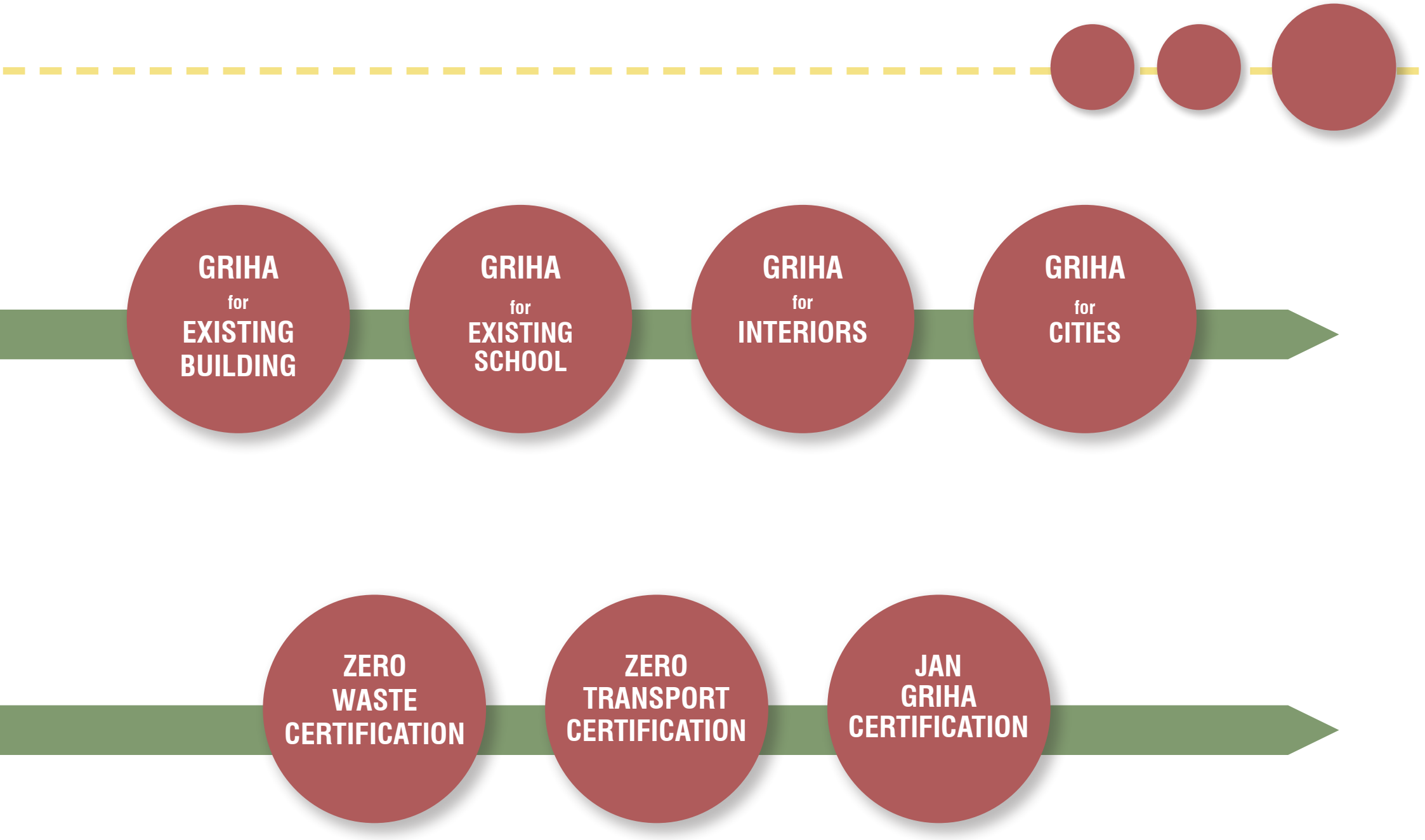
GRIHA's rating system, grounded in scientific and environmental principles, aims to guide architects, engineers, developers, and policymakers toward creating buildings that are environmentally responsible, resource-efficient, and capable of enhancing the quality of life for their occupants. By promoting sustainability in the built environment, GRIHA plays a pivotal role in mitigating climate change and fostering long-term environmental stewardship.

"We, at *GRIHA Council*, stand for *credibility*, *integrity*, and *inclusiveness*, while upholding *Indian ethos* for *future-ready* and *sustainable habitat*."

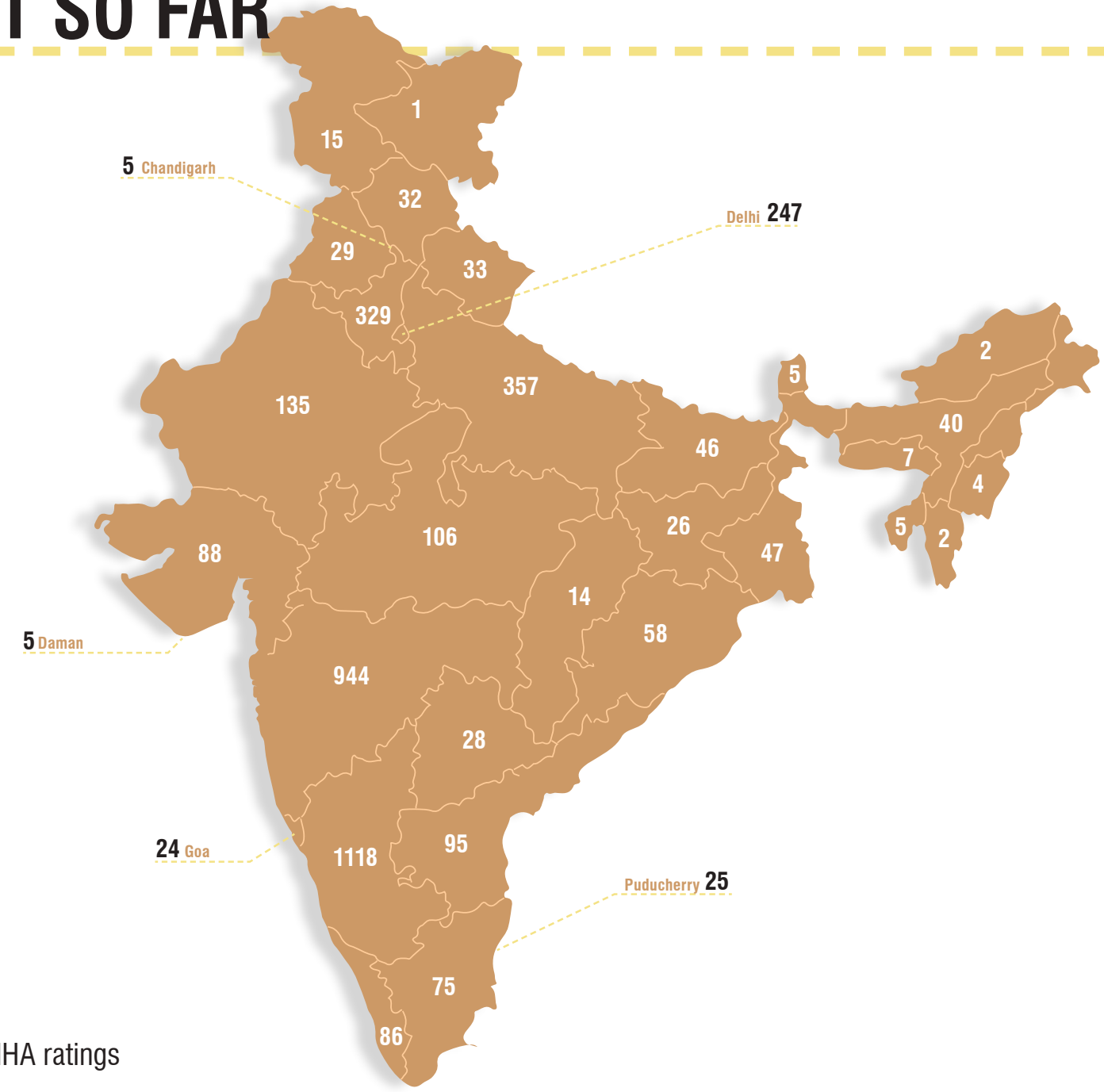
- vision statement for GRIHA Council

RATINGS & CERTIFICATIONS UNDER GRIHA COUNCIL




GRIHA for EXISTING BUILDING
GRIHA for EXISTING SCHOOL
GRIHA for INTERIORS
GRIHA for CITIES
ZERO WASTE CERTIFICATION
ZERO TRANSPORT CERTIFICATION
JAN GRIHA CERTIFICATION

GRIHA IMPACT SO FAR



Statevise registered projects under various GRIHA ratings

4000+ projects registered across India exceeding the **930+ million square feet** of built-up area. **1300+** buildings successfully rated.

More than **2,66,770+ new trees** have been planted & **55,000+ trees** have been preserved.

Under these projects **650+ MWp** of renewable energy systems have been installed & are responsible for saving **29700+ GigaWh** Of energy &preventing **8400+ Gigatons** of carbon dioxide from being released into the atmosphere every year.

GRIHA rated projects have contributed to water savings of **1,04,192+ Megalitre/annum.**

**Based on infomration reported uptill November 2023*

ABOUT THE BOOK

The launch of '*GRIHA's Impactful 50: Beyond Green Building Blocks*' holds particular significance as it aligns with the 50th anniversary of The Energy and Resources Institute (TERI), a pioneering institution in the field of sustainable development. This synchronicity underscores a profound moment in the journey towards a greener, more sustainable future.

As TERI commemorates half a century of dedication to environmental stewardship and resource conservation, the selection of 50 exemplary GRIHA-rated projects serves as a testament to the progress made in sustainable construction practices over the years. These projects stand as shining examples of innovation, resilience, and commitment to environmental responsibility.

However, beyond being a mere commemoration of past achievements, the launch of the '*GRIHA's Impactful 50: Beyond Green Building Blocks*' Coffee Table Book serves as a catalyst for future action. It represents a call to arms for the construction industry, policymakers, and stakeholders to redouble their efforts in promoting sustainability and resilience in the built environment.

By showcasing the success stories of these 50 projects, the book not only celebrates the strides made thus far but also inspires and empowers others to follow suit. It serves as a roadmap for future endeavors in sustainable construction, offering valuable insights, best practices, and lessons learned from real-world implementations.

Moreover, the timing of the book's release amidst TERI's 50th-anniversary festivities amplifies its impact and outreach. It provides a platform to engage a broader audience, including industry professionals, policymakers, students, and the public, in the dialogue surrounding sustainable development and the imperative for action.

The launch of the '*GRIHA's Impactful 50: Beyond Green Building Blocks*' represents a pivotal moment in the ongoing quest for sustainability. It symbolizes a collective commitment to building a more resilient, equitable, and environmentally conscious future for generations to come, guided by the principles of innovation, collaboration, and stewardship.

SELECTION OF THE CASE STUDIES

The selection process for the '*GRIHA's Impactful 50: Beyond Green Building Blocks*' book was meticulously designed to identify India's most impactful, innovative, and exemplary green building projects. By adhering to a stringent set of criteria, the book ensures that only projects demonstrating outstanding sustainability performance and broad applicability were chosen, offering a comprehensive showcase of the country's leadership in sustainable development.

Key selection factors included:

Performance Metrics: Projects were evaluated based on third-party validated data, focusing on energy efficiency, water conservation, waste management, site planning, and indoor environmental quality. Priority was given to projects with significant reductions in resource use, renewable integration, and lower carbon footprints.

Innovation and Best Practices: Projects showcasing innovative technologies, design strategies, and construction practices that advanced sustainability were prioritized, especially those offering scalable solutions.

Diversity in Building Types and Locations: The selected projects represent a range of building types—residential, commercial, institutional, and hospitality—and come from various regions across India, addressing diverse climatic challenges.

Social Impact and Scalability: Projects were assessed for their scalability and positive social impact, focusing on replicability, cost-effectiveness, operational expenditure (OPEX), life-cycle cost (LCC), and payback periods.

Community Engagement and Stakeholder Collaboration: Projects demonstrating meaningful community involvement and strong stakeholder partnerships were given special attention for their holistic approach to sustainability.

By adhering to these stringent criteria, the '*GRIHA's Impactful 50: Beyond Green Building Blocks*'book showcases India's most impactful green building projects, aiming to inspire and empower industry professionals to embrace sustainable practices and foster a more resilient built environment.

HOW TO READ THIS BOOK?

'*GRIHA's Impactful 50: Beyond Green Building Blocks*' offers a deep dive into sustainable construction, presenting innovative strategies and solutions implemented by project teams to meet GRIHA standards. Each case study spans four pages: The first two pages provide a project overview, covering essential details like project data, climate zone, building typology, GRIHA variant and rating, area statements, and project team. They also feature critical performance metrics, including the Energy Performance Index (EPI), renewable energy capacity, and carbon offset, highlighting the project's sustainability achievements.

LOCATION MAP

Map showcasing the location of the project in respect to the state & city

TYPYOLOGY INFO

this band has the name, location, climate classification, function type and the rating type along with the star rating of the prhect

PROJECT IN NUMBERS

Reduction in Energy Efficiency Index, decrease in water consumption, installed renewable energy capacity, total trees planted, and overall carbon offset collectively highlight the project's quantified impact

SATELLITE VIEW

Higlighting the location of the project on satellite view to have an idea of the immediate context of the project

KEY PROJECT INFO

Includes area, occupancy, and the team behind the project.

PROJECT IMAGE

One overall image to give the reader an idea of what the project looks like

Reading through the detailed descriptions on pages 3 and 4 of each case study invites readers to immerse themselves in the nuanced approaches these projects have taken to address complex sustainability challenges. From innovative water conservation measures to groundbreaking passive design techniques, each narrative offers a wealth of knowledge and inspiration. Readers are encouraged to think critically about how these strategies can be adapted and applied in different contexts, promoting a broader understanding and appreciation of sustainable design principles in action.

PROJECT FEATURES

Divided into 4 themes to highlight the overall features of the project

Strategic Site Planning: Sustainable infrastructure (e.g., stormwater management), native plant selection for biodiversity, and urban heat island reduction via reflective surfaces and green roofs.

Energy Efficient Design: Optimized design for natural light/ventilation, energy-efficient systems, renewable energy, and sustainable materials with low embodied energy.

KEY HIGHLIGHTS

the unique feature of the project is described in detail here

PROJECT IMAGE

Sketch or zoomed image of a feature of the building that highlights its uniqueness

PROJECT FEATURES

Divided into 4 themes to highlight the overall features of the project

Lifestyle and Innovation: Waste reduction strategies, health-focused indoor environment, and inclusive design for accessibility.

Water Use Optimization: Water-saving fixtures, rainwater harvesting,

CASE STUDIES PROJECTS INDEX

SNO.	PROJECT NAME	CITY	STATE/UT
1	ITC Residential Parks	Guntur	Andhra Pradesh
2	The Bihar Museum	Patna	Bihar
3	Phase I of Development of Nalanda University NET Zero Campus	Nalanda	Bihar
4	Proposed International Terminal at Chandigarh Airport	Chandigarh	Chandigarh
5	Indian Institute of Technology - Bhilai	Bhilai	Chhattisgarh
6	Pawan Hans Heliport (Passenger Terminal Building & Utility Building), Sector 36, Rohini	New Delhi	Delhi
7	Punjab National Bank Headquarters, Dwarka	New Delhi	Delhi
8	Expansion & Modernization of the British School	New Delhi	Delhi
9	UIDAI Headquarter Building	New Delhi	Delhi
10	Reconstruction of HPCL Petrol Pump, Pick N Drive, Meera Bagh, New Delhi	New Delhi	Delhi
11	Smart Ghar -3, Rajkot Municipal Corporation	Rajkot	Gujarat
12	Light House Project	Rajkot	Gujarat
13	Raksha Shakti University	Ahmedabad	Gujarat
14	Indian Institute of Technology, Gandhinagar	Gandhinagar	Gujarat
15	EIL Complex	Gurugram	Haryana
16	HAREDA - Akshay Urja Bhawan	Panchkula	Haryana
17	Milestone Experion Centre	Gurugram	Haryana
18	Treasury Building at Kuthar	Solan	Himachal Pradesh
19	Convention Centre and Allied Building at Darbhanga House Complex	Ranchi	Jharkhand
20	Titan New Corporate Campus	Bengaluru	Karnataka
21	R&D Unit for Astra Microwave Products Ltd	Bengaluru	Karnataka
22	Employee Residential Building of ITC (Mudfort)	Bengaluru	Karnataka
23	Ladies Hostel project at Indian Institute of Science	Bengaluru	Karnataka
24	Annex Building, EMPRI	Bengaluru	Karnataka
25	Tamara Luxury Hotel (New Name: O by Tamara)	Thiruvananthapuram	Kerala

STARS AWARDED	GRIHA CATEGORY	TYPOLOGY	BUILT-UP AREA (SQ. MTR.)	CARBON REDUCTION (T/ANNUM)	PAGE NO.
★★★★★	GRIHA	Residential	57,208	26,18,547	30
★★★★★	GRIHA	Institutional	25,000	14,96,295	34
★★★★★	GRIHA LD	Institutional	3,41,000	61,59,873	38
★★★★	GRIHA	Airport	4,24,362	3,89,734	42
★★★★★	GRIHA LD	Institutional	13,99,300	1,37,78,198	46
★★★★	GRIHA	Airport	3,403	3,92,279	50
★★★★★	GRIHA	Institutional	37,874	18,78,929	54
★★★★★	GRIHA	Institutional	21,300	17,91,313	58
★★★★★	GRIHA	Institutional	8,635	6,19,052	62
★★★★★	SVAGRIHA	Commercial	100	1,454	66
★★	AH	Residential	57,408	14,71,924	70
★★★	AH	Residential	47,827	13,86,983	74
★★★★★	GRIHA LD	Institutional	7,28,791	34,27,042	78
★★★★★	LD	Institutional	1,27,534	54,02,776	82
★★★★★	GRIHA	Commercial	32,837	16,78,050	86
★★★★★	GRIHA	Commercial	5,100	77,785	90
★★★★★	GRIHA	Commercial	22,916	12,77,040	94
★★★★	SVA GRIHA	Commercial	277	2,699	98
★★★★	GRIHA	Institutional	11,469	7,72,379	102
★★★★★	GRIHA	Commercial	25,344	7,58,130	106
★★★★★	GRIHA	Commercial	10,215	6,85,516	110
★★★★★	GRIHA	Residential	13,875	9,44,901	114
★★★★★	GRIHA	Residential	5,473	1,38,372	118
★★★★★	SVAGRIHA	Institutional	1,283	7,388	122
★★★★	GRIHA	Commercial	13,741	35,40,512	126

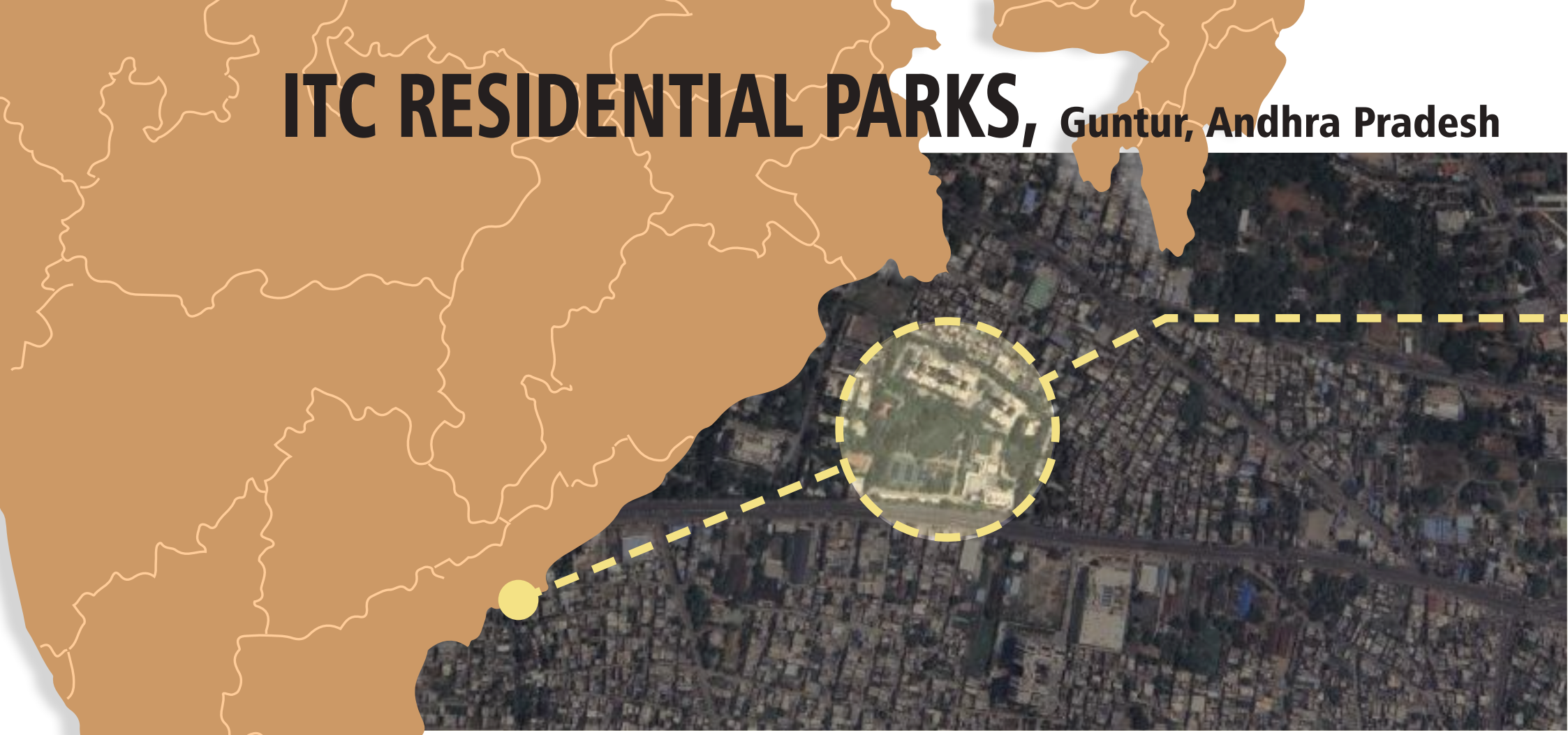
CASE STUDIES PROJECTS INDEX

SNO.	PROJECT NAME	CITY	STATE/UT
26	IIM	Kozhikode	Kerala
27	Atulya IT Park	Indore	Madhya Pradesh
28	Mr. Azad Jain Residence	Indore	Madhya Pradesh
29	LHP	Indore	Madhya Pradesh
30	Smart Data Enterprises	Nagpur	Maharastra
31	BPCL, Residential Building	Mumbai	Maharastra
32	Royal Orange County	Pune	Maharastra
33	Gandhi Research Foundation	Jalgaon	Maharastra
34	Pimpri Chinchwad New Town	Pune	Maharastra
35	Govardhan Eco Village	Wada	Maharastra
36	Grape County Resort	Nashik	Maharastra
37	VVIP Circuit House	Pune	Maharastra
38	Vastukar Design Studio	Bhubaneswar	Odisha
39	Gratitute Ecovilla	Puducherry	Puducherry
40	STPI Incubation Centre	Mohali	Punjab
41	Bhamashah Data Centre	Jaipur	Rajasthan
42	Manipal University Campus	Jaipur	Rajasthan
43	Singareni powerproject 2x600 MW, Service Building	Pegadapalli	Telangana
44	ITC Kohenur	Hyderabad	Telangana
45	Airport Terminal Building	Agartala	Tripura
46	Office Building, Design Associates Inc.,	Noida	Uttar Pradesh
47	HPCL, Administrative Block	Kanpur	Uttar Pradesh
48	Pavna Residence	Aligarh	Uttar Pradesh
49	UPES	Dehradun	Uttarakhand
50	Office Complex for CIL	Kolkata	West Bengal

STARS AWARDED	GRIHA CATEGORY	TYPOLOGY	BUILT-UP AREA (SQ. MTR.)	CARBON REDUCTION (T/ANNUM)	PAGE NO.
★★★★★	GRIHA	Institutional	29,599	29,19,863	130
★★★★	GRIHA	Commercial	14,050	8,34,581	134
★★★★★	SVAGRIHA	Residential	541	1,987	138
★★★★	AH	Residential	44,352	11,76,954	142
★★★★	GRIHA	Commercial	2,972	1,84,240	146
★★★★	GRIHA	Commercial	8,000	9,11,338	150
★★★★★	GRIHA	Commercial	23,968	20,77,336	154
★★★★★	GRIHA	Institutional	4,000	2,46,295	158
★★★★★	GRIHA	Institutional	10,834	1,24,374	162
★★★★★	GRIHA	Commercial	2,401	1,84,351	166
★★★★★	SVA GRIHA	Institutional	1,475	9,216	170
★★★★	GRIHA	Institutional	4,887	1,50,032	174
★★★★★	SVAGRIHA	Commercial	453	3,198	178
★★★★★	SVAGRIHA	Residential	474	1,664	182
★★★★★	SVAGRIHA	Commercial	10,700	13,35,100	186
★★★★★	GRIHA	Commercial	23,921	11,20,811	190
★★★★	GRIHA	Institutional	53,173	37,54,556	194
★★★★★	GRIHA	Service Building	6,087	40,17,959	198
★★★★★	GRIHA	Residential	49,595	1,50,52,406	202
★★★★	GRIHA	Commercial	53,173	6,21,176	206
★★★★★	SVAGRIHA	Commercial	1,002	5,924	210
★★★★	SVAGRIHA	Commercial	1,875	1,958	214
★★★	SVAGRIHA	Residential	2,406	2,920	218
★★★★	GRIHA	Institutional	33,787	8,11,577	222
★★★★	GRIHA	Commercial	25,520	11,11,610	226

CASE STUDIES

ITC RESIDENTIAL PARKS, Guntur, Andhra Pradesh



Site Area: **16,357.03 SQM**
Built-up Area: **23,967.53 SQM**
Occupancy: **1115**
Client: **ITC LIMITED**
Principal Architect: **EDIFICE CONSULTANTS PVT LTD**
Landscape Architect: **INTEGRATED DESIGN**
Structural Consultant: **NEILSOFT LTD**
Electrical Consultant: **NEILSOFT LTD**
Green Building Design & Certification: **THE ENERGY & RESOURCES INSTITUTE**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
56.7%

TOTAL WATER DEMAND REDUCTION
49%

TOTAL NUMBER OF TREES
42,677

TOTAL RENEWABLE ENERGY CAPACITY
46.3
MW

CARBON OFFSET
26,18,547.4
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **63.9%**

Reduction in landscape water demand by native tree plantation is **48.6%**

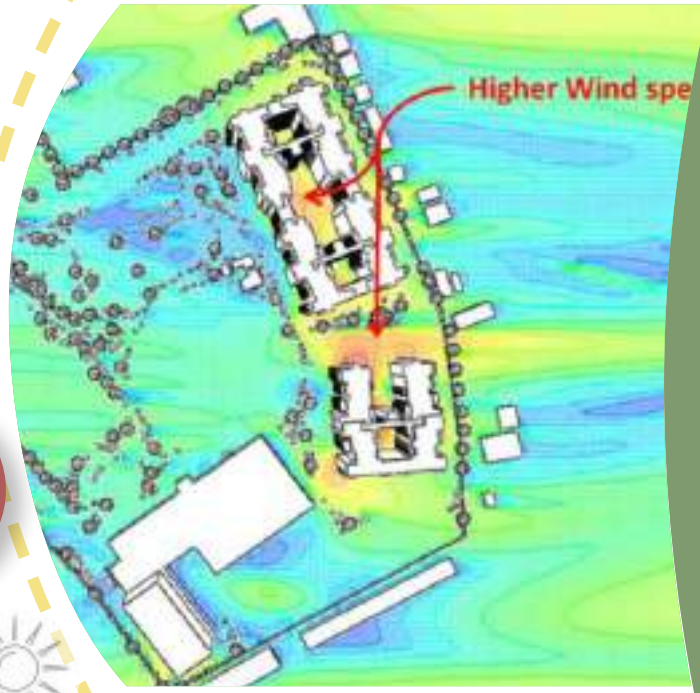
Exisiting trees at site are preserved & number of new trees planted is **42,677**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **75.43%**

Average WWR of all blocks, reducing heat gain & maintaining daylighting, is **21.2%**

Embodied energy of project reduced using PPC with 30% of flyash content in masonary & plaster, Vitrified tiles used for flooring reducing embodied energy & environmental impact



CFD analysis showing higher wind flow in between building blocks & in courtyards to maintain thermal comfort & ventialtion

PASSIVE DESIGN STRATEGIES ADOPTED

BUILDING ORIENTATION:

- Designed with a central courtyard to respond to warm humid weather & oriented with longer facades on east-west axis
- Windows provided on north-south faces to minimize heat gain
- Higher wind speeds observed between blocks that ensures outdoor thermal comfort

LOCATION OF AIR INLETS:

- Windows designed to promote wind flow through blocks by optimizing window sizes. Louvers provided for all windows for good ventilation while shading

REDUCING ROOF HEAT GAIN:

- Insulated reflective roofs with high SRI roof tiles were provided.
- Massive roof gardens were provided in the project

INTEGERATED LANDSCAPE DESIGN REDUCING UHIE EFFECTS

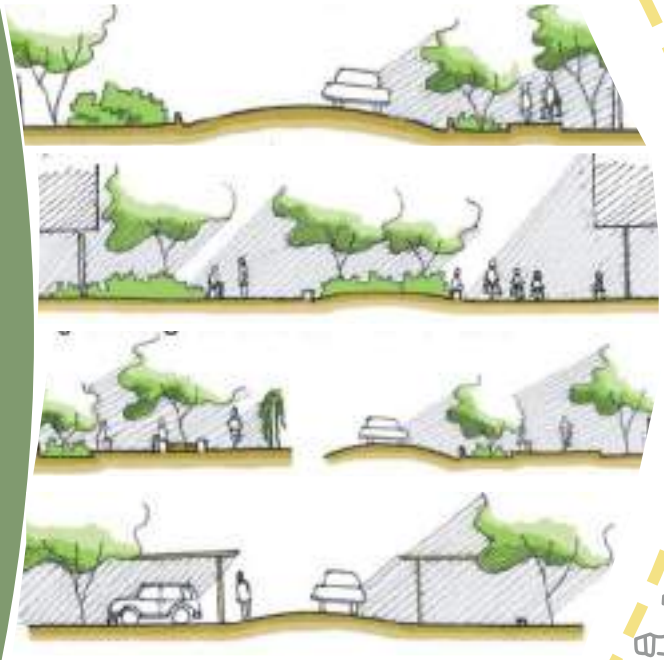
- Buffer plantation along the edges of the road provide shade & insulate from noise from the road

- A cycyling & jogging track along the roadedge with buffer plantation provide shaded & cool areas for pedestrians

- Large shading trees with multilayered vegetation provide shade to reduce heat islamd effect, & offer opportunities for nestling of shaded walkways, cycling & wider space visually

- Large shading trees along with pergoals create earth shading areas for vehicle parking

- Streets between building &planting islands create shaded walkways which remain cool by creating wind funnels



Sketches showing integeration of landscape on site to reduce urban heat island effect & better usage of spaces

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Wet waste generated is treated on site through 249kg Organic Waste Composter

User manual created highlighting different sustainability parameters adopted on site

WATER USE OPTIMIZATION

51% Reduction in water demand using low flow fixtures for kitchen & toilets

Water reuse on site after treating from Phytorid system STP of 72 KLD for irrigation purpose

Terrace runoff rain water collected in 65 KLD storage tank & reused for domestic purposes after treatment

THE BIHAR MUSEUM, Patna, Bihar

Site Area: **54,000 SQM**
Built-up Area: **25,000 SQM**
Year of completion: **2020**
Occupancy: **608**
Client: **BIHAR CONSTRUCTION DEPARTMENT**
Principal Architect: **OPOLIS ARCHITECTS + MAKI &ASSOCIATES**
Structural consultants: **MAHENDRA RAJ CONSULTANTS**
Landscape consultants: **FORETHOUGHT CONSULTANTS**
Green Building Design & Certification: **ENVIRONMENTAL DESIGN SOLUTIONS PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
INSTITUTIONAL

RATING
GRIHA

★ ★ ★ ★ ★

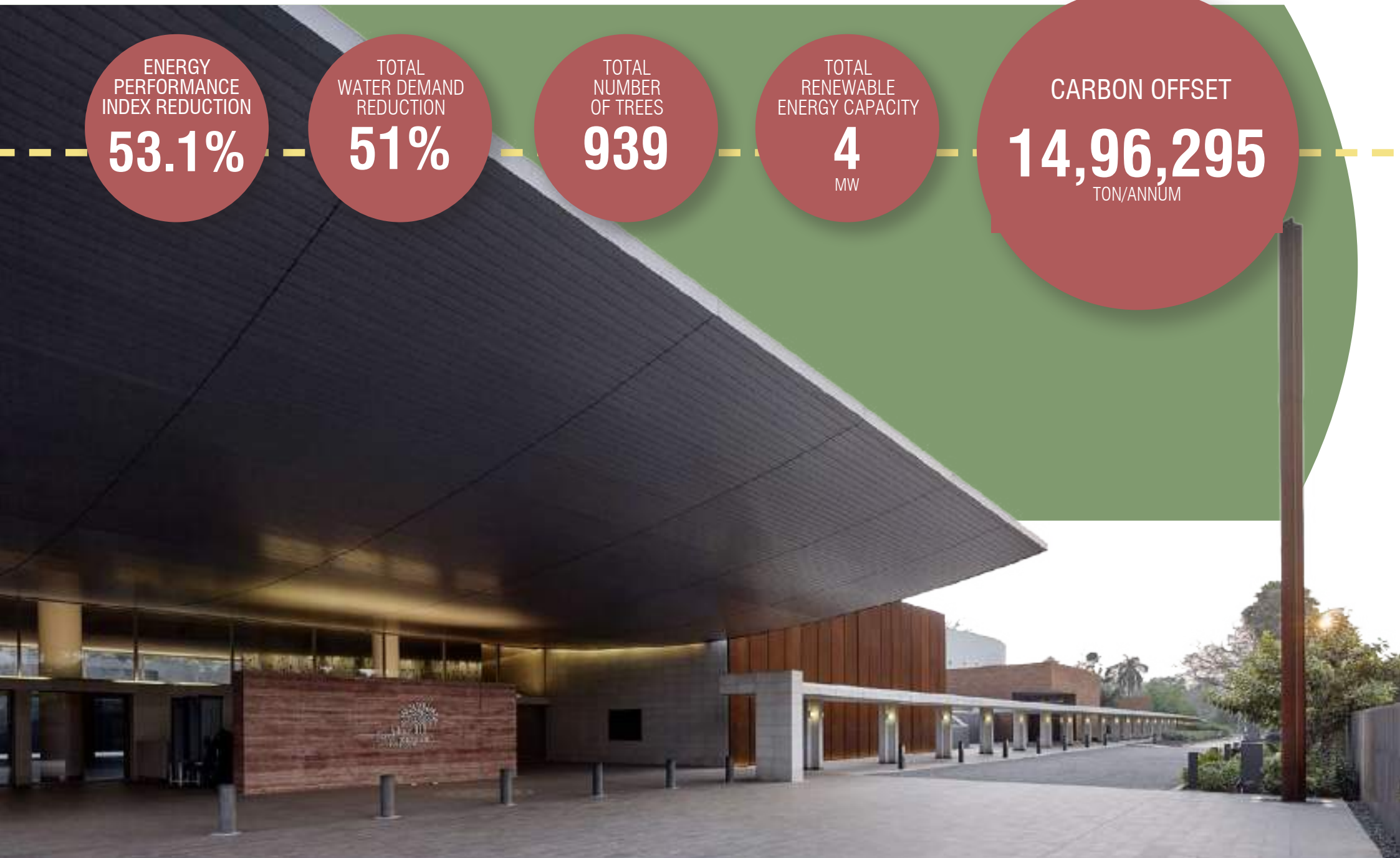
ENERGY PERFORMANCE INDEX REDUCTION
53.1%

TOTAL WATER DEMAND REDUCTION
51%

TOTAL NUMBER OF TREES
939

TOTAL RENEWABLE ENERGY CAPACITY
4
MW

CARBON OFFSET
14,96,295
TON/ANNUM



STRATEGIC SITE PLANNING

Exisiting 165 mature trees preserved & new native trees planted at site is **774**

Site hardscaped surface laid with high SRI-coated and pervious pavers covering **67%**

Hard paving was reduced at site with integrated landscape clusters to reduce UHIE

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **54%**

Materials used for door & windows are low energy materials like Aluminium & MS doors with recycled content

Reduction in embodied energy of structural system of the building using flat slab & pre-cast panels is **15%**

Image showing one of the courtyards of the building with walkways & air inlets for ventilation

BUILDING ENVELOPE PERFORMANCE

12%

WindowWall Ratio(WWR) for all buildings

0.21 W/m²K U value

Building envelope using fly ash bricks & optimum insulation.

0.4 SHGC

63 % VLT

1.5 W/m²K U value

DGU unit for glazing in the project, complying to requirements of ECBC 2007

PASSIVE DESIGN STARTEGIES

ORIENTATION

- Building is longitudinally oriented in North-South direction reduces direct solar radiation entering the building

- Multiple courtyards provided to ensure open spaces & provide day light & ventilation to all spaces in the building

FENESTERATION DESIGN

- Windows are located along the north & south façade, & overlooking the courtyards

- Air inlets are provided at strategic locations to facilitate natural air movement inside the building

LANDSCAPE DESIGN

- Extensive green areas have been planned within the courtyards, on the roof & around the building reducing heat gains, maintaining micro climate & reducing noise from roadside

Image showing envelope construction with insulation & flyash brick

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

BMS installed to control air-conditioning & fresh air units at individual spaces

Central waste segregation area with colour coded bins provided in project

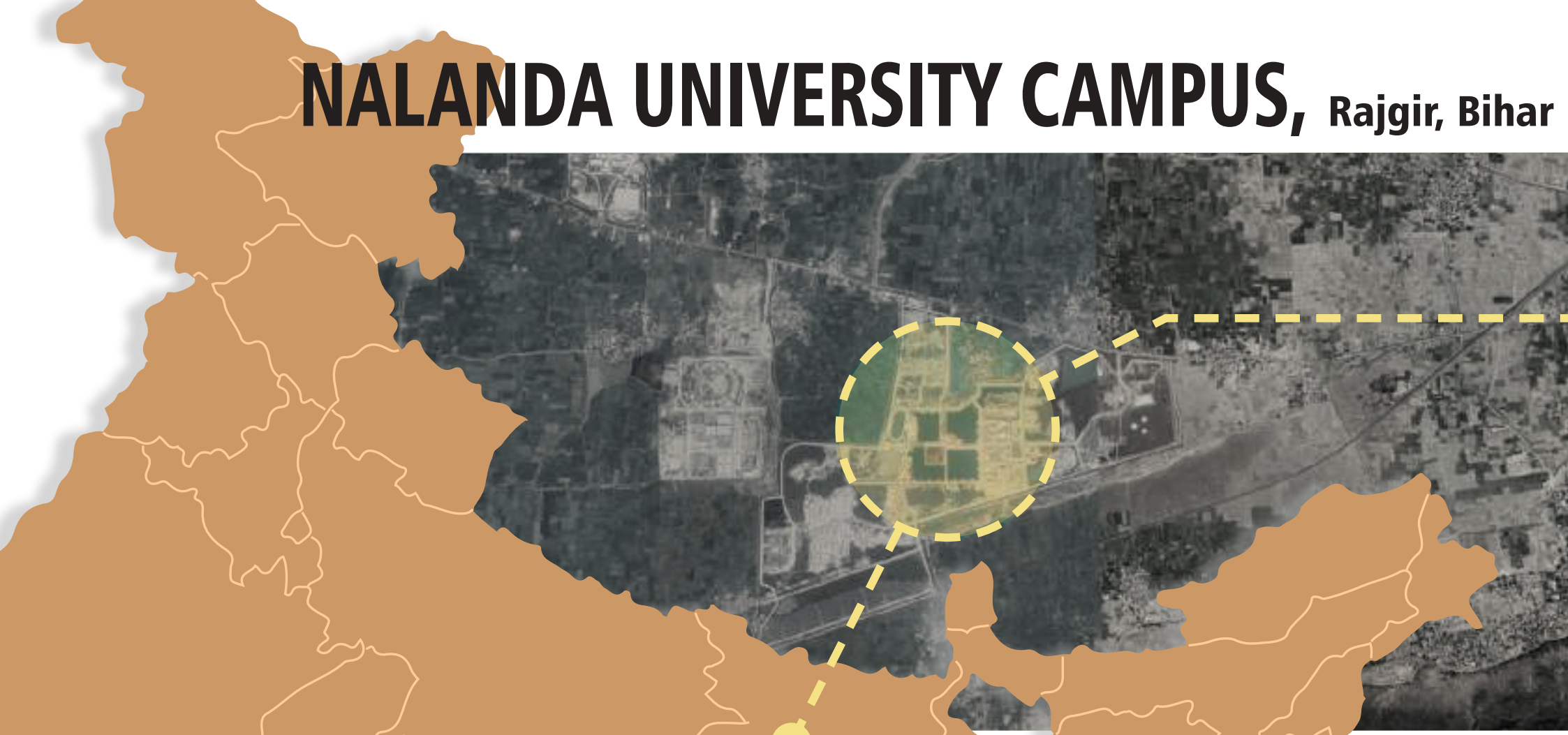
WATER USE OPTIMIZATION

60.5% Reduction in water demand using low flow fixtures for kitchens & toilets

62.5% Reduction in annual landscape irrigation demand by planting native species plants

47% Annual water resuse after treating from MBBR type 930KLD STP on site for flushing & irrigation

NALANDA UNIVERSITY CAMPUS, Rajgir, Bihar



Site Area: **18,41,320 SQM**
Built-up Area: **3,41,000 SQM**
Number of buildings**: 150**
Occupancy**: 11,305**
Client: **NALANDA UNIVERSITY**
Principal Architect: **VASTUSHILPA CONSULTANT**
Green Building Design & Certification: **GREENTREE BUILDING ENERGY PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
INSTITUTIONAL

RATING
GRIHA LD
MASTER PLAN

★ ★ ★ ★ ★

STRATEGIC SITE PLANNING

Project retains the existing site contours & slopes, existing natural water bodies, & dense tree clusters for more than 75% of site area

390 exisiting mature trees preserved & New trees planted at site are **3000**

Hard paving was reduced at site with integrated landscape clusters to reduce UHIE

ENERGY-EFFICIENT DESIGN

Compressed Stabilised Earth Blocks used for walling made from soil excavated at site reducing embodied energy of structure

Plastic waste generated is used to construct roads at site reducing use of cement by **5%**

Recycled concrete & hollow bricks are used to construct & reduce dependence on natural materials

Storm runoff management plan with seasonal water bodies at site

STRATEGIES FOR ACHIECING NET ZERO ENERGY & CARBON

ENERGY

- Energy consumption reduced using incorporative passive building design to maintain favorable microclimate, daylighting. Further Descant Evaporative (DEVAP) cooling technology used to achieve energy reduction

- 2.2 MWp Combined heat & power(CHP) engine proposed by use of biofuel, generated from waste in surrounding farms, to provide energy for the building operations

- Integrated with solar renewable power to facilitate clean energy & achieve net zero

CARBON

- Vehicular access is restricted &entire site perimeter is accessible by cycling or walking, combined with proper footpath & cycling network

- Electrical vehicles used for transport within site

STRATEGIES FOR ACHIECING NET ZERO WASTE & WATER

WASTE

- Construction waste is reduced by reutilizing all excavated mud at site for walling and filling

- Organic and agricultural waste used in bio-gas plants

- Sludge from bio-gas plant to be used as manure for landscaping

- Recyclable and E- waste to be given for recycling plants and recycled materials to be bought back for site use

WATER

- Rainwater capture and harvesting using traditional Ahar- Pyne catchment system, to be reused after appropriate treatment

- Strict monitoring of water use to avoid wastage and assuring reduced demand

Plan shocasing the electric vehicle operated network in the project

LIFESTYLE & INNOVATION

100% Organic waste treated at site with organic waste composter of 700kg/ day capacity

Electric charging facility for 90 cars & 60 bikes has been provided within the campus

Dedicated walking, cycling tracks & bicycle parking provided along all roads

WATER USE OPTIMIZATION

All fixtures throughout campus are low flow fixtures to reduce water demand & usage

Metering & sub-metering of all water usage considered on BMS for continuous monitoring & auditing

100% Self sufficient water campus with water harvesting management system & reuse of grey water after treatment by DEWATS of 235kld capacity

AIRPORT TERMINAL BUILDING, Chandigarh

Site Area: **1,38,562 SQM**
Built-up Area: **4,24,362 SQM**
Year of completion: **2015**
Client: **AIRPORTS AUTHORITY OF INDIA**
Principal Architect: **SIKKA ASSOCIATES ARCHITECTS**
Landscape Architect**: DESIGN CELL**
Project Management Consultant: **L & T CONSTRUCTION**
Structural Consultant: **MEHRO CONSULTANTS**
Green Building Design & Certification: **PREFACT ENVIRO SOLUTION PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
58%

TOTAL WATER DEMAND REDUCTION
50%

TOTAL NUMBER OF TREES
1410

TOTAL RENEWABLE ENERGY CAPACITY
5
MW

CARBON OFFSET
3,89,734
TON/ANNUM

STRATEGIC SITE PLANNING

Services have been aggregated & planned along the transport corridor for optimized laying

Automatic timer based lighting controls installed for all outdoor lighting in the project

Number of new native trees planted in all aound the site is 1410

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of 67%

Fly ash content by weight AAC blocks used in walling to reduce embodied energy

Materials used in the building interiors for internal partitions, false cieling & built furniture are low environment impact materials

Rendered image of the layout of the master plan of the chandigarh aiport

BUILDING ENVELOPE DESIGN TO REDUCE HEAT GAIN

58%
WindowWall Ratio(WWR) for all buildings

0.074Btu/hr/sq.ft. U value
Building envelope double wall with an air gap
A double wall with an air gap

0.2 SHGC
30% VLT
0.32Btu/hr/sq.ft. U value
DGU unit for glazing in the project, complying to requirements of ECBC 2007

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

ORIENTATION

- The building is oriented in the northeast &southwest direction

- North & south walls have curtain walls which draws natural light deep inside the building reducing dependence on artificial light

- East & west façade have a solid wall to curtail solar heat gain from those directions, therefore reducing cooling load

FENESTERATION DESIGN

- Windows are located along the northeast & southwest façade with adequate provision of shading to prevent heat gain

- Building entrance positioned in a way that users will be sheltered from the direct impacts of local site & climatic conditions of wind &solar radiation

-A large overhang is provided for shading of the windows ensuring lower heat gain from envelope, while permitting daylighting

A close up image of the front facade of building showing the deep overhang in the project shading the façade

LIFESTYLE & INNOVATION

Relative humidity, CO2 & temperature sensors are installed at all AHU levels for monitoring

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Designated seggregation areas & multicolour bins provided for waste in project

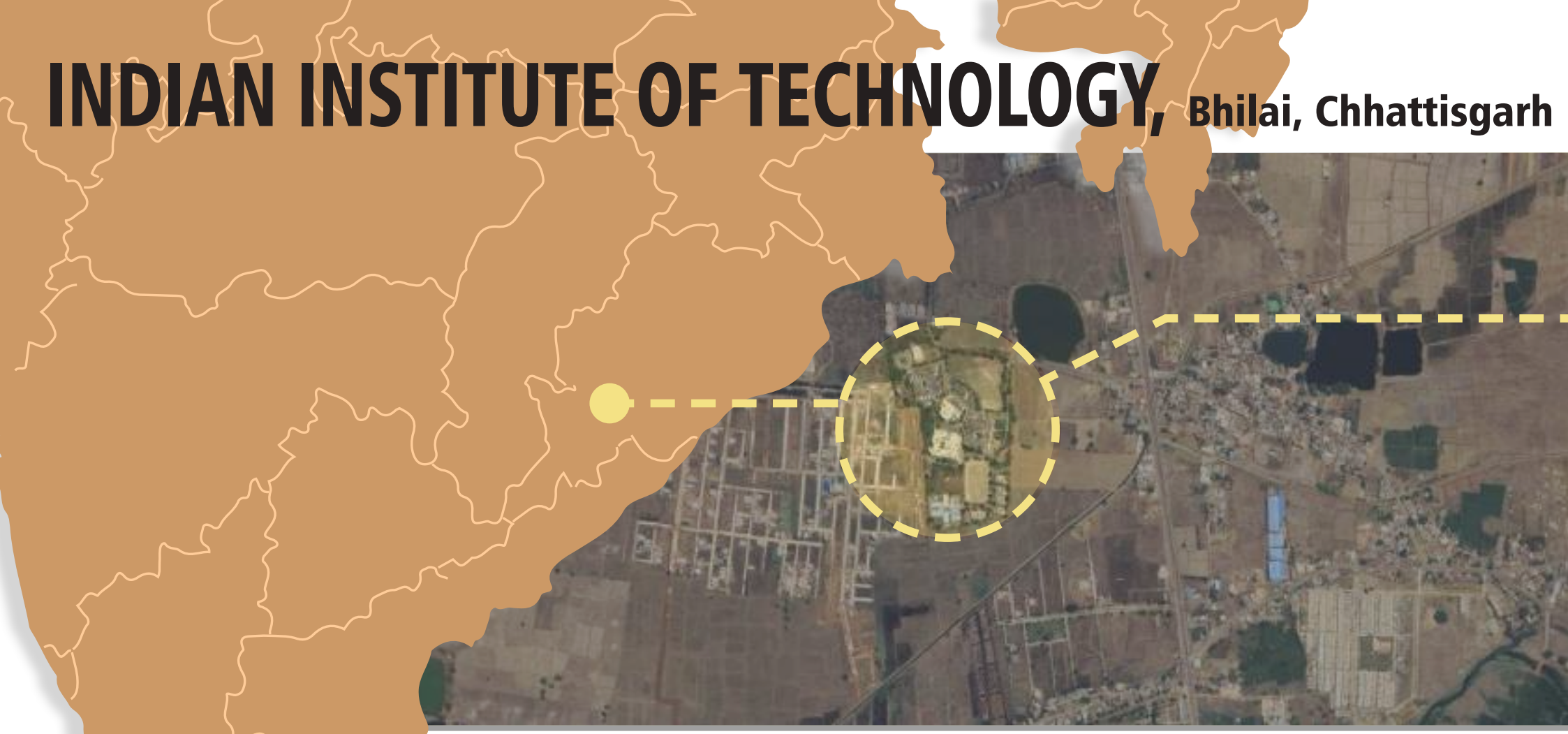
WATER USE OPTIMIZATION

67% Reduction in water demand using low flow fixtures for kitchens & toilets

39% Reduction in annual landscape irrigation demand by planting native species plants

50% Annual water resuse on site after treating from extended aeration technology of 930KLD STP for flushing & irrigation

INDIAN INSTITUTE OF TECHNOLOGY, Bhilai, Chhattisgarh



Site Area: **13,99,300 SQM**
Built-up Area: **8,70,975 SQM**
Number of buildings: **105**
Occupancy**: 19,011**
Client: **INDIAN INSTITUTE OF TECHNOLOGY**
Principal Architect: **KANVINDE RAI & CHOWDHURY**
Landscape Architect: **SJA CONSULTANTS**
Green Building Design & Certification: **THE ENERGY & RESOURCE INSTITUTE**

CLIMATE
WARM & HUMID

TYPE
INSTITUTIONAL

RATING
GRIHA LD

★ ★ ★ ★ ★

STRATEGIC SITE PLANNING

Reduction in landscape water demand using Microdrip & microspray irrigation is **75.12%**

45% of exisiting tree cover was reatined and number of new trees planted at site is **4533**

23.80 square meters of green space per capita, enhancing environmental quality

ENERGY-EFFICIENT DESIGN

Reduction in embodied energy of non srtuctural application using flyash bricks is **32%**

Reduction of energy consumption in the project by design optimization is **75.12%**

Reduction in cement usage through the incorporation of fly ash and Ground Granulated Blast Furnace Slag (GGBS) in structural applications is **25%**

Storm runoff management plan with seasonal water bodies at site

BUILDING ENVELOPE DESIGN TO REDUCE HEAT GAIN

FENESTERATION DESIGN

- Appropriate fenestration on south & east faces to minimize the direct ingress of sunlight

- Vertical fenestration are provided on west faces.

- Light shelves integrated in window design for natural light penetration into the hostel rooms

- Adequate punctures in the façade are provided to permit cross ventilation through courtyards

REDUCING HEAT GAIN

- Insulated roof finished with china mosaic for reflection of 70% incident sunlight

- Optimization of building envelope by using insulated cavity walls, insulated roofs and high performance insulated glass for reduction of heat gain

- Optimization of window wall ratio to balance between daylight and heat gain

- Appropriate external shading devices and large overhangs to reduce radiation and external heat gain

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

ORIENTATION

- Orientation of the building blocks is predominantly North South. Optimal Building orientation with rooms avoided on west side

- The architectural design is optimized as per climate & sun-path analysis

- Width of buildings kept optimal to provide natural light in majority of the work areas &allowing air movement

- Provision of internal courtyards to provide natural lighting to inner core &create shaded spaces for interaction

CIRCULATION & SERVICES

- Covered walkways at two levels linking the various Departments & Lecture Halls/ Library/ around the water body in the Academic Zone are integrated in the design as active movement paths fostering interaction outside of the enclosed spaces

- Services are also laid combined with these walkways to create efficient construction

Sketch showing section through the connecting bridges at site with clubbed services also runing along pathways

LIFESTYLE & INNOVATION

10% Landscape area is dedicated for food production for consumption in project

BMS system installed for real time monitoring & demand side management

Dedicated walking, cycling tracks & bicycle parking with benches provided along all roads

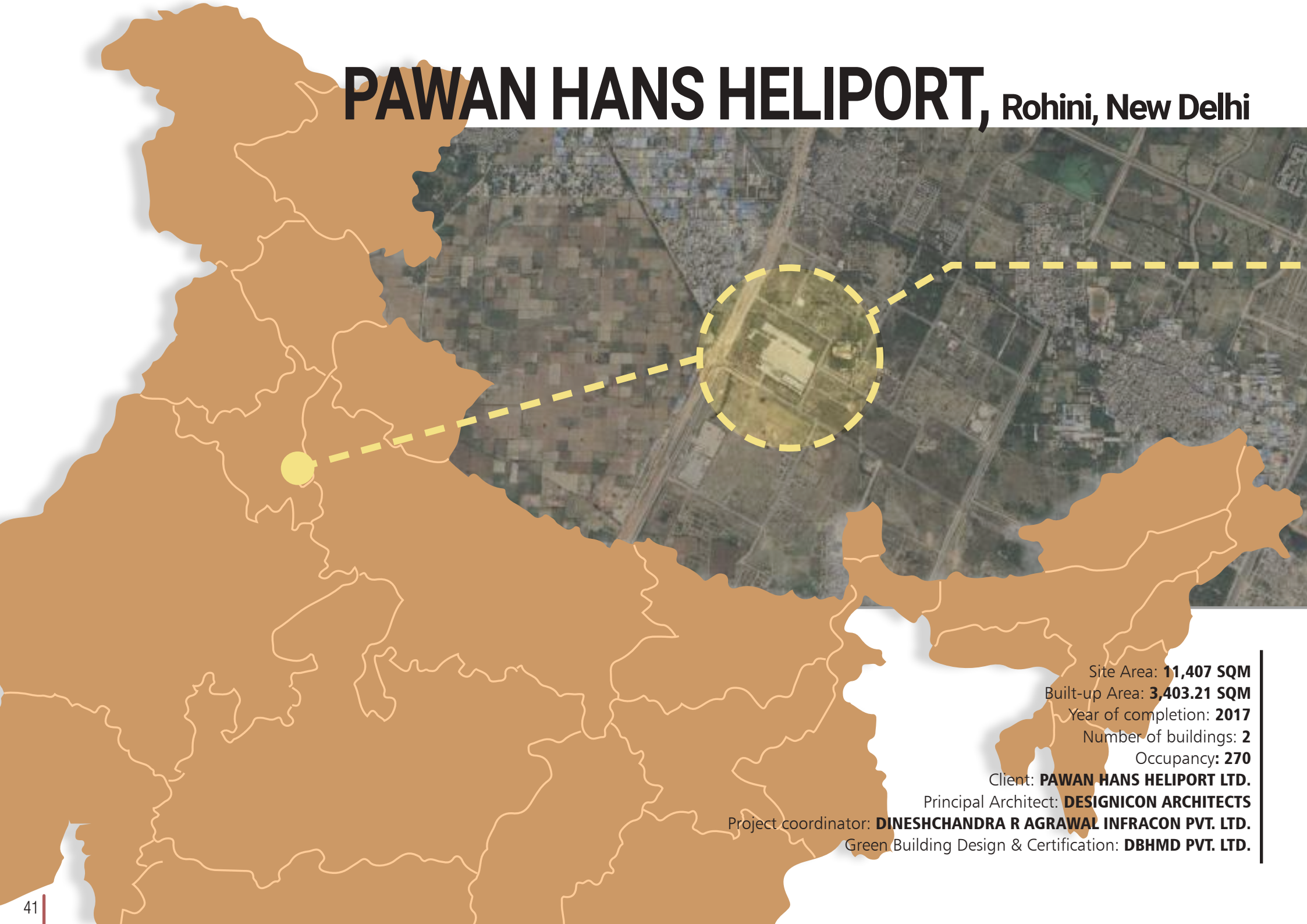
WATER USE OPTIMIZATION

59.4% Reduction in water demand using low flow fixtures for kitchen & toilets

Harvesting of surface rainwater runoff at site to recharge aquifers via seasonal water bodies

84.22% Annual water resuse after treating from MBBR 270OKLD STP for flushing & irrigation on site

PAWAN HANS HELIPORT, Rohini, New Delhi



Site Area: **11,407 SQM**
Built-up Area: **3,403.21 SQM**
Year of completion: **2017**
Number of buildings: **2**
Occupancy**: 270**
Client: **PAWAN HANS HELIPORT LTD.**
Principal Architect: **DESIGNICON ARCHITECTS**
Project coordinator: **DINESHCHANDRA R AGRAWAL INFRACON PVT. LTD.**
Green Building Design & Certification: **DBHMD PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
63.2%

TOTAL WATER DEMAND REDUCTION
44.3%

TOTAL NUMBER OF TREES
657

TOTAL RENEWABLE ENERGY CAPACITY
5
kW

CARBON OFFSET
3,92,279.16

STRATEGIC SITE PLANNING

Offset in energy consumption in landscaping lighting using photovoltaics is **11.5%**

Automatic timer based lighting controls installed for all outdoor lighting in the project

Number of new trees planted of native species at site is **657**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **77.5%**

Embodied energy reduced by using AAC blocks with fly ash content by weight of **65%**

Materials used in the building interiors are low environment impact materials like flush doors, aluminum window frames & vitrified tiles with recycyled content

Image showing the large overhangs for shading of building facade & entrance

BUILDING ENVELOPE DESIGN TO REDUCE HEAT GAIN

34%
Window Wall Ratio(WWR) for all buildings

0.6W/m2K U value
Building envelope using fly ash bricks with Granite & ACP cladding.

0.24 SHGC
47% VLT
1.7W/m2K U value
DGU unit for glazing in the project, complying to requirements of ECBC 2007

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

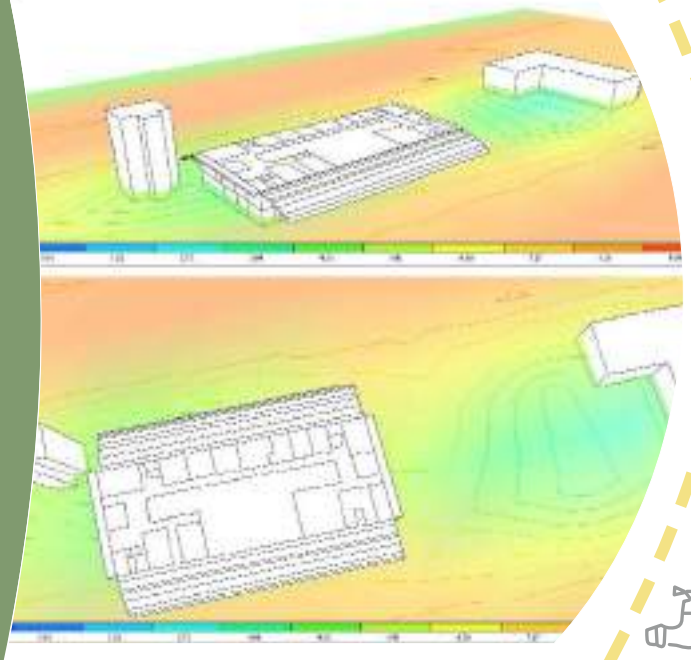
- Air conditioned areas like Clubhouse are north-south elongated to reduce direct heat gain

- High performance glass, insulated roof & bricks for walls in facade to reduce energy load for cooling

- Curated shading devices are provided for habitable & air conditioned spaces to reduce direct heat gain & energy load for cooling

- Day lighting ensured in all habitable areas to reduce demand for artificial lighting

-Building blocks placed at site to reduce wind trap in between blocks and verified using CFD simulation before construction to ensure windflow.



CFD analysis showcasing no wind trap generated between blocks

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Designated seggregation areas & multicolour bins provided for waste in project

Dedicated charging points and parking provided for electric vehicles

WATER USE OPTIMIZATION

54.8% Reduced water demand by using low flow fixtures for kitchens & toilets

Four rainwater harvesting pits provided along with de-silting chambers provided in the project

30% Reduction in annual landscape water demand by providing efficient sprinkler & drip irrigation system

PUNJAB NATIONAL BANK HQ, Dwarka, New Delhi

Site Area: **19,470 SQM**
Built-up Area: **76,188 SQM**
Occupancy: **1550**
Client : **PUNJAB NATIONAL BANK**
Principal Architect: **RKA ASSOCIATES**
Interior contractor: **GODREJ INTERIO**
Landscape Architect: **INTEGRAL DESIGNS**
Project Management Consultant: **CENTRAL PUBLIC WORKS DEPARTMENT (CPWD)**
Civil & structural contractor: **ACIL(AHLUWALIA CONTRACTORS INDIA LTD**
Green Building Design & Certification: **ENVIRONMENT DESIGN SOLUTIONS**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

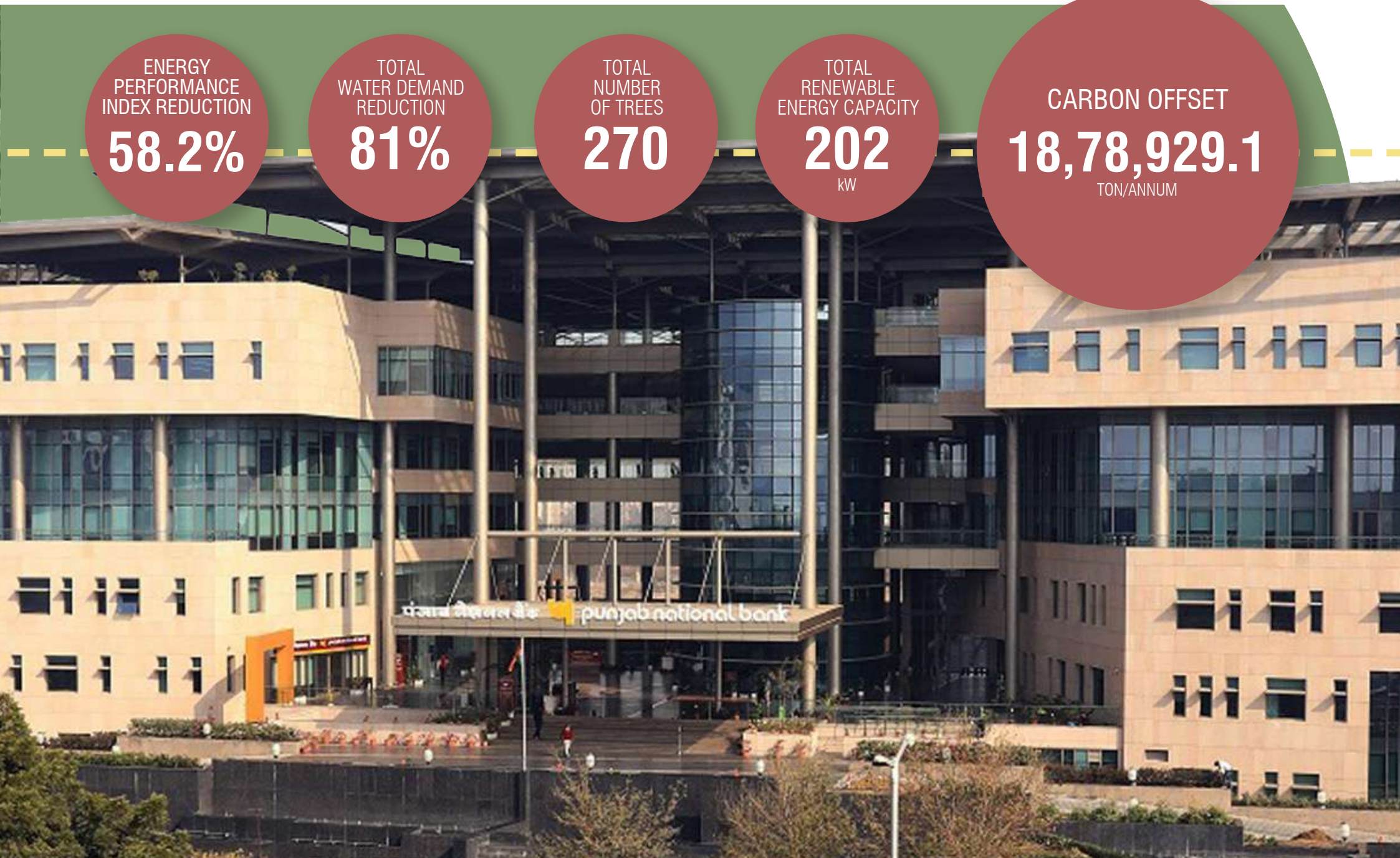
ENERGY PERFORMANCE INDEX REDUCTION
58.2%

TOTAL WATER DEMAND REDUCTION
81%

TOTAL NUMBER OF TREES
270

TOTAL RENEWABLE ENERGY CAPACITY
202
kW

CARBON OFFSET
18,78,929.1
TON/ANNUM



STRATEGIC SITE PLANNING

1,560 cubic meters of excavated topsoil was preserved during construction and reused for site landscaping

Reduction in landscape water demand using drip irrigation is 79%

Number of new trees planted of native species at site is 269

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of 76%

Embodied energy reduced by using AAC blocks with fly ash content by weight of 55%

Materials used in the building interiors are low environment impact materials like compressed wood, veneer wall paneling & gypsym partitions

Image showing the central courtyard in the building with opening &daylight access to ear level

OPTIMIZATION OF BUILDING ENVELOPE PERFORMANCE

FENESTERATION DESIGN

- The windows have been provided on all façade with the vision glazing of 3200 mm
- All the windows in the facades are recessed with overhangs, which make them completely shaded, cutting direct heat gain and glare on the south-west and south-east envelope
- The effective SHGC is 0.25 which will help in reducing the heat gain inside the building

CENTRAL ATRIUM

- The atrium is experienced at different levels with the entrance, corporate floor, upper-level bridges and terraces
- Light is admitted into the atrium from the sides and by some sky lit panels within the metal roof from the top. Metal screen patterns from the roof create a very interesting interplay of light while shading the space from direct heat gain
- The Central atrium is non-airconditioned, thermal comfort is maintained by designing for ventilation & air movement by leveraging venturi effect

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

ORIENTATION

- The design has been developed as a compact squarish plan-oriented along north-east & south-west directions

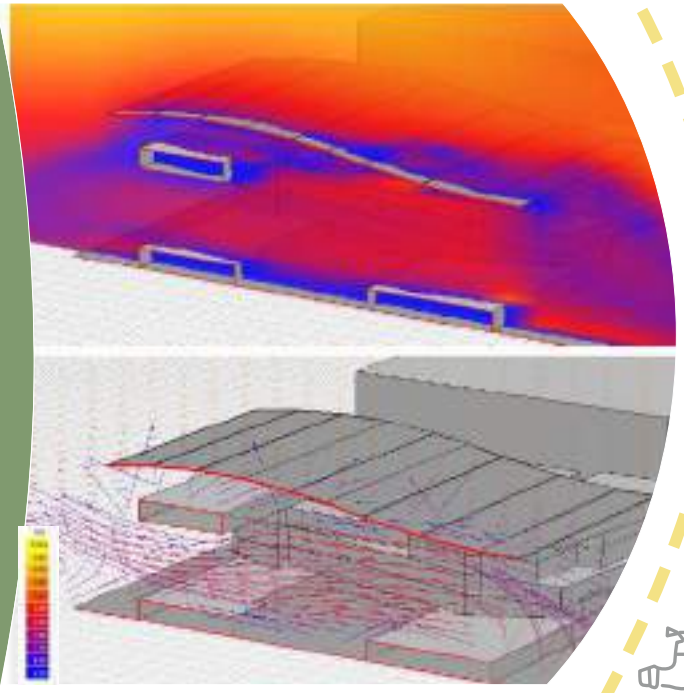
- Planned according to the wind direction. This allows the design of site layout for wind protection & solar access in winter at the same time adequate sun protection & ventilation in summer

- The compact footprint also allows to have more of open green spaces in terms of native vegetation. Within the site constraint strong emphasis has been laid to develop more of open & vegetative spaces either in form of plantation or grass pavers

CIRCULATION & SERVICES

- Entry plaza is located in Southwest &heavily shaded to ensure protection from elements .

- The public plaza in the SW direction with water body & green space helps in cooling the wind entering the building through evaporative cooling



CFD analysis of venturi effect in the courtyard space of the building showcasing the wind movement

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Organic waste treated at site using Automatic composting machine of 125kg/day

32 number of parking dedicated to electric vehicles with charging points

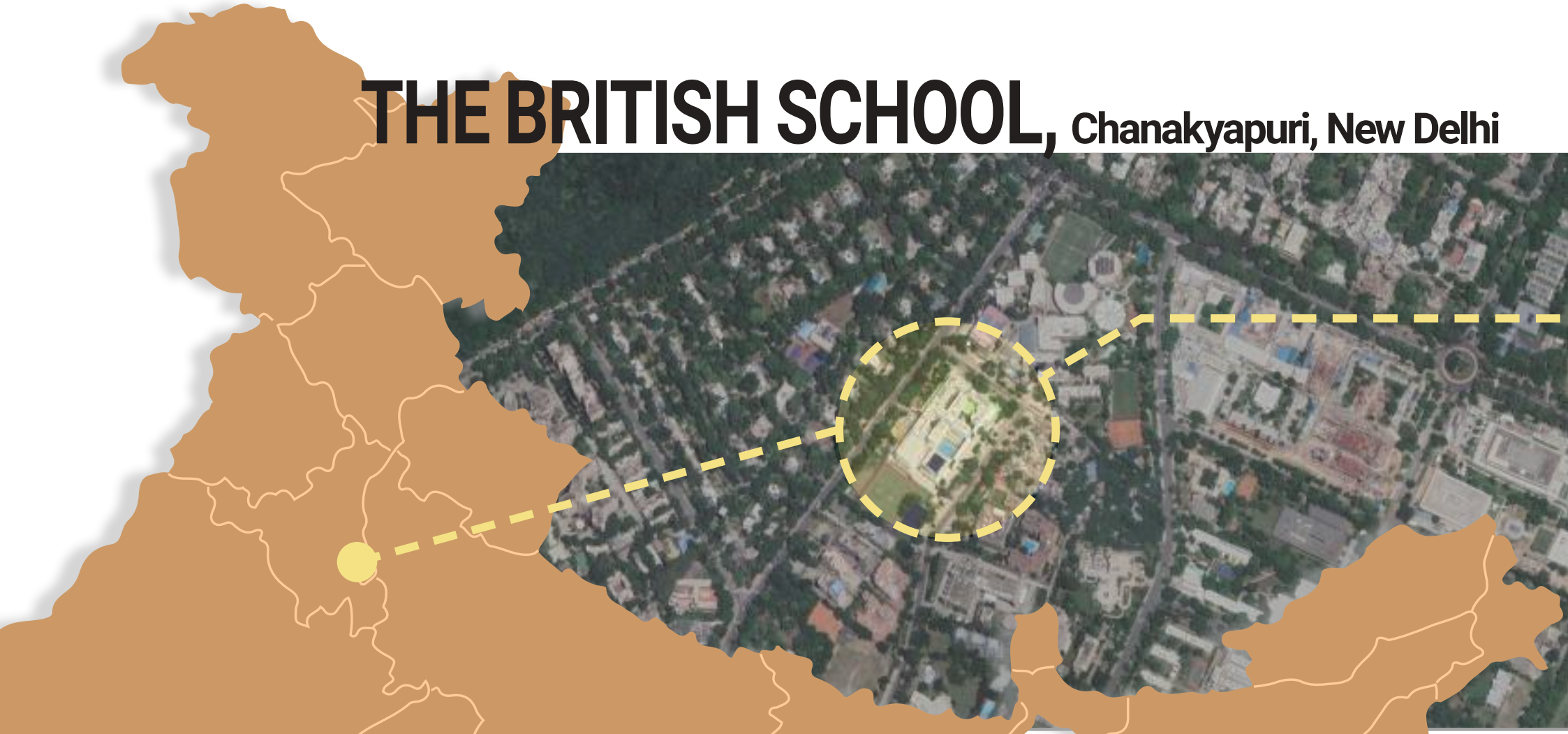
WATER USE OPTIMIZATION

81.1% Reduction in water demand using low flow fixtures for kitchens &toilets.

Collection of surface rainwater run-off for recharging water table using rain water harvesting pit at site

93.9% Annual water resuse after treating from MBBR 25KLD STP for flushing & irrigation on site

THE BRITISH SCHOOL, Chanakyapuri, New Delhi



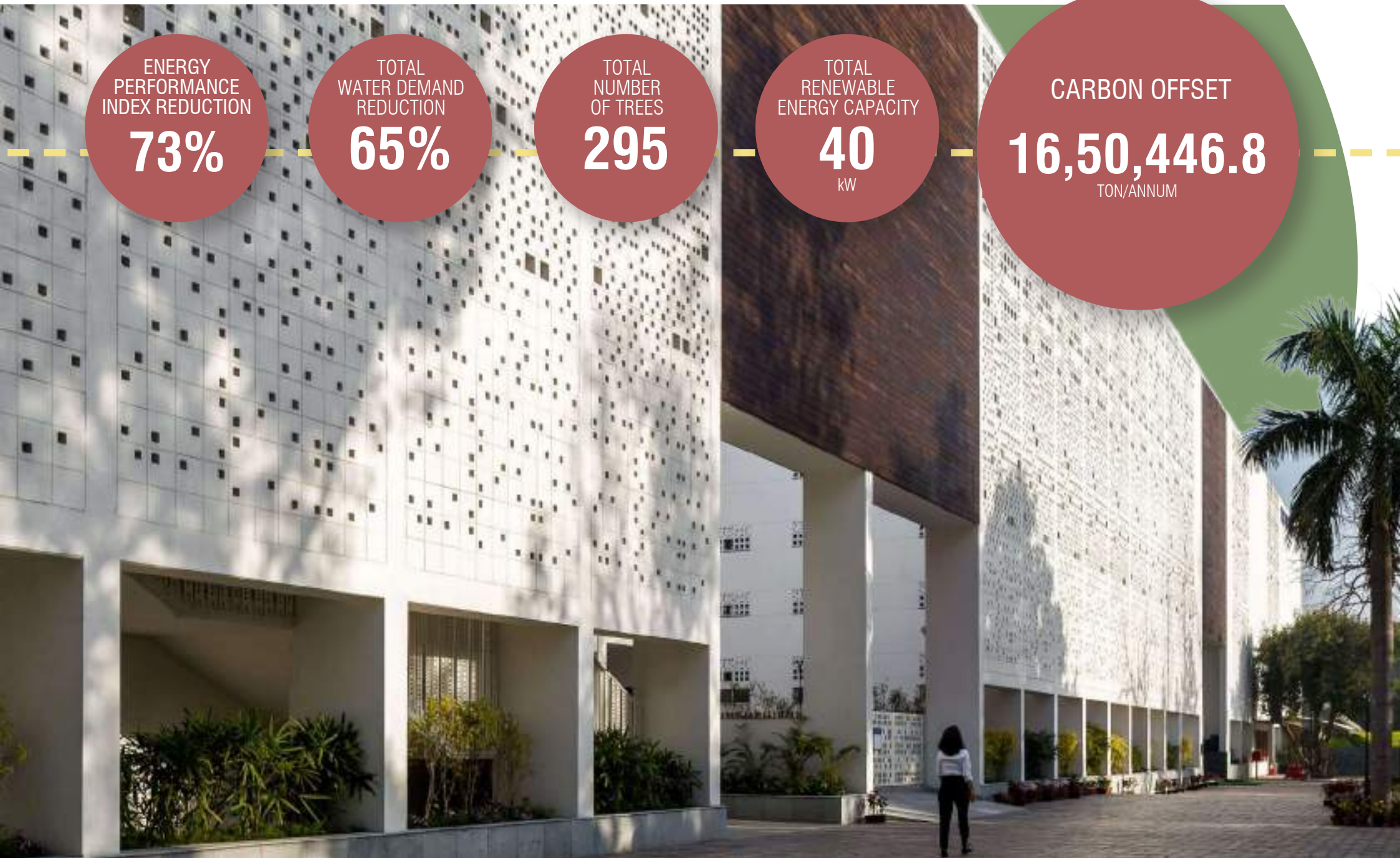
Site Area: **21,521 SQM**
Built-up Area: **52,000 SQM**
Client: **THE BRITISH SCHOOL**
Occupancy: **1653**
Principal Architect: **MORPHOGENESIS**
Landscape Architect: **DESIGN CELL**
Project Management Consultant: **RRA PROJECT MANAGEMENT PVT. LTD.**
Civil &structural contractor: **OPTIMAL CONSULTANCY SERVICES PVT. LTD.**
Green Building Design & Certification: **THE ENERGY &RESOURCE INSTITUTE**

CLIMATE
COMPOSITE

TYPE
INSTITUTIONAL

RATING
GRIHA

★ ★ ★ ★ ★



STRATEGIC SITE PLANNING

Services have been aggregated & planned along the transport corridor for optimized laying

Reduction in landscape water demand using drip irrigation is **56%**

Number of new trees planted of native species were planted at site is **292**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **62%**

Embodied energy reduced by using AAC blocks with fly ash content by weight of **43%**

Low-energy materials such as flush doors and aluminum frames with recycled content were used in the building interiors, covering **92%**

3D view of the building showing courtyards &use of jaali
Source: Morphogenesis

BUILDING ENVELOPE DESIGN TO REDUCE HEAT GAIN

12.5%
Window Wall Ratio(WWR) for all buildings

0.3 W/m²K U value
Building external walls provided with cavities as insulation for better thermal performace

0.5 SHGC
75 % VLT
1.95 W/m²K U value
DGU unit for glazing in the project, complying to requirements of ECBC 2007

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

- Courtyards & corridors act buffer spaces to classrooms to reduce heat gain and provide insulation for maintaing indoor comfort

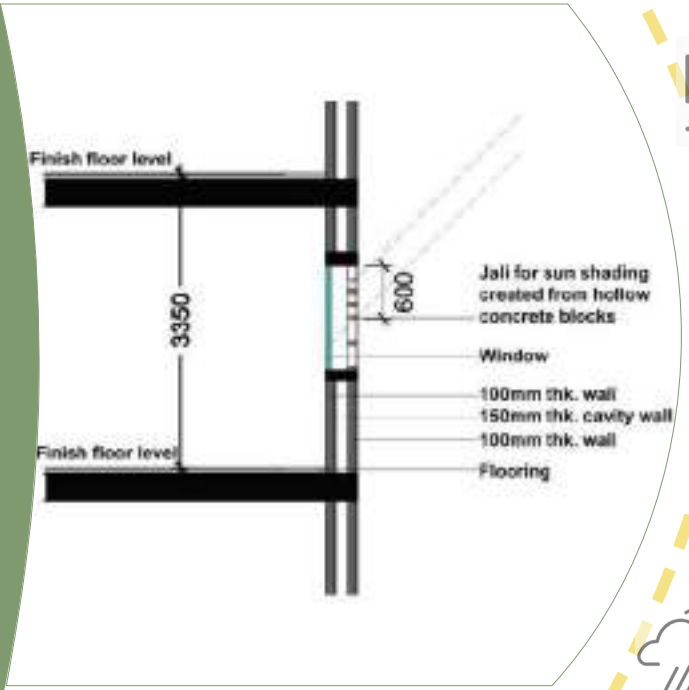
- Spaces not regularly occupied are on top floors of the school which act as thermal buffer to the regularly occupied spaces.

- Hollow concrete block jali provided as shading devices ro reduce direct heat gain as well as air circulation

- All exterior walls provided with cavities for providing better insulation for maintiang indoor environmental qality

- Occupancy sensors to control internal lighting have been installed

- 100% Outdoor lighting has automatic timer based control



Part section showing details of jaali for sun protection in the facade

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Project organizes environmental awareness workshops involving students & nearby residents

Dedicated charging points and parking provided for electric vehicles

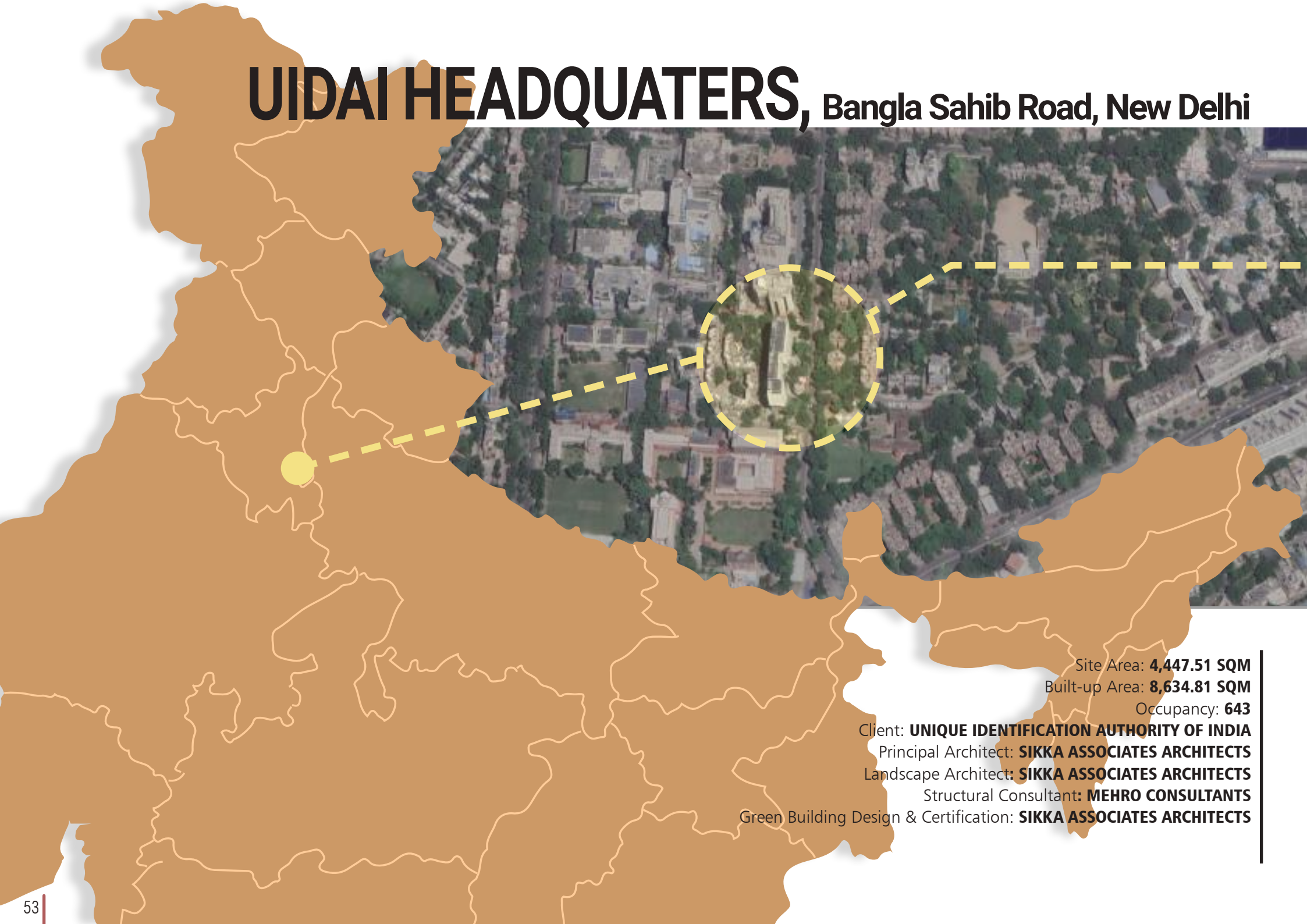
WATER USE OPTIMIZATION

Annual water recharge of 9,235 kL is achieved through five rainwater harvesting pits installed on the site

65% Reduction in water demand using low flow fixtures for kitchens & toilets

46% Annual water resuse on site after treating from MBBR 72.9 KLD STP for flushing & irrigation

UIDAI HEADQUATERS, Bangla Sahib Road, New Delhi



Site Area: **4,447.51 SQM**
Built-up Area: **8,634.81 SQM**
Occupancy: **643**
Client: **UNIQUE IDENTIFICATION AUTHORITY OF INDIA**
Principal Architect: **SIKKA ASSOCIATES ARCHITECTS**
Landscape Architect**: SIKKA ASSOCIATES ARCHITECTS**
Structural Consultant**: MEHRO CONSULTANTS**
Green Building Design & Certification: **SIKKA ASSOCIATES ARCHITECTS**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

(PROVISIONAL)

ENERGY PERFORMANCE INDEX REDUCTION
62.2%

TOTAL WATER DEMAND REDUCTION
52.3%

TOTAL NUMBER OF TREES
638

TOTAL RENEWABLE ENERGY CAPACITY
100
kW

CARBON OFFSET
6,19,051.97
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **51%**

Reduction in annual irrigation demand by using drip irrigation is **40%**

48 exisiting trees preserved & number of new native species were planted is **590**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **75%**

Materials used in the building interiors are low environment impact materials like flush doors with recycled content, teak windows & vitrified tiles reducing embodied energy

Reduction in embodied energy using non structural application of AAC blocks & flyash concrete is **37.8%**

Image showing the solar panels on roof used to provide shade for service oulets & roof, reducing heat gain

BUILDING ENVELOPE DESIGN TO REDUCE HEAT GAIN

22.3%
window wall ratio(WWR) for all buildings

0.24 W/m²K U value
Building external walls provided with heat resistant tiles & efficient insulation

0.23 SHGC
40 % VLT
1.36 W/m2K U value
DGU unit for glazing in the project, complying to requirements of ECBC 2007

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

- Building is longitudinally oriented in North-South direction & consumes 35.74% less energy as per results of PRM (Performance Rating Method)

- 73.05% External wall area has service areas & buffer zones to reduce heat gain in habitable areas

- Maximum buffer areas in west façade of the building as west receives the harshest sun

- The heat gain from the building in design case is 29.21 W/m2 & in base case 45.45 W/m2, indicating the effects of passive design features

- Blinds / curtains are provided to avoid glare in occupied areas in summer months

Image of facade under construction showing the steel framework constructed to reduce RCC structure

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Environmentally friendly cleaning chemical products are being used for housekeeping

Robotic shuttle parking provided to reduce carbon emissions from vehicular movement

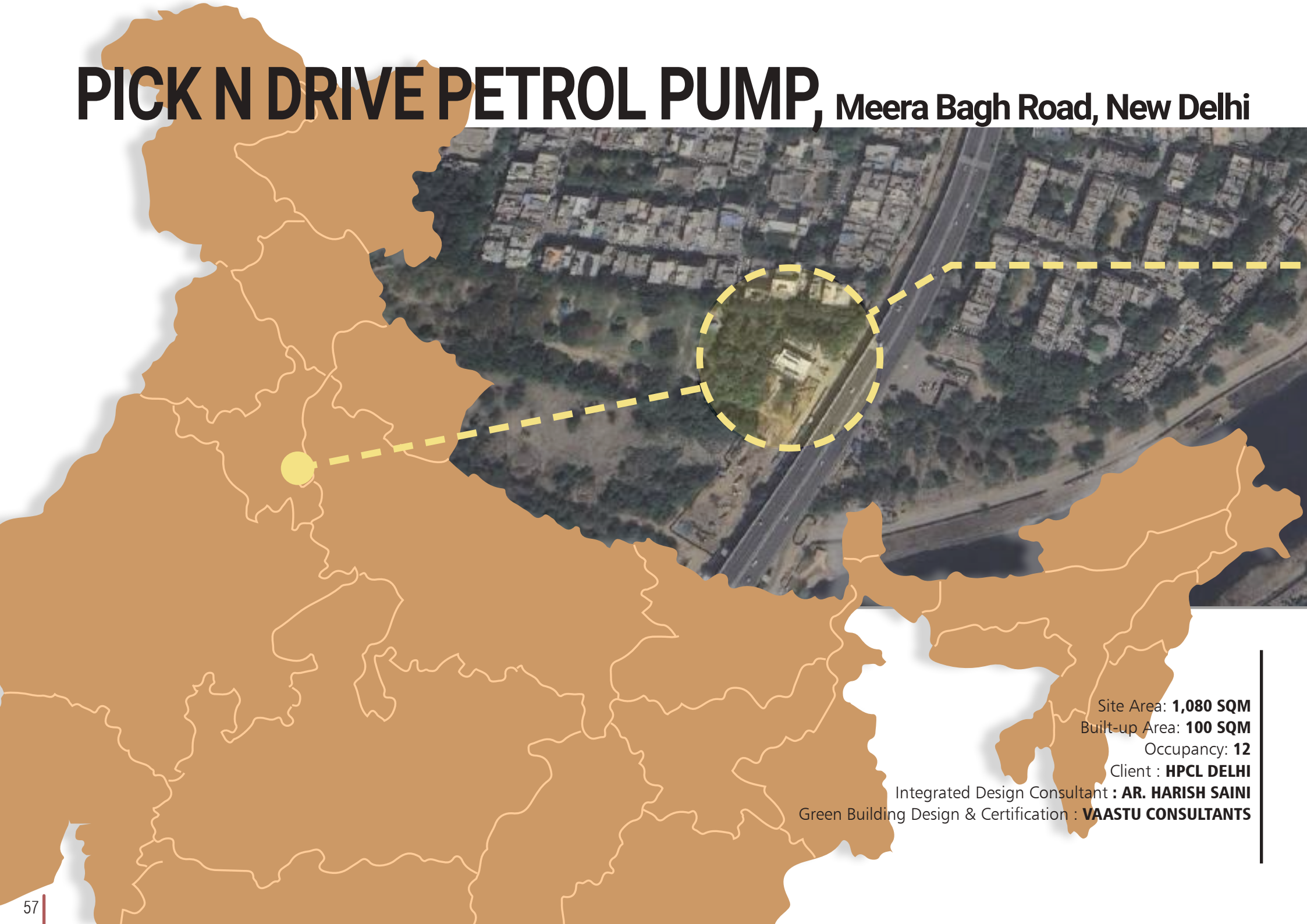
WATER USE OPTIMIZATION

54% Reduction in water demand using low flow fixtures for kitchens & toilets

Collection surface rainwater run-off for recharging water table using rain water harvesting pit

100% Annual water resuse on site after treating from MBBR 25KLD STP for flushing & irrigation

PICK N DRIVE PETROL PUMP, Meera Bagh Road, New Delhi



Site Area: **1,080 SQM**
Built-up Area: **100 SQM**
Occupancy: **12**
Client : **HPCL DELHI**
Integrated Design Consultant **: AR. HARISH SAINI**
Green Building Design & Certification : **VAASTU CONSULTANTS**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
SVAGRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
53%

TOTAL WATER DEMAND REDUCTION
57%

TOTAL NUMBER OF TREES
12

TOTAL RENEWABLE ENERGY CAPACITY
10
kW

CARBON OFFSET
1454
TON/ANNUM

STRATEGIC SITE PLANNING

More than 50% of the external wall surface area had buffer spaces, such as service areas

Number of new native trees have been planted within site boundary are 12

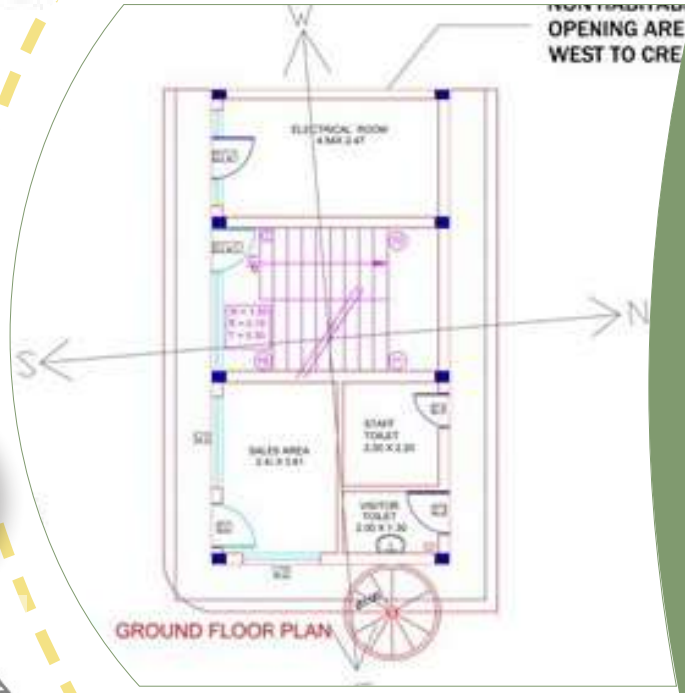
Percentage of total site surface soft paved, shaded by trees is 54%

ENERGY-EFFICIENT DESIGN

LPD of the project is 4.83 W/m2, which is lower than the ECBC specified limit of 10.80 W/m2

Reduction in embodied energy by using PPC for slab and flyash bricks in masonry walls is 55%

Materials used in the building interiors are low environment impact materials like Granite and polished glazed vitrified tiles for flooring



Plan shocasing orientation of the east west alignment of the structure

BUILDING ENVELOPE DESIGN TO REDUCE HEAT GAIN

0.29 SHGC
28 % VLT
3.8 W/m2K U value

Glazing utilized in the project with Tinted film coating with following specification

84% glare reduction
99% UV blocked

Envelope performance fiurther improved with following measures
- use of fly ash bricks
- use of thermal insulation board

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

- Building orientation is along east west axis to reduce heat gain in summer and maximise heat gain in winters

- High SRI paint used in exterior surfaces of the project

- Good Fenestration Design for reducing Direct Heat Gain and Glare while maximising Daylight Penetration.

- Non habitable are provided along the west face of the building to act as thermal mass

- All habitable areas are daylit and meet the day lighting factors prescribed by NBC

Close up image of facade of building showcasing use of tinted relective film on glass and shading in glazing

LIFESTYLE & INNOVATION

Essential amenities—including a grocery store, ATM, park, and pharmacy—are located close to the site, reducing dependence on transportation

Dedicated charging points and parking provided for electric vehicles

Environmental awareness signage's have been displayed at multiple locations

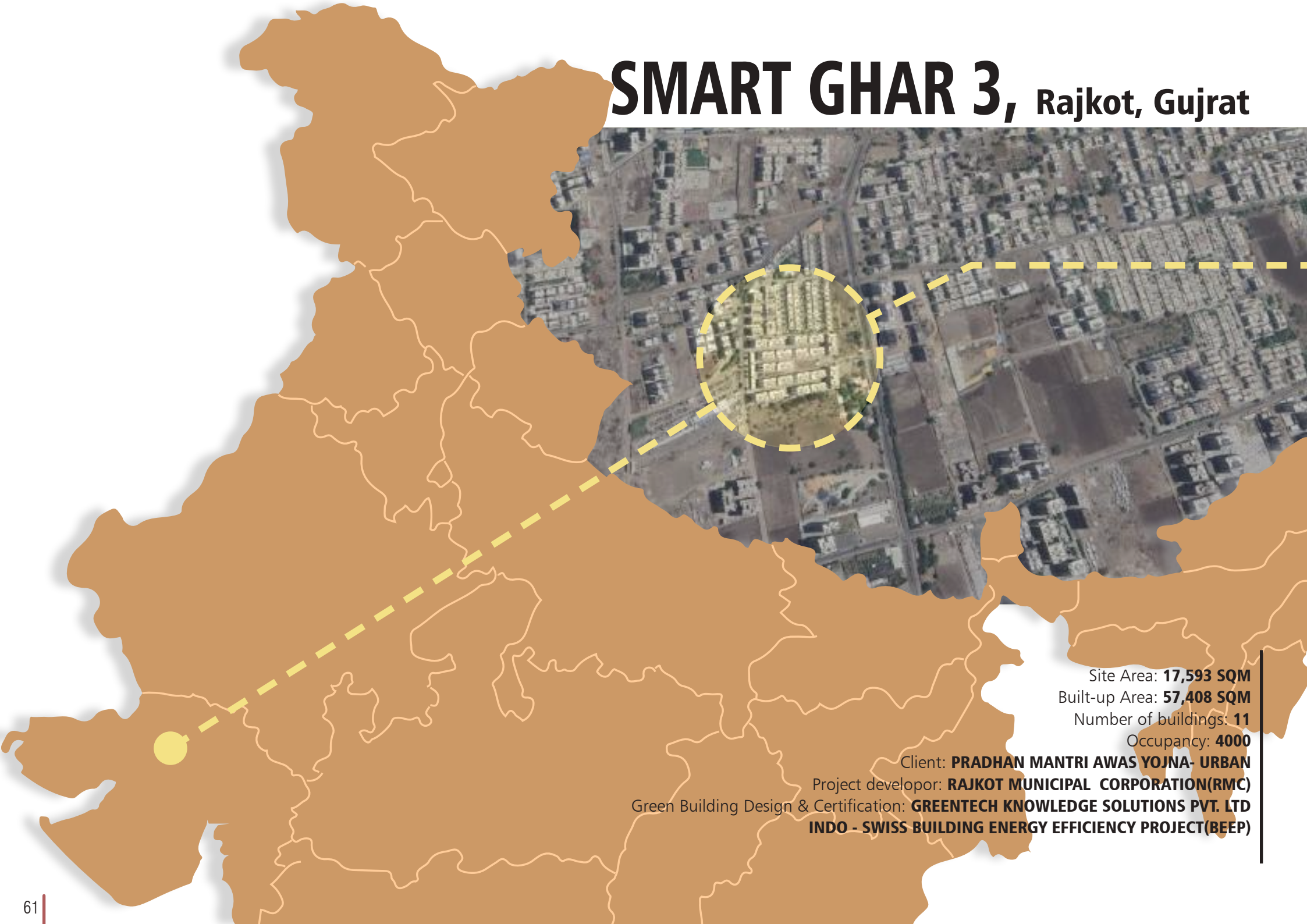
WATER USE OPTIMIZATION

57% Reduction in water demand using low flow fixtures for kitchens & toilets

Rainwater storage tank of 1,200 litres capacity has been constructed on site for reuse after treatment

94.5% Reduction has been demonstrated in landscape water demand by using native trees

SMART GHAR 3, Rajkot, Gujrat



Site Area: **17,593 SQM**
Built-up Area: **57,408 SQM**
Number of buildings: **11**
Occupancy: **4000**
Client: **PRADHAN MANTRI AWAS YOJNA- URBAN**
Project developor: **RAJKOT MUNICIPAL CORPORATION(RMC)**
Green Building Design & Certification: **GREENTECH KNOWLEDGE SOLUTIONS PVT. LTD**
INDO - SWISS BUILDING ENERGY EFFICIENCY PROJECT(BEEP)

CLIMATE
HOT & DRY

TYPE
RESIDENTIAL

RATING
GRIHA AH

★ ★

ENERGY PERFORMANCE INDEX REDUCTION
34%

TOTAL WATER DEMAND REDUCTION
53.2%

TOTAL NUMBER OF TREES
764

TOTAL RENEWABLE ENERGY CAPACITY
65
kW

CARBON OFFSET
14,71,924
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **50%**

A dedicated space for an informal market is planned within the site boundary to serve residents' needs

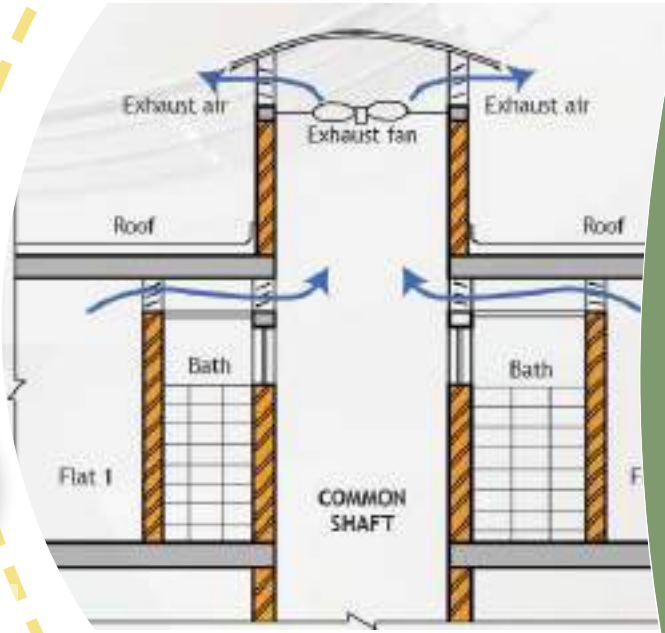
Number of new native trees have been planted at site is **764**

ENERGY-EFFICIENT DESIGN

Astronomical timer installed for all outdoor lighting in the project to reduce electric consumption

Light-colored paints were applied to the façade to minimize heat gain through the walls

AAC blocks containing 65% fly ash by volume were used for wall construction reducing embodied energy of project



Conceptual sketch showing assissted ventialtion using exisiting service shaft

OPTIMIZATION OF FENESTRATION DESIGN & VENTILATION

FENESTRATION

- Taller, partially glazed casement windows are used to enhance natural ventilation, offering up to 90% openability. The window shutters are two-thirds opaque to limit heat gain, while the one-third glazing ensures ample daylight

VENTILATION

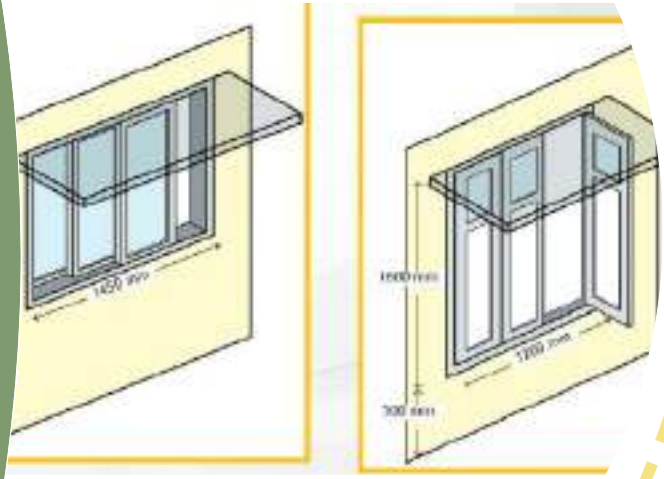
- Provision has been made to ensure adequate ventilation (air change rate: 10) through all flats, by using the existing service shaft between two flats. This assisted ventilation concept will have a roof feature and a fan on top of the shaft, which will create negative pressure in the shaft (with / without ambient wind) improving air-change through the flats

OPTIMIZATION OF BUILDING ENVELOPE PERFORMANCE

- The walls are constructed of 230 mm AAC blocks1, which has a U-value of 0.8 W/m2.K. This is lower than the U-value of 230 mm burnt clay brick wall (U-value 2 W/m2.K), thus allowing less conduction heat gains through the wall. Walls on the southern side are cavity walls, constructed of 230 mm AAC blocks on both sides of an air cavity of 50 mm (U-value 0.3 W/m2.K).

- The roof will have external insulation (40 mm polyurethane foam) which reduces the U-value of the roof from 2.7 W/m2.K to 0.56 W/m2.K. The roof will also have high-reflective china mosaic finish.

- By adopting the energy efficiency measures it is estimated to reduce peak summer room temperature by >5°C, as well as increase the number of comfortable hours (those below 30°C) from ~2600 hours to ~6300 hours.



Sketch showing optimum fenesteration design utilized in the project

LIFESTYLE & INNOVATION

50.4% Reduction in carbon footprint of building occupants by close proximity of all services

Mural depicting culture of Rajkot painted around entrance for awareness

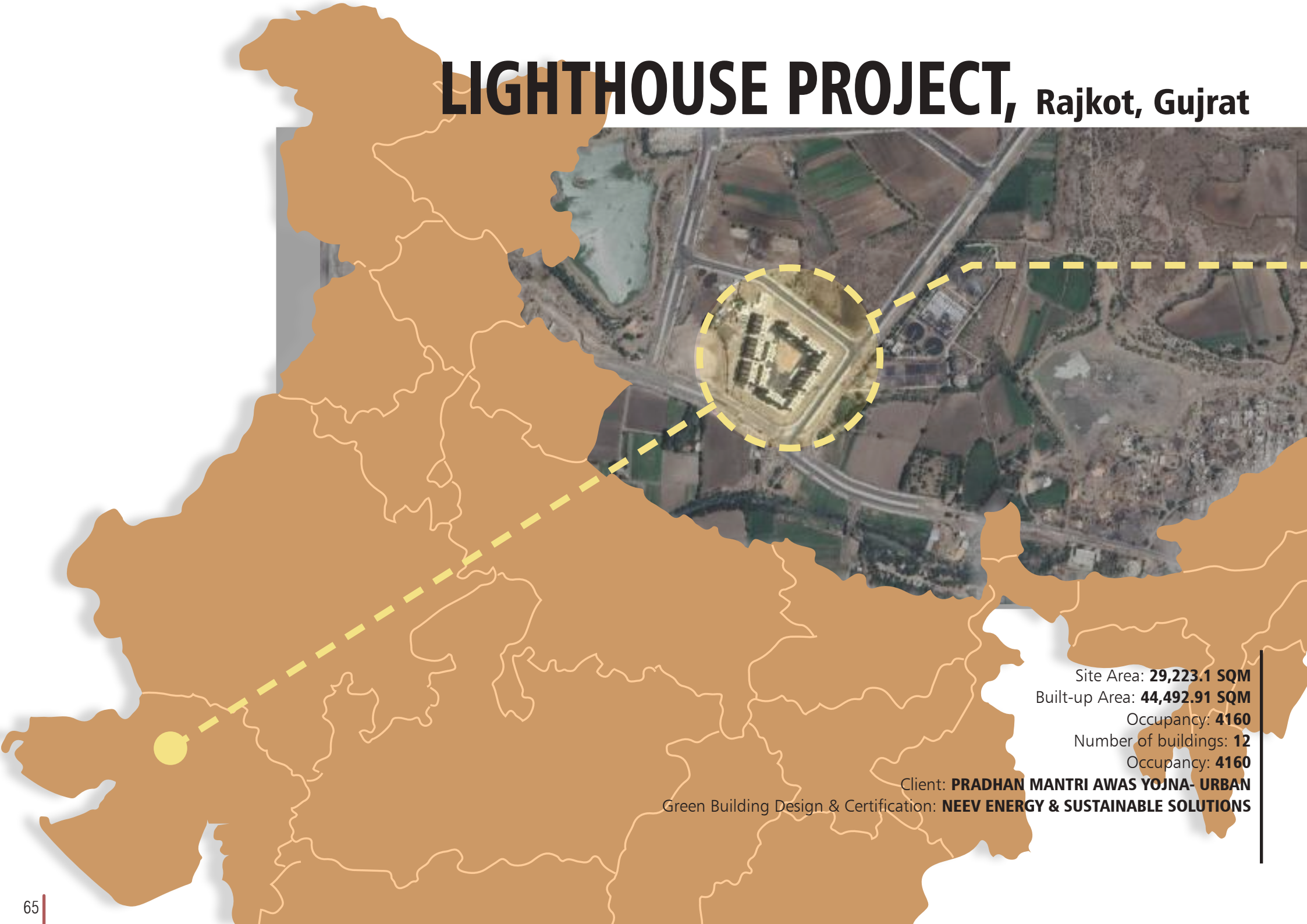
Dedicated charging points and parking provided for electric vehicles

WATER USE OPTIMIZATION

50.9% Reduction in water demand using low flow fixtures for kitchen & toilets

51.7% Reduction in irrigation water requirement using native plant species for landscaping

LIGHTHOUSE PROJECT, Rajkot, Gujrat



Site Area: **29,223.1 SQM**
Built-up Area: **44,492.91 SQM**
Occupancy: **4160**
Number of buildings: **12**
Occupancy: **4160**
Client: **PRADHAN MANTRI AWAS YOJNA- URBAN**
Green Building Design & Certification: **NEEV ENERGY & SUSTAINABLE SOLUTIONS**

CLIMATE
HOT & DRY

TYPE
RESIDENTIAL

RATING
GRIHA AH

★ ★ ★

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is 69%

Reduction in annual landscape water demand achieved by using micro sprinkler systems & planting native vegetation

Modular tunnel formwork technology was employed for the structural construction of the project, ensuring efficiency and precision

ENERGY-EFFICIENT DESIGN

Reduction in cement usage through the incorporation Ground Granulated Blast Furnace Slag (GGBS) in structural applications is 44%

Materials used in the building interiors are low environment impact materials like pressed WPC for door & windows, stone for flooring & counters

Photograph showing mutual shading amont he building blocks by offset plan.

ENSURING VISUAL COMFORT FOR OCCUPANTS

76.2%

Total living area meets UDI criteria to ensure visual comfort of occupants using the following measures:

- Single glazed unit of 5mm thickness & VLT of 0.89, SHGC of 0.83 & U-value of 5.90 ensures that maximum daylight enters the space with minimal heat gain.

- Each room has access to an outdoor view & one window. Mutual shading of buildings helps reduce glare within the spaces.

- Local shading in the form of overhangs & vertical fins (through the building shape) ensure UDI levels are maintained in the space.

-All the interior spaces have white walls & ceilings which ensure uniform propagation of daylight in the space.

ACTIVE AND PASSIVE LOW IMPACT DESIGN STRATEGIES

REDUCING HEAT GAIN:

- Light colour scheme used for all external surfaces to reduce heat gain through walls, reducing heat gain from envelope.
- High SRI white china mosiac tiles installed on the rooftop ensuring reduced heat gain from roof.

SHADING:

- Offset create mutual shading among elements in the building to ensure reduce heat gain.
- External windows shaded by overhangs of projection factor(PF) of 0.5 to ensure reduced direct heat gain.

ACTIVE FEATURES:

- BEE 5-star equivalent fans were installed in the project.

- Tenant guidelines issued to state that desert coolers to be installed by occupants.

Photograph showing light coloured exterior with shading used for windows.

LIFESTYLE & INNOVATION

75% Reduction in carbon footprint of building occupants by proximity of all services

Universal accessibility for residents improved with slip resistant surfaces, double grab bars & ramps

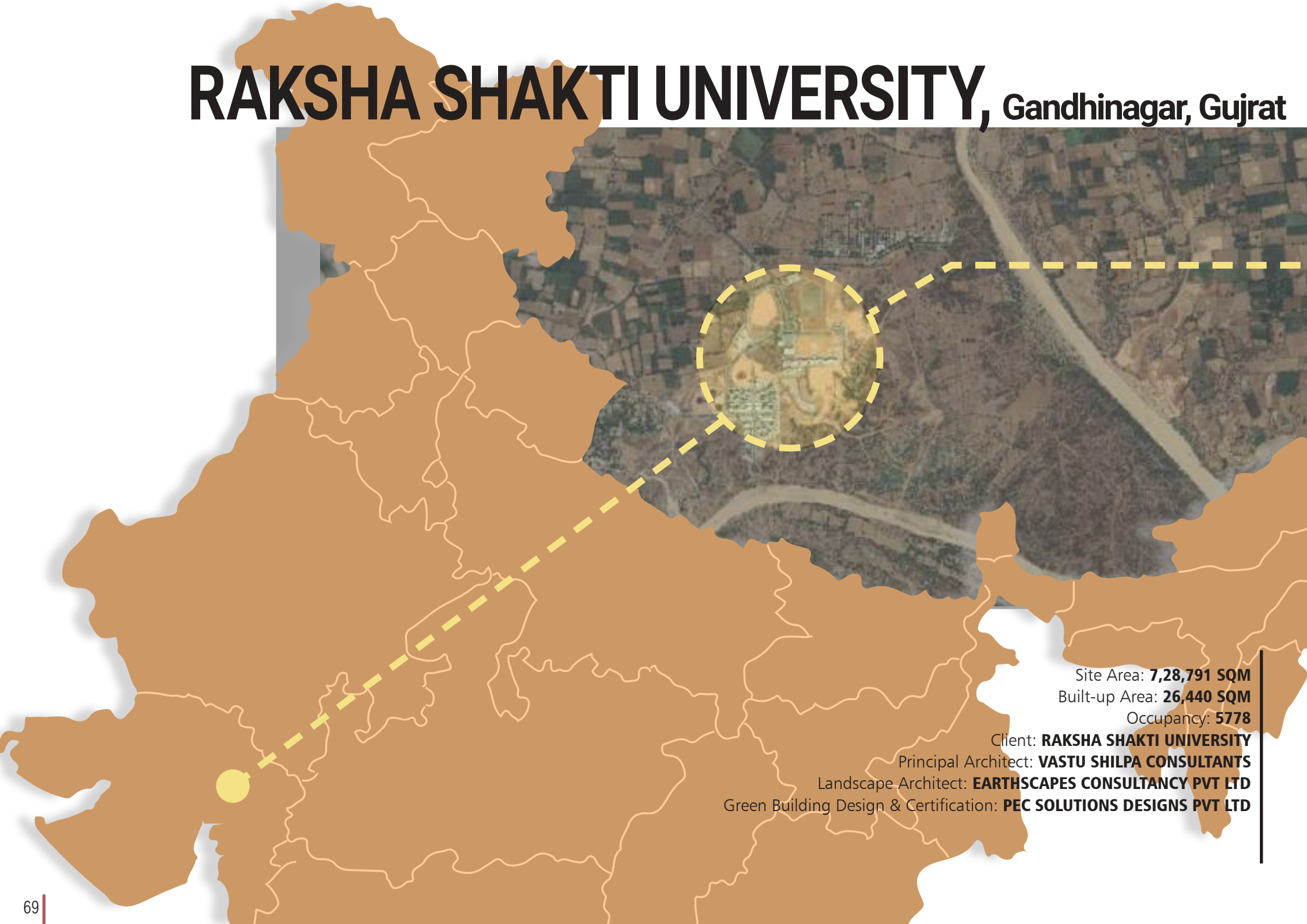
Common area walls are painted with environment awareness murals for residents

WATER USE OPTIMIZATION

65% Reduced water demand by using low flow fixtures for kitchens & toilets

Annual water resuse on site after treating from prefabricated FRP type underground 235KLD STP for flushing & irrigation

RAKSHA SHAKTI UNIVERSITY, Gandhinagar, Gujrat



Site Area: **7,28,791 SQM**
Built-up Area: **26,440 SQM**
Occupancy: **5778**
Client: **RAKSHA SHAKTI UNIVERSITY**
Principal Architect: **VASTU SHILPA CONSULTANTS**
Landscape Architect: **EARTHSCAPES CONSULTANCY PVT LTD**
Green Building Design & Certification: **PEC SOLUTIONS DESIGNS PVT LTD**

CLIMATE
HOT & DRY

TYPE
INSTITUTIONAL

RATING
GRIHA LD

★ ★ ★ ★ ★

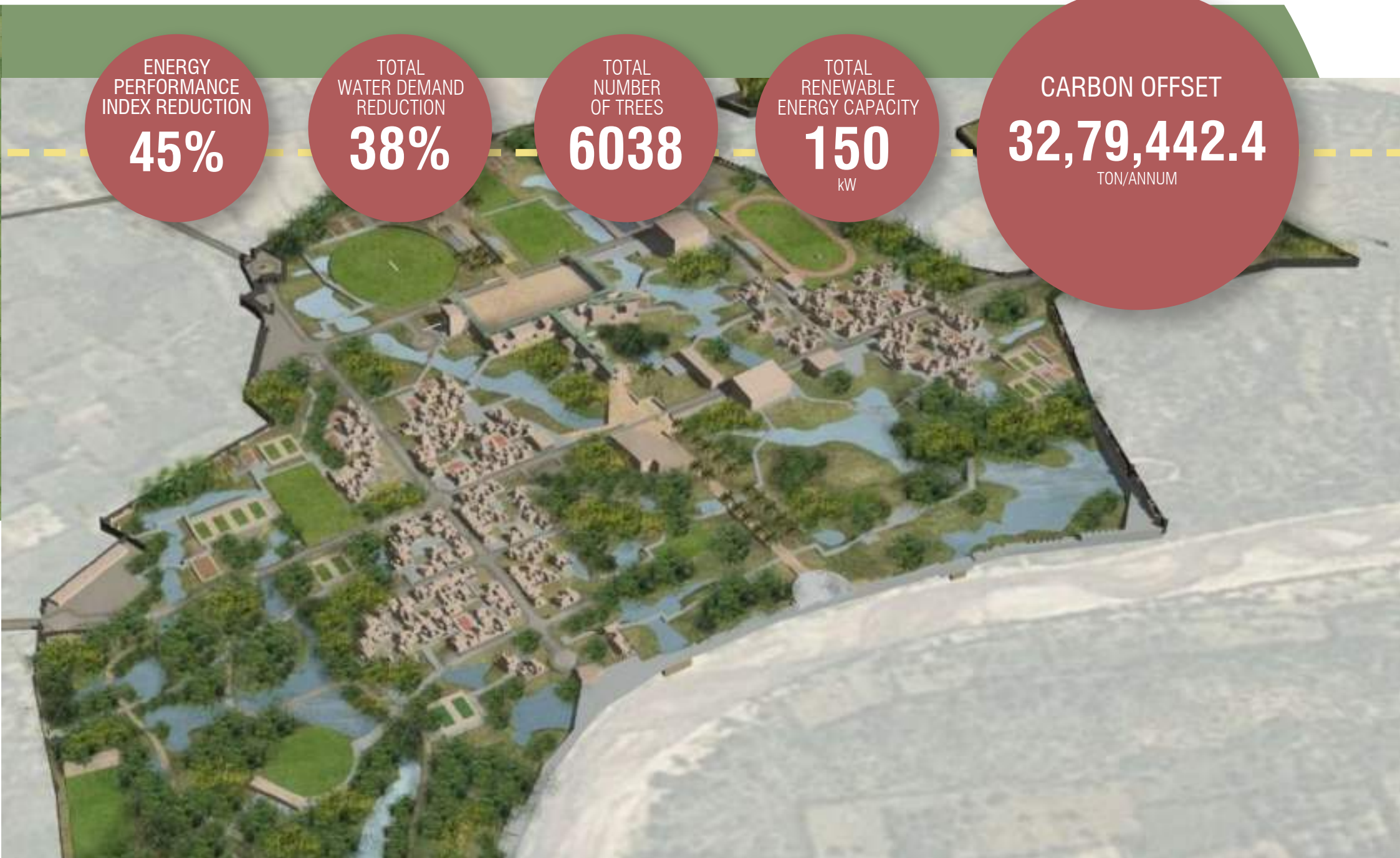
ENERGY PERFORMANCE INDEX REDUCTION
45%

TOTAL WATER DEMAND REDUCTION
38%

TOTAL NUMBER OF TREES
6038

TOTAL RENEWABLE ENERGY CAPACITY
150
kW

CARBON OFFSET
32,79,442.4
TON/ANNUM



STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **71.2%**

390 exisiting mature trees preserved and number of new trees planted is **5648**

Hard paving was reduced at site with integrated landscape clusters to reduce UHIE

ENERGY-EFFICIENT DESIGN

Glass Reinforced Concrete panel cladding with air gap from walls to reduce heat gain

Astronomical timer installed for all outdoor lighting in the project to reduce electric consumption

Recycled materials were incorporated into the road construction to significantly reduce embodied energy

Image showing various form of shading devices design used in the building design

OPTIMIZATION OF FENESTRATION DESIGN & VENTILATION

DECREASE EXPOSED SURFACE AREA

The buildings in the project are designed & orientated taking into consideration the solar path & wind direction, such that maximum of the building surfaces face N-S thus decreasing the exposed surface area in E-W direction.

INCREASE THERMAL RESISTANCE & INCREASE THERMAL CAPACITY (TIME LAG)

All the listitutional buildings are cladded with Glass Reinforced Concrete (GRC) panels at adequate distance from the building surface forming an air gap i.e. time lag, which act as an excellent thermal insulation

INCREASE SURFACE REFLECTIVITY

High reflective and light coloured tiles has been proposed on the roof areas of all the buildings.

REDUCE SOLAR HEAT GAIN

Minimum fenestration openings are designed in east – west orientation

OPTIMIZATION OF BUILDING ENVELOPE PERFORMANCE

INCREASE BUFFER SPACES

The project design comprises of following features which contribute towards passive designing & helps to increase the buffer spaces:

- Incorporates courtyards to enhance daylight and ventilation, minimizing direct heat gain.
- GRC panel cladding is used on the building envelope, positioned at an adequate distance from the surface.
-Water bodies are strategically placed in wind flow directions to provide passive cooling.

INCREASE SHADING

Following are the shading strategies incorporated in various types of buildings:
- Institutional Building: GRC Panel cladding in the building envelope at an adequate distance from the building surface
- Hostel Building: Self Shaded Concrete Jalis with fixed & openable panels of Shera board & Glass + thick tree plantation surrounding the buildings

Image showing use of courtyards with shading devices and water bodies in building blocks

LIFESTYLE & INNOVATION

66% Organic waste treated at site with organic waste composter of 1000kg/ day capacity.

Footpaths, cycle tracks, parking & benches provided to facilitate pedestrian movement within the site

Motorized transport has been restricted to the residential & service areas only

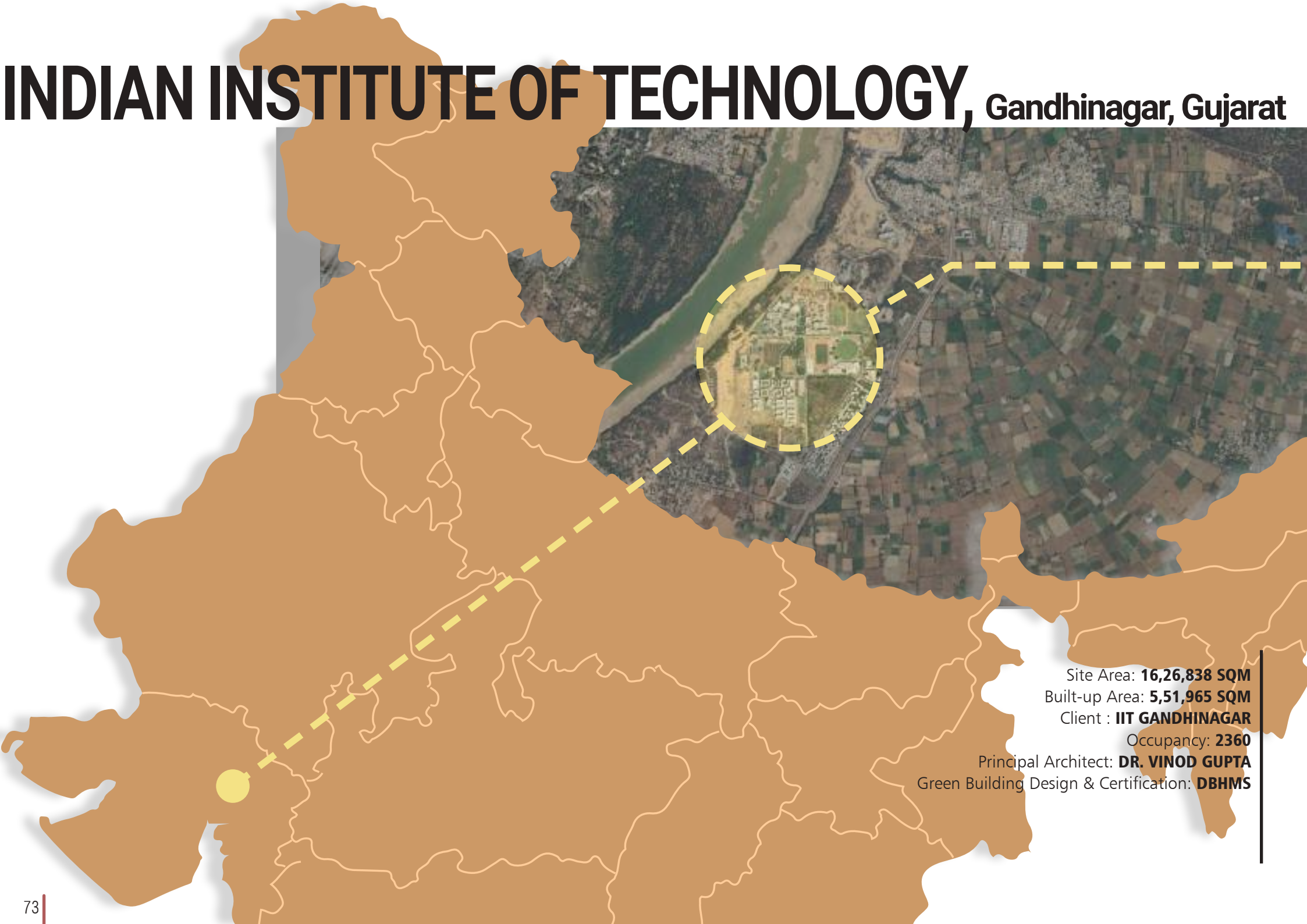
WATER USE OPTIMIZATION

All fixtures throughout campus are low flow fixtures to reduce water demand and waste

Metering & sub-metering of all water usage considered on BMS for continuous monitoring & auditing

Self sufficient water campus with water harvesting management system & reuse of grey water after treatment by MBBR type of STP

INDIAN INSTITUTE OF TECHNOLOGY, Gandhinagar, Gujarat



Site Area: **16,26,838 SQM**
Built-up Area: **5,51,965 SQM**
Client : **IIT GANDHINAGAR**
Occupancy: **2360**
Principal Architect: **DR. VINOD GUPTA**
Green Building Design & Certification: **DBHMS**

CLIMATE
HOT & DRY

TYPE
INSTITUTIONAL

RATING
GRIHA LD

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
44.8%

TOTAL WATER DEMAND REDUCTION
30%

TOTAL NUMBER OF TREES
1226

TOTAL RENEWABLE ENERGY CAPACITY
500
kW

CARBON OFFSET
52,80,137.16
TON/ANNUM

SUSTAINABLE SITE PLANING MEASURES

STRATEGIC SITE PLANNING

Percentage of the total site area preserved under existing tree clusters, lakes, and ravines is 79%

Hard paving reduced & landscape interspersed between the building clusters to reduce UHIE

Sustainable Urban Drainage Systems (SuDS) are implemented through the use of holding ponds to manage stormwater effectively

ENERGY-EFFICIENT DESIGN

Street lights designed to meet minimum lighting requirements & installed with automatic switches

Percentage of energy efficient buildings in project as compared to GRIHA LD base case in the project is 36%

Percentage of energy efficient lighting as compared to GRIHA LD base case in the project is 48%

image highlighting open corridors with strategically positioned louvres designed to provide shading and rain protection

RAVINES AND CONTOURS

- Prior to construction, the site's slopes and contours were analyzed, and areas vulnerable to soil erosion were identified. Based on the ravine depth and slope gradient, check dams were constructed in regions with greater vulnerability

- Contour bunds were installed at smaller contour sections to capture sediment runoff and prevent ravine erosion

EXISTING DRAINAGES ON SITE

- The site's zoning and phasing were designed with consideration for natural drainage patterns. As construction progresses, these natural drainage systems will be gradually integrated into the stormwater network. The site, initially a flat farmland, features gradual slopes leading to two seasonal ponds on the northern side.

RESTORING RAIN WATER HARVESTING

LAKES

- The major ridges and slopes on the relatively flat land were analyzed to determine the division of construction phases

- Natural slopes leading to seasonal lakes were preserved and enhanced to increase rainwater capture

- Rainwater from rooftops is collected and stored for use throughout the year, ensuring a sustainable water supply

- Water from surfaces such as pavements, pathways, and roads is directed into channels that lead to the lakes, following the land's natural slope. The water is filtered before being sent to the lakes, improving water storage capacity

Image showcasing use of light wells in the buildings for daylighting

LIFESTYLE & INNOVATION

100% Organic waste treated at site with organic waste composter of 700kg/ day capacity

Electric charging facility for 90 cars & 60 bikes has been proposed within the campus

Dedicated walking , cycling tracks & bicycle parking provided along all roads

WATER USE OPTIMIZATION

All fixtures throughout campus are low flow fixtures reducing water demand & usage

30% Annual water demand is reduced through the reuse of treated wastewater and captured rainwater

DEWATS (Decentralized Wastewater Treatment System) is installed to treat wastewater, enabling its reuse within the campus

EIL CAMPUS, Gurugram, Haryana

Site Area: **41,701.6 SQM**
Built-up Area: **32,837 SQM**
Year of completion: **2016**
Occupancy: **500**
Client: **SOFTWARE TECHNOLOGY PARKS OF INDIA**
Principal Architect: **PLANNERS GROUP**
Landscape Architect: **PLANNERS GROUP**
Structural Consultant: **M/S DESIGN ACCREDITS**
Green Building Design & Certification: **ENERGETIC CONSULTING PVT. LTD**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

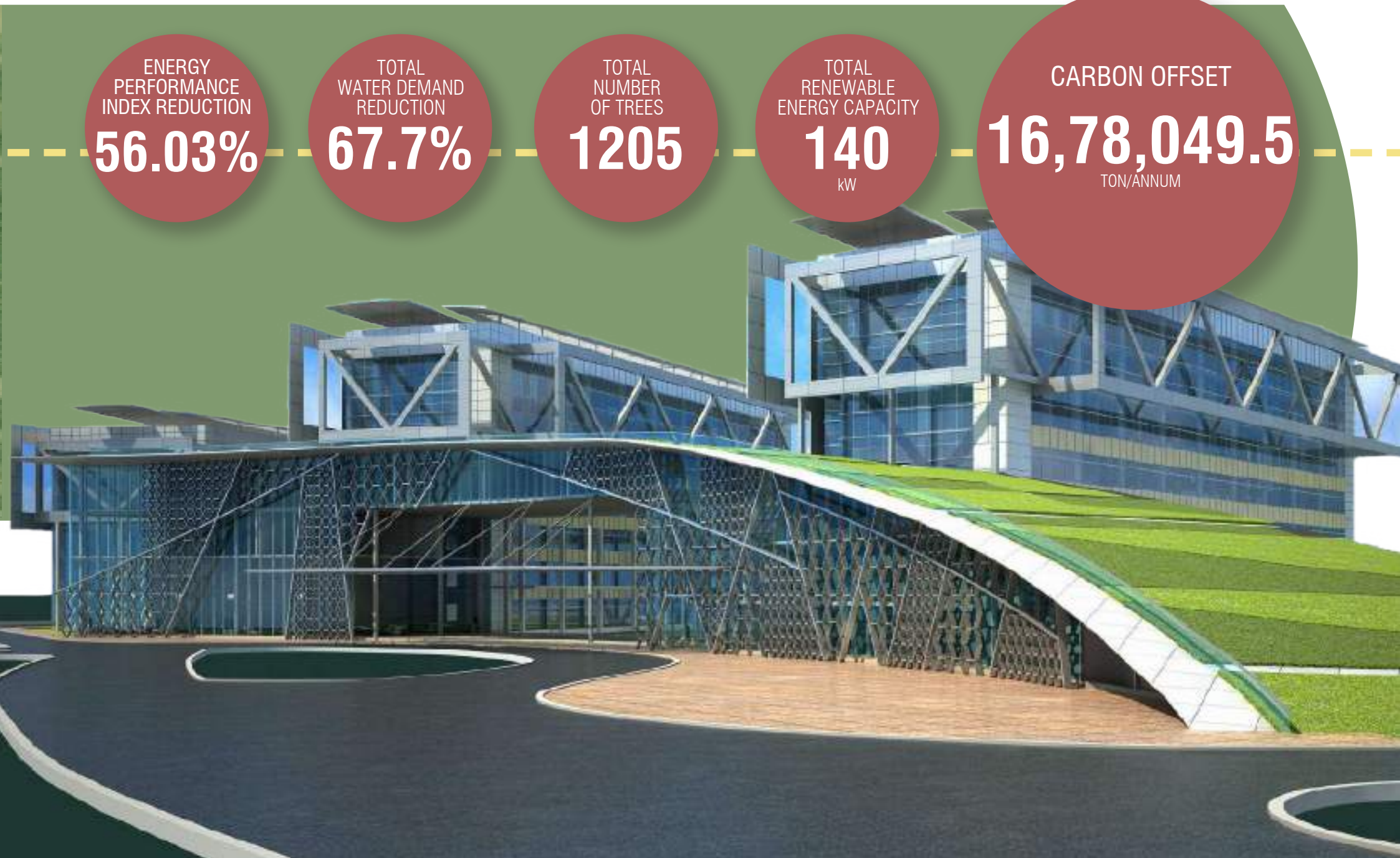
ENERGY PERFORMANCE INDEX REDUCTION
56.03%

TOTAL WATER DEMAND REDUCTION
67.7%

TOTAL NUMBER OF TREES
1205

TOTAL RENEWABLE ENERGY CAPACITY
140
kW

CARBON OFFSET
16,78,049.5
TON/ANNUM



STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **50.1%**

Courtyard is integrated between blocks to promote natural wind flow and enhance the air tunnel effect for improved ventilation

Number of new native trees of planted at site along the periphery is **1205**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **60.15%**

Reduction in embodied energy of the building using AAC blocks for walling & fly ash in concrete is **58%**

Percentage use of low environment impact materials like UPVC for door & windows in the building interiors is **90.94%**

Plan showing wind direction &courtyard used to create air tunnel & venturi effect to facilitate air ventialtion & movement.

PASSIVE DESIGN STRATEGIES AT SITE

ORIENTATION

- The zoning of the blocks has been placed facing north-south orientation

- Service core areas provided on south face. Further, Screens have been provided on South to block the south sun. Also, cut-outs have been provided for the screens to get natural light and ventilation

- Greenbelt is proposed towards the highway, sensitively landscaped to provide a noise buffer yet give a presence of the campus on the highway

VENTILATION

- Courtyard space has been created between building blocks to facilitate wind flow through the spaces and create venture effect/air-tunnel effect

- Further, fins and wind scoops are added along the prevailing wind direction to facilitate ventilation in the building and basement

ACTIVE DESIGN STRATEGIES FOR COMFORT

< 40%

window wall ratio(WWR) for all buildings

AUTOMATIC LIGHT SHUTOFF

- Occupancy sensors &daylight sensors have been installed

CONTROL IN DAY LIT AREA

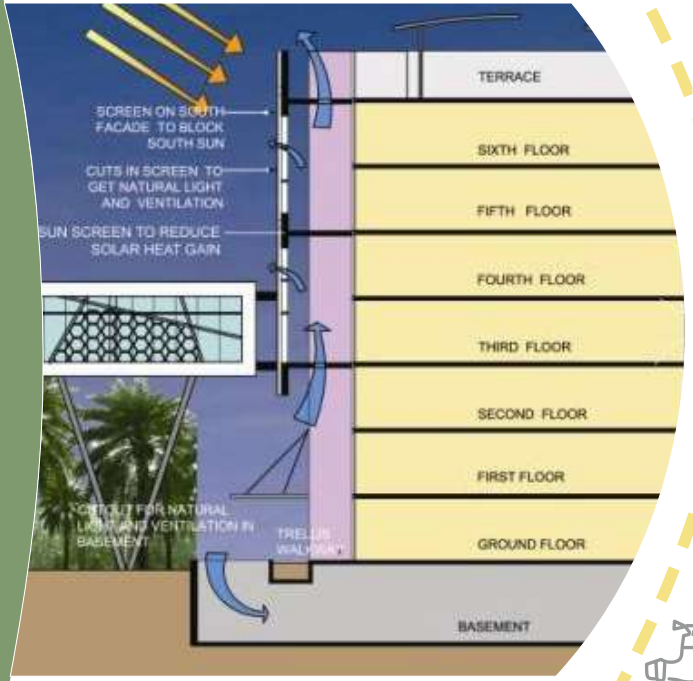
- Manual switches are provided in such areas

TIME CLOCK CONTROL

- Mechanical cooling, schedule fed into BMS system

TEMPERATURE CONTROL

- All cooling systems are temperature controlled through BMS system



Section showing jaalis used to provide shading to windows with air gap to facilitate air ventilation & reduce heat gain

LIFESTYLE & INNOVATION

Smart metering & monitoring installed for energy & water in irrigation, HVAC plant & lighting

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Awareness created among staff & provision for campus visits for awareness generation

WATER USE OPTIMIZATION

67.76% Reduction in water demand using low flow fixtures for kitchen & toilets

68.11% Reduction in annual landscape water demand using drip irrigation & micro sprinkler systems

41.2% Annual water resuse on site after treating from MBBR 225KLD STP for flushing & irrigation

AKSHAY URJA BHAWAN, HAREDA, Panchkula, Haryana

Site Area: **3,900 SQM**
Built-up Area: **5,111 SQM**
Year of completion: **2012**
Occupancy: **40**
Client: **MR D K CHOPRA, ADDITIONAL DIRECTOR, HAREDA**
Principal Architect: **AR SIDDHARTHA WIG, THE ELEMENTS**
Landscape Architect: **AR JITESH MALIK, BRICK & GREEN**
Structural Consultant: **AR SANJAY PRAKASH, SANJAY PRAKASH &ASSOCIATES**
Green Building Design & Certification: **MAHESH BABU, ASHOK A SANADI, MCD BUILT ENVIRONMENT RESEARCH LABORATORY PVT. LTD**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
61%

TOTAL WATER DEMAND REDUCTION
86%

TOTAL NUMBER OF TREES
56

TOTAL RENEWABLE ENERGY CAPACITY
48
kW

CARBON OFFSET
77,785.2
TON/ANNUM

STRATEGIC SITE PLANNING

Reduction in landscape water demand using drip irrigation & drought tolerant species is **85.9%**

Planting of high-foliage trees along the boundary reducing traffic noise and enhancing acoustic comfort

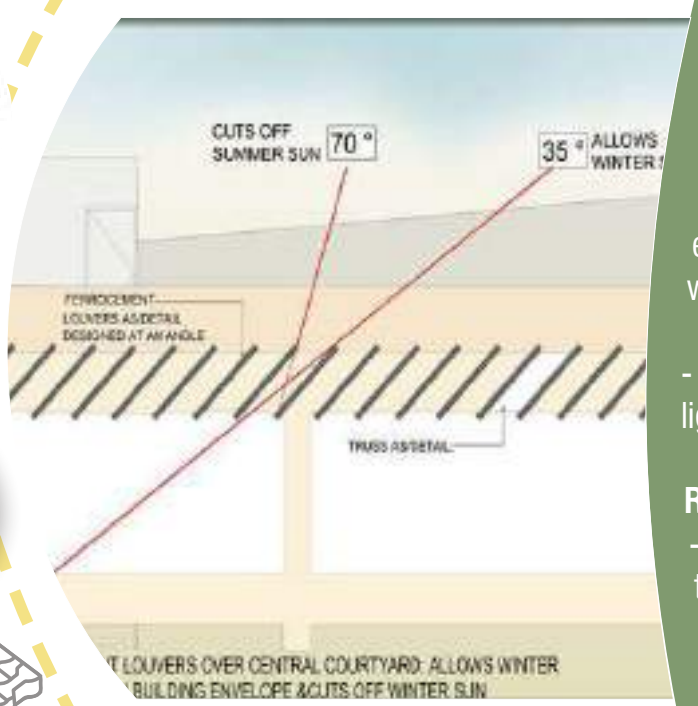
Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **49.6%**

ENERGY-EFFICIENT DESIGN

Reduction in embodied energy by utilization of fly ash in masonary is **40%**

Reduction in energy demand for Internal artifical lighting capacity on site, using renewables, of **32%**

Cement replaced with flyash in reinforced concrete & plaster mansonary & AAC blocks with flyash in non structural application by **50%**



Section showing the angle of ferro cement louvers above the central atrium for maintaining shade &sunlight in winter

PASSIVE DESIGN STRATEGIES AT SITE

ORIENTATION

- Well oriented site and building along cardinal directions. Glazing is coordinated to take advantage of building orientation. South glazing is provided with horizontal shades. Almost no east and west openings. Reasonable north glazing with vertical shading

- All workspaces of the building are daylit. Efficient lighting with 25% reduced lighting energy use

REDUCING HEAT GAIN

- The courtyard is covered with angled louvers that maximize winter sun on the south face of the north wing and shade the atrium in the summer while allowing diffused daylight in winter

- Cavity walls with PUF insulation with double glazed windows are provided in the envelope of the building to reduce heat gain

ACTIVE DESIGN STRATEGIES FOR COMFORT

VENTILATION

- The south face has solar chimneys to aid ventilation in some of the non-air-conditioned spaces which are cooled by misting installed in the central atrium

OTHER MEASURES

- Spaces divided into zones as per desired temperature set points. Thermal comfort conditions in apex zones are maintained through mechanical air conditioning. Controlled zones are cooled in summer &chilled in monsoon. Passive zones are cooled in summer & ventilated in monsoon

- SHGC is less than 0.25(ECBC threshhold)
- Automatic controls for HVAC systems & artificial lighting systems

- Solar water heater meets 100% of demand
- Meters & Sub-meters have been installed to moitor energy & water use

Central Atrium with louvers to provide shading &the courtyard above is misted to maintain thermal comfort

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Solar van stationed as an exhibition to create awareness on solar energy utlized at site

Dedicated resting areas and toilets for well being of all service staff

WATER USE OPTIMIZATION

ETP plant installed on site to treat grey water & reused for horticulture

66.25% Reduction in water demand using low flow fixtures for kitchen & toilets

Surplus rain water from soft paved surfaces is recharged into the aquifer using 22 percolation pits

MILESTONE EXPERION CENTER, Gurugram, Haryana

Site Area: **7,287.08 SQM**
Built-up Area: **22,915.92 SQM**
Year of completion: **2018**
Occupancy: **5214**
Client: **M. RAMACHANDRAN, EXPERION**
Principal Architect: **SANDEEP CHAWLA**
Landscape Architect: **DESIGN CELL**
Structural Consultant: **H.K.JOSHI**
Green Building Design & Certification: **GREEN HORIZON**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
50.3%

TOTAL WATER DEMAND REDUCTION
54.4%

TOTAL NUMBER OF TREES
1205

TOTAL RENEWABLE ENERGY CAPACITY
136
kW

CARBON OFFSET
12,77,040
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **50.1%**

Number of new trees of native species planted at site along the periphery is **1205**

Courtyard is provided between blocks for wind flow & create air tunnel effect for air movement

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **34%**

Materials used in the building interiors are low energy materials such as UPVC for door & windows

Reduction in embodied energy of the building using AAC blocks for walling & fly ash in concrete is **73.17%**

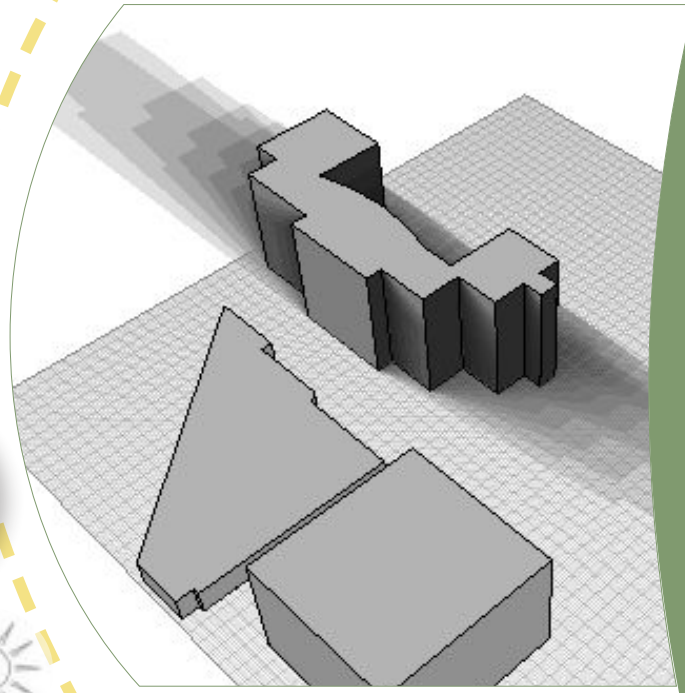


Image showing shadow analysis with central area in constant shade

BUILDING ENVELOPE PERFORMANCE

47%

window wall ratio(WWR) for all buildings

0.24 W/m²K U value

Building external walls provided with heat resistant tiles & efficient insulation

0.23 SHGC

40 % VLT

1.36 W/m²K U value

DGU unit for glazing in the project, complying to requirements of ECBC 2007

GREEN FEATURES OF BUILDING

ENERGY EFFICIENCY

The building is designed to reduce dependence on artificial lighting and cooling, resulting in significant energy savings. Energy-efficient lighting fixtures, along with air conditioners and fans, are installed to further enhance energy conservation. Additionally, solar PV panels are integrated to generate renewable energy, reducing the reliance on grid power.

WASTE MANAGEMENT

Effective waste management strategies are employed to reduce landfill contributions. Waste is segregated on-site and sent for recycling, while e-waste is responsibly handled by certified e-scrap vendors. These measures ensure minimal environmental impact and promote recycling practices.

ENVIRONMENTAL PRESERVATION

Preserving the natural environment is a priority for the project. Most existing trees are retained on-site, maintaining ecological balance and shade. Additionally, the premises are designated as a no-smoking zone, promoting a healthy and pollution-free environment.

Front elevation image of the building with the view of central shaded area

LIFESTYLE & INNOVATION

Smart metering & monitoring is done for energy, water in irrigation, HVAC plant & lighting

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Awareness created among staff & provision for campus visits for awareness generation

WATER USE OPTIMIZATION

66.31% Reduction in water demand using low flow fixtures for kitchen & toilets

41.2% Annual water resuse after treatment from MBBR system of 106KLD STP at site for irrigation & flushing

68.11% Reduction in annual landscape water demand using drip irrigation &micro sprinkler systems

KUTHAR TREASURY BUILDING, Solan, Himachal Pradesh

Site Area: **125.9 SQM**
Built-up Area: **276.95 SQM**
Year of Award**: 2023**
Occupancy: **21**
Client: **TTREASURIES, ACCOUNTS &LOTTERIES, HIMACHAL PRADESH**
Principal Architect: **CHIEF ARCHITECT, PWD, HIMACHAL PRADESH**
Green Building Design & Certification: **DESIGN2OCCUPANCY SERVICES LLP**

CLIMATE
COLD

TYPE
COMMERCIAL

RATING
SVAGRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
25%

TOTAL WATER DEMAND REDUCTION
37%

TOTAL NUMBER OF TREES
4

TOTAL RENEWABLE ENERGY CAPACITY
5
kW

CARBON OFFSET
2,699
TON/ANNUM

PASSIVE & ACTIVE DESIGN STRATEGIES AT SITE

STRATEGIC SITE PLANNING

The building is designed to preserve natural contours, ensuring minimal disruption to the site's topography

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **50%**

Reduction in landscape water demand by planting native species is **79 %**

ENERGY-EFFICIENT DESIGN

Percentage of Total living area is day lit & meets daylight factor prescribed by NBC is **85.6%**

LPD of the project is 2.56 which is lower than the ECBC specified LPD limit of 10.80 (W sq.m)

Reduction in embodied energy of the building using autoclaved AAC blocks & PPC for walling application is **40.06%**

Image showcasing horizontal shadingof windows on facade

PASSIVE ARCHITECTURAL DESIGN

- Horizontal shading devices are installed on windows to minimize heat gain during summers

- Multiple operable windows are strategically oriented to facilitate effective cross-ventilation throughout the building.

ACTIVE LOW-ENERGY COOLING AND HEATING SYSTEMS

- Energy-efficient fans are installed in office spaces to enhance air circulation and provide cooling during summers

- All appliances used in the building are BEE 5-star rated to ensure minimal energy consumption

REDUCING CARBON FOOTPRINT OF BUILDING

- Portland Pozzolana Cement with fly ash content was used in construction of the project

- Low energy flooring materials like Kota stone &vitrified tiles are used in the building

- All chairs &workstations procured for the project contain recycled content reducing environmental impact

- Adequate daylight in all areas, saving on energy load by reducing need for artificial lighting

- Solar PV panels are utilized to generate energy thus reducing energy demand of the project

- All organic waste is treated on site using an organic waste converter

- BEE 5- star rated appliance used in the project

External mechanical filteration device for rain water filteration

LIFESTYLE & INNOVATION

All amenities are available nearby including bus stop, bank & post office reduction in travel

Dedicated charging points and parking are provided for electric vehicles

Environmental awareness signage is prominently displayed throughout the project site

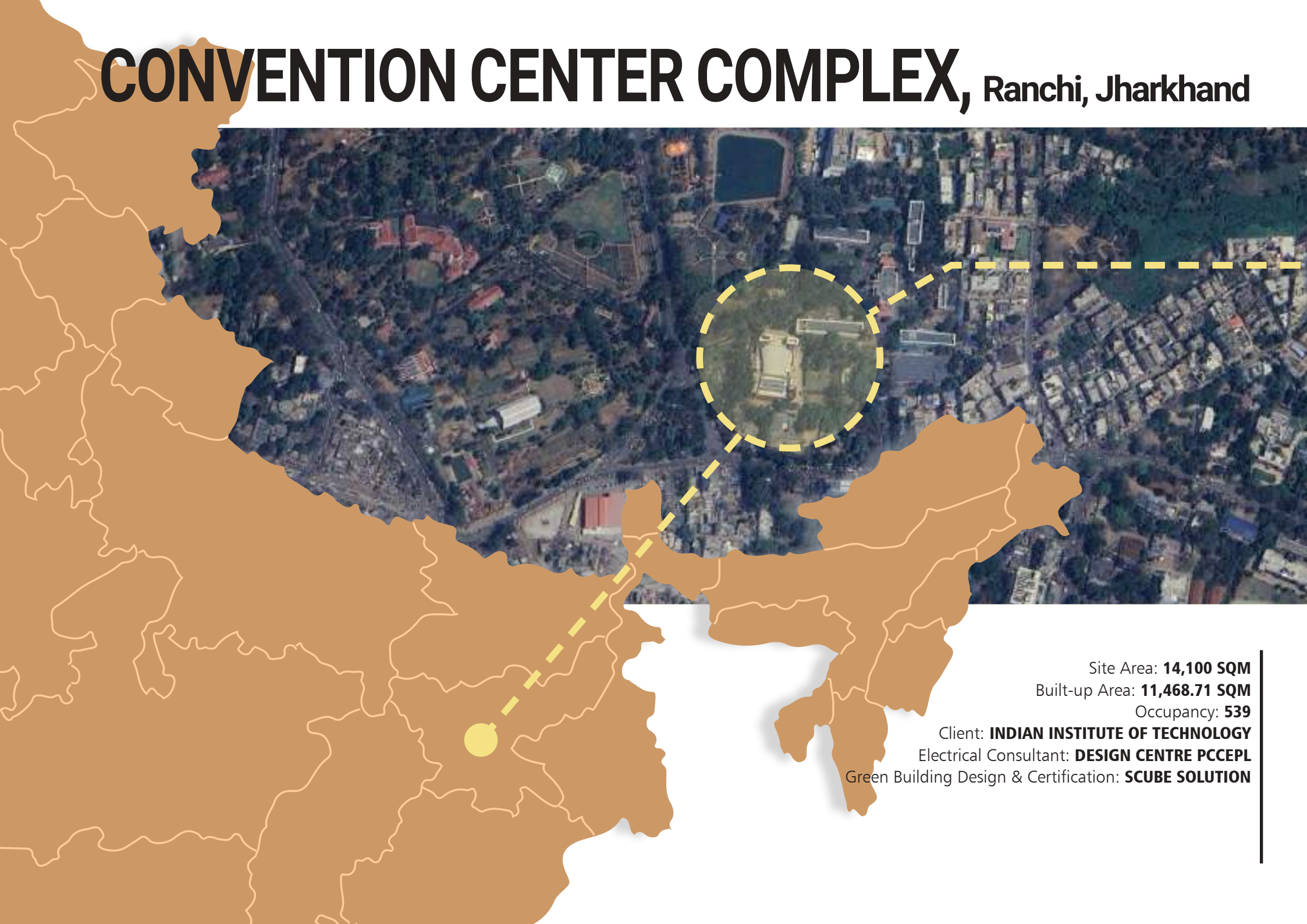
WATER USE OPTIMIZATION

6KL rainwater recharge pit provided on site, along with filtration system, to recharge the ground water

27.14% Reduction in water demand using low flow fixtures for kitchen & toilets

75% of two day water demand can be met through 6000 litres of rainwater storage tank provided at site

CONVENTION CENTER COMPLEX, Ranchi, Jharkhand



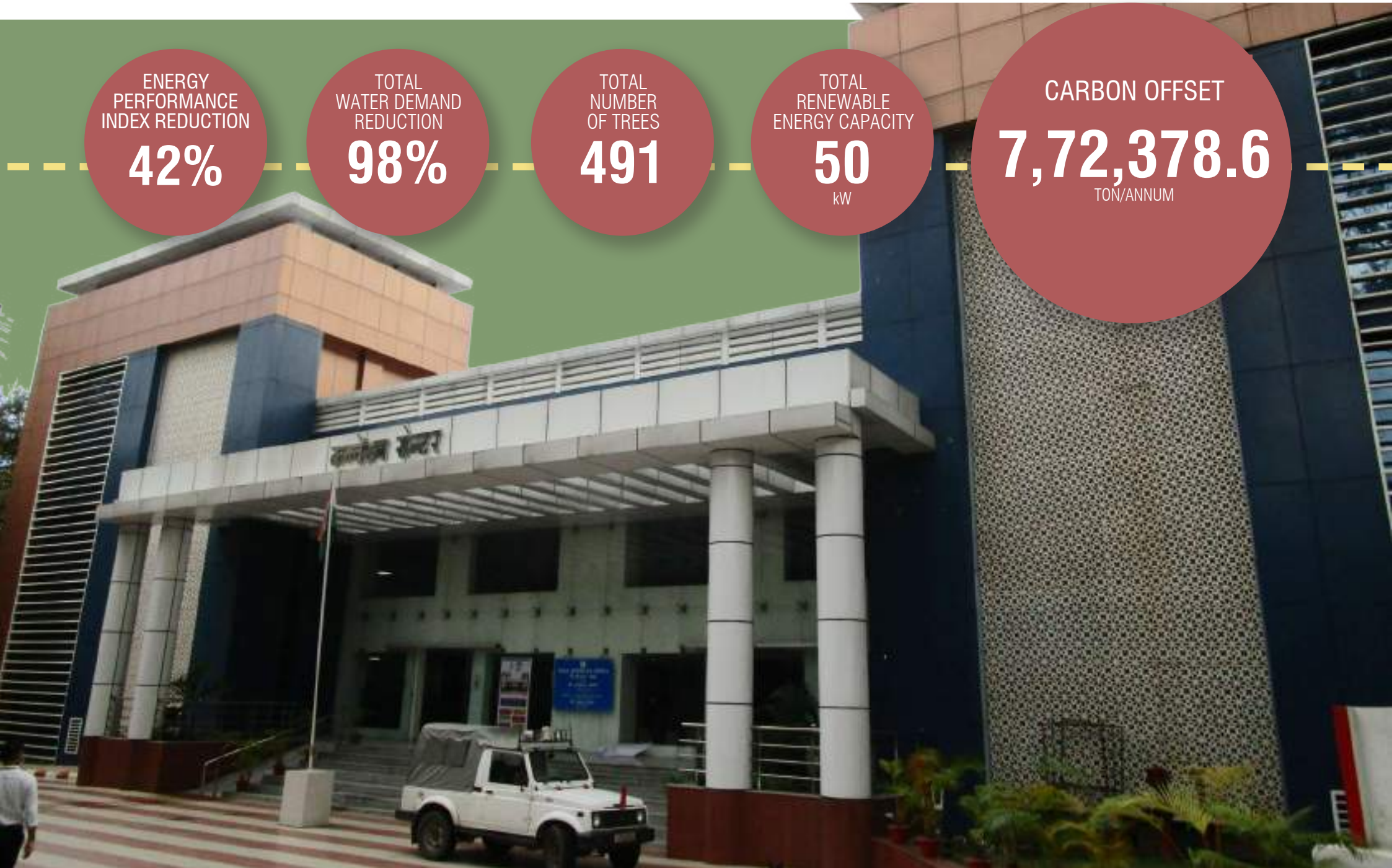
Site Area: **14,100 SQM**
Built-up Area: **11,468.71 SQM**
Occupancy: **539**
Client: **INDIAN INSTITUTE OF TECHNOLOGY**
Electrical Consultant: **DESIGN CENTRE PCCEPL**
Green Building Design & Certification: **SCUBE SOLUTION**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★



ENERGY PERFORMANCE INDEX REDUCTION
42%

TOTAL WATER DEMAND REDUCTION
98%

TOTAL NUMBER OF TREES
491

TOTAL RENEWABLE ENERGY CAPACITY
50
kW

CARBON OFFSET
7,72,378.6
TON/ANNUM

PASSIVE DESIGN STRATEGIES

STRATEGIC SITE PLANNING

Central courtyard is integrated between the building blocks to harness and direct wind flow, generating an air tunnel effect that optimizes natural ventilation throughout the structure

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **50.1%**

Exisiting 42 trees were preserved & number of new trees planted at site is **445**

ENERGY-EFFICIENT DESIGN

Percentage of Total living area is day lit & meets daylight factor prescribed by NBC is **34%**

Reduction in embodied energy of the building using AAC blocks & fly ash in concrete is **73.17%**

Materials used in the building interiors, such as UPVC for doors and window frames, are all low environmental impact materials.

Image depicting tree-lined pathways providing natural shade along the periphery

OPTIMIZED ORIENTATION FOR SOLAR CONTROL:

The building's orientation is carefully planned to minimize passive solar heat gain. The larger, daytime-operational sections of the building are aligned with their longer façades facing north and south, reducing exposure to harsh east and west sun. Specifically, the office block located behind the auditorium maximizes openings along the northern and southern façades, ensuring ample daylight while mitigating heat ingress.

SHADING THROUGH RECESSED WINDOWS:

All windows are designed as recessed box windows, providing inherent shading throughout the year. This design ensures that direct sunlight penetration is minimized, maintaining thermal comfort and reducing the cooling load across seasons.

OPTIMIZING SITE PLANNING

MINIMIZED FOOTPRINT WITH ENHANCED LANDSCAPING:

The building's footprint and the extent of hard-paved surfaces have been kept to a minimum, allowing for expansive landscaped courts on both sides of the structure. These green spaces not only enhance the aesthetic appeal but also contribute to microclimate regulation and stormwater management.

TREE-SHADED ROADS AND BUILDING FAÇADES:

The road network within the site is designed to be fully shaded by leveraging both existing mature trees and newly planted species. Additionally, the east and west façades of the building are shielded from direct sun exposure by mature trees, further improving thermal performance and integrating the built form seamlessly with the site's natural elements.

Image depicting recessed windows combined with jaali elements to create a self-shading façade

LIFESTYLE & INNOVATION

Smart metering and monitoring are implemented for energy & water usage in irrigation, the HVAC plant & lighting

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Guided tours for awareness among visitors are organized to exihibit green features

WATER USE OPTIMIZATION

66.31% Reduction in water demand using low flow fixtures for kitchens & toilets

82.2% Reduction in annual landscape irrigation demand by planting native species plants & drip irrigation

16.1% Annual water resuse after treatment from MBBR system of 25 KLD STP capacity for irrigation & flushing

TITAN CORPORATE CAMPUS, Bengaluru, Karnataka

Site Area: **25,992.95 SQM**
Built-up Area: **25,344 SQM**
Client: **TITAN COMPANY LIMITED**
Occupancy: **1100**
Principal Architect: **MINDSPACE ARCHITECTS**
Landscape Architect: **ONE LANDSCAPE DESIGN LIMITED**
Electrical Consultant: **SRIPEKSHA ENGINEERING CONSULTANCY SERVICES PRIVATE LIMITED**
Green Building Design & Certification: **EN3 SUSTAINABILITY SOLUTIONS PVT LTD.**

CLIMATE
WARM & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

STRATEGIC SITE PLANNING

All exisiting trees were preserved & number of new trees planted at site is **441**

Reduction in landscape water demand using drip irrigation is **62%**

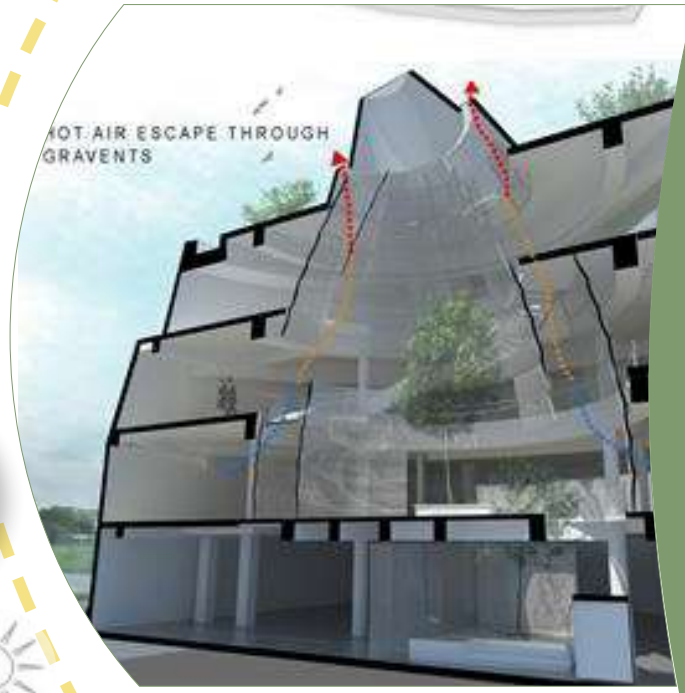
Dense vegetaion cover is provided throughout site to moderate microclimate in the vicinity

ENERGY-EFFICIENT DESIGN

Percentage of interior lighting load offset by renewable energy generation at site is **100%**

Reduction of embodied energy of project using AAC blocks in the building is **84.32%**

Low energy materials used for doors, windows, frames, and flooring make up the total materials by **83.34%**



Section showing the working of gravents for ventilation in the building

ENVELOPE PERFORMANCE FOR COMFORT

29.9%
is the Window Wall Ratio of the Building

0.47 W/m²K
Uvalue of the external walls

60.96%
Total living area is day lit &meets prescribed day lit factor by NBC 2005

0.39 SHGC
36 % VLT
5.15 W/m²K U value
for the facade glazing in the project, complying to requirements of ECBC 2007

PASSIVE DESIGN STRATEGIES

ORIENTATION

- Building is oriented with longer sides facing North-South direction to bring in glare free natural light & minimal heat gain

- The lake on the Eastern side of the site &extending the lake into the site as a bio pond has been driving core of this design. Porosity allows breeze to flow through the building atirums as shown in left figure. The project has designed atrium where the hot air inside the building escapes through gravents

VEGETATION

- Green wall on the western side shields the building from harsh western sun. Green buffer zone in between green wall &usable spaces further cuts of the radiation &prevents heat gain

SHADING

- The Landscaping along with the shading devices in the west direction,at each floor acts as buffer space to minimise the heat gain

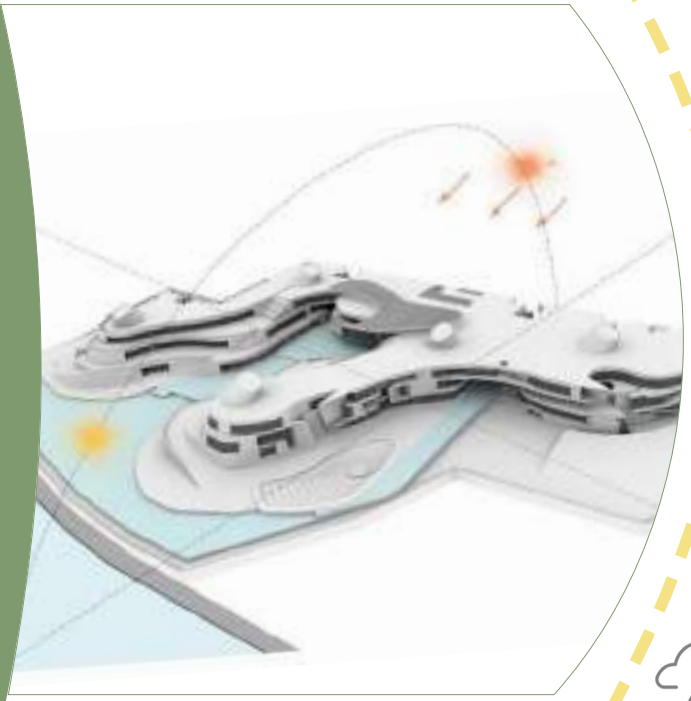


Diagram showing the sun path movement &shadows in the building.

LIFESTYLE & INNOVATION

Wet waste generated on site is treated in 2 Organic Waste Composter(OWC) installed at site

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Guided tours for awareness among visitors are organized to exihibit green features

WATER USE OPTIMIZATION

Three surface wells with filteration provided within site to aid rainwater recharge

59.45% Reduction water demand by using low flow fixtures for kitchen & toilets

62.6% Annual water resuse on site after treatment from STP for flushing & irrigation

R&D ASTRA MICROWAVE PRODUCTS, Rajkot, Gujrat

Site Area: **20,234 SQM**
Built-up Area: **10,215 SQM**
Client: **: ASTRA MICROWAVE PRODUCTS LTD.**
Green Building Consultant : **THE ENERGY &RESOURCE INSTITUTE**

CLIMATE
HOT &DRY

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
69.4%

TOTAL WATER DEMAND REDUCTION
62.7%

TOTAL NUMBER OF TREES
3

TOTAL RENEWABLE ENERGY CAPACITY
15
kW

FROM ENERGY SAVINGS
CARBON OFFSET
6,85,516.39
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **96%**

Existing 3 mature trees on site were preserved & protected during construction

Topsoil was preserved during site construction & reused in landscape within site

ENERGY-EFFICIENT DESIGN

Building oriented to allow solar gain in winter & avoid solar heat gain in summer

Percentage reduction in embodied energy of the building using AAC blocks & fly ash in concrete is **54%**

Materials used in the building interiors, such as UPVC for doors and window frames, are all low environmental impact materials, making up **100%**

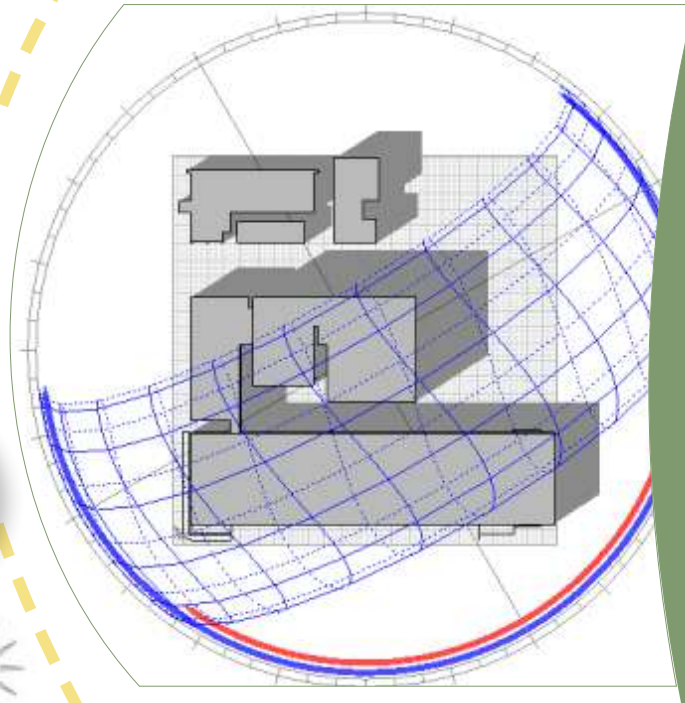


Diagram showing sun path above the building to create self shading among building blocks to reduce heat gain

ENVELOPE PERFORMANCE FOR COMFORT

0.41 W/m^2K

Uvalue of the external walls

< 32.11%

window wall ratio(WWR) for all buildings

0.38 SHGC

69 % VLT

1.64 W/m^2K **U value**

for the facade glazing in the project, complying to requirements of ECBC 2007

MAINTAINING INDOOR COMFORT LEVEL

52.95%

of total living area is day lit &meets daylight factor prescribed by NBC

AUTOMATIC LIGHT SHUTOFF

- Exterior lighting is managed by automatic timer controls to enhance energy efficiency

CONTROL IN DAY LIT AREA

- Manual switches and occupancy sensors in toilets and corridors ensure optimal lighting in naturally lit areas

TEMPERATURE CONTROL

- Thermostats and remote controls enable precise regulation of room temperatures

- A Variable Refrigerant Volume (VRV) system is installed for efficient space conditioning

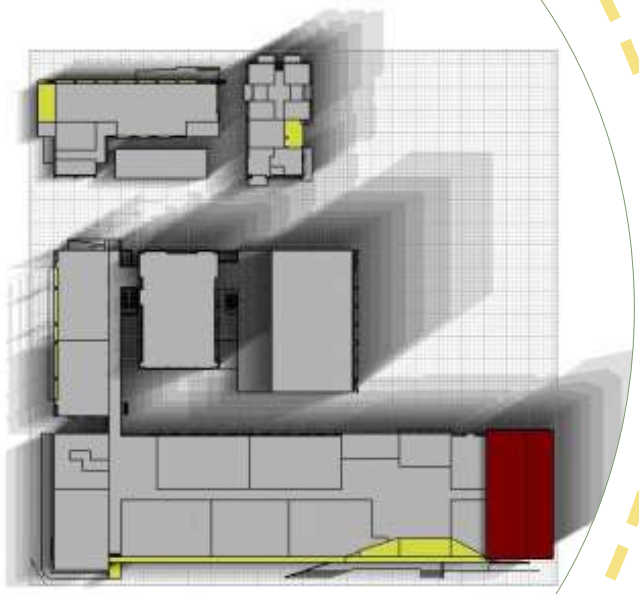


Diagram showing the shadows of the building to create self shading among building blocks to reduce heat gain

LIFESTYLE & INNOVATION

Universal accessibility implemented with measures of toilets, entrance ramps, lift with braille & dedicated parking spots

All wet waste generated on-site is composted into manure directly at the site

Posters showcasing the implemented green features are displayed on-site

WATER USE OPTIMIZATION

Six recharge pits have been constructed on-site to manage surplus rainwater

63.82% Reduction in water demand using low flow fixtures for kitchen & toilets

62.51% Reduction in annual landscape water demand by micro drip irrigation & multi sprinkler systems

Employee residential Building, ITC MUDFORT, Bengaluru, Karnataka

Site Area: **7,673.15 SQM**
Built-up Area: **13,875 SQM**
Occupancy: **352**
Client: **ITC LIMITED**
Principal Architect: **CNT ARCHITECTS**
Landscape Architect: **OIKOS STUDIOS**
Structural Consultant: **ISA –STRUCTURAL STUDIO**
Electrical Consultant: **AECOM**
Green Building Design & Certification: **ENVIRONMENT DESIGN CONSULTANT PVT. LTD**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
30.9%

TOTAL WATER DEMAND REDUCTION
98%

TOTAL NUMBER OF TREES
62

TOTAL RENEWABLE ENERGY CAPACITY
15
kW

CARBON OFFSET
9,44,901.3
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **96%**

Exisiting 42 trees were preserved & number of new trees planted at site is **22**

Sewer pipes are installed following the natural slope of the site eliminating need for pumping

ENERGY-EFFICIENT DESIGN

Building is oriented to maximize solar gain during winter while minimizing solar heat gain in summer

Percentage reduction in embodied energy of the building using AAC blocks & fly ash in concrete is **56%**

Materials used in the building interiors, such as UPVC for doors and window frames, are all low environmental impact materials, making up **100%**

Image showing vertical shading devices used on balconies at site to reduce heat gain

ENVELOPE PERFORMANCE FOR COMFORT

0.41 W/m²K
Uvalue of the external walls

14.65%
window wall ratio(WWR) for all buildings

0.5 SHGC
56 % VLT
5.6 W/m²K U value
for the facade glazing in the project, complying to requirements of ECBC 2007

OCCUPANT COMFORT STRATEGIES

68.5%

of total living area is day lit &meets daylight factor prescribed by NBC

AUTOMATIC LIGHT SHUTOFF
- Automatic timer control have been installed for all exterior lighting.

CONTROL IN DAY LIT AREA
- Manual switches are provided in all spaces to control comfort for occupants.

- 100% of the paints, adhesives &sealants are Low VOC.

- No smoking policy implemented at site to ensure no pollutants.

Louvers used to facilitate ventilation in stairwell & provide natural light to reduce energy load

LIFESTYLE & INNOVATION

Universal accessibility implemented with measures of toilets, entrance ramps, lift with braille & dedicated parking spots

All organic waste produced is processed int he 800 KG OWC installed at site

Posters on implemented green features are on display at site for awareness among visitors

WATER USE OPTIMIZATION

Six recharging pits for surplus rain water have been constructed on site.

60% Reduction water demand using low flow fixtures for kitchen & toilets.

59% Reduction in annual landscape water dem&using micro drip irrigation & spray systems.

LADIES HOSTEL, IISc, Bengaluru, Karnataka

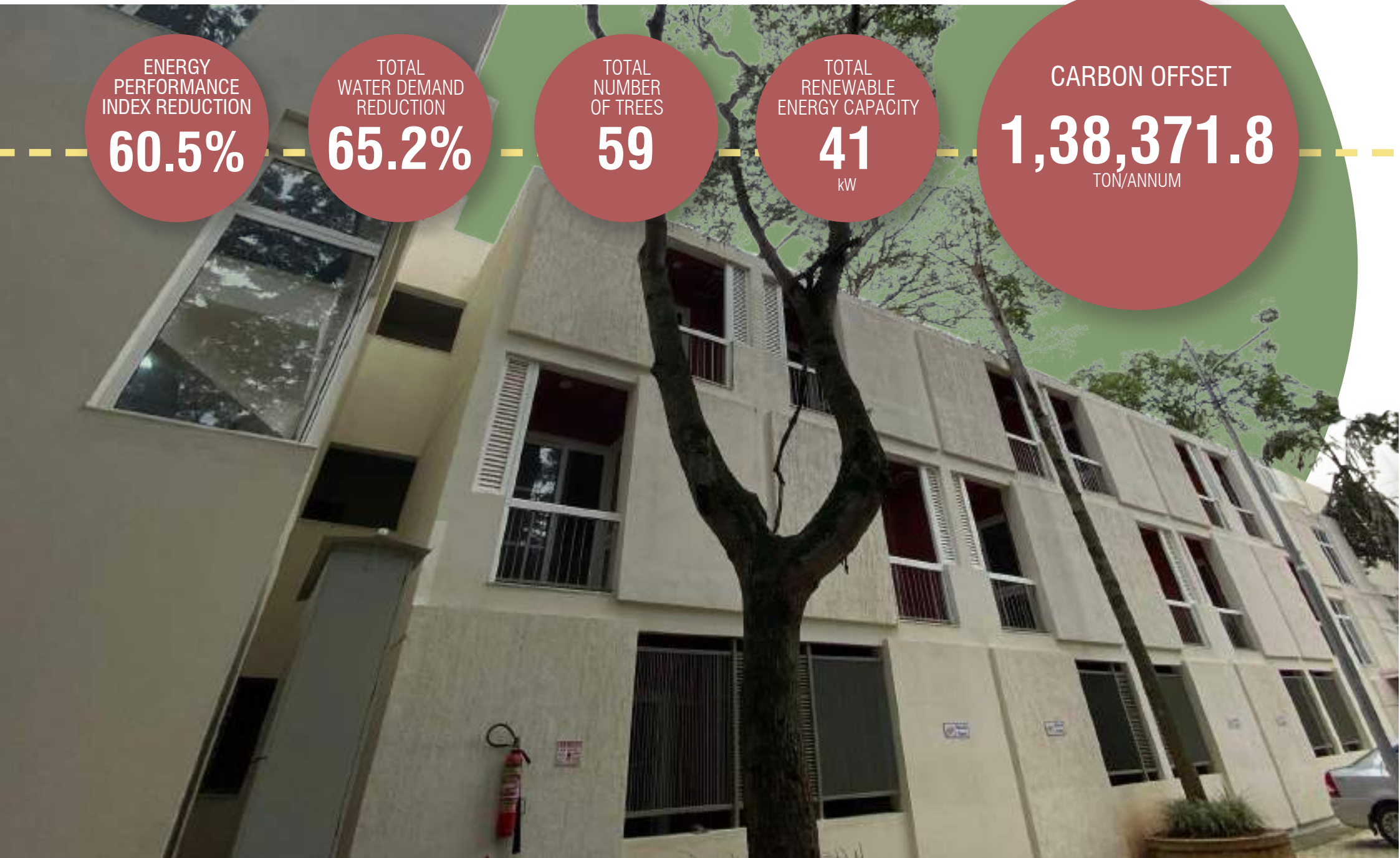
Site Area: **3403 SQM**
Built-up Area: **5473.43 SQM**
Year of completion: **2022**
Client: **INDIAN INSTITUTE OF SCEINCE**
Integrated Design Team: **ADVANI ASSOCIATES**
Green Building Consultant: **MINDWAGON SUSTAINABLE DESIGN**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
GRIHA

★ ★ ★ ★ ★



ENERGY PERFORMANCE INDEX REDUCTION
60.5%

TOTAL WATER DEMAND REDUCTION
65.2%

TOTAL NUMBER OF TREES
59

TOTAL RENEWABLE ENERGY CAPACITY
41
kW

CARBON OFFSET
1,38,371.8
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **51.7%**

Percentage reduction in landscape water demand by planting native species is **78%**

All 43 exisiting mature trees on the site preserved during construction

ENERGY-EFFICIENT DESIGN

Percemtage of internal artifical lighting load & HVAC needs met by solar photo voltaic is **44.4%**

Percentage reduction in embodied energy of the building using AAC blocks & fly ash in concrete is **38%**

Materials used in the building interiors, such as UPVC for doors and window frames, are all low environmental impact materials, making up **100%**

Image showing extra horizontal shading devices on west face for reducing direct heat gain

ENVELOPE PERFORMANCE FOR COMFORT

> 90%

Total living area is day lit &meets prescribed day lit factor

< 40db

Average indoor noise level in building

< 0.45 SHGC

Effective SHGC on all facades of the project

OCCUPANT COMFORT STRATEGIES

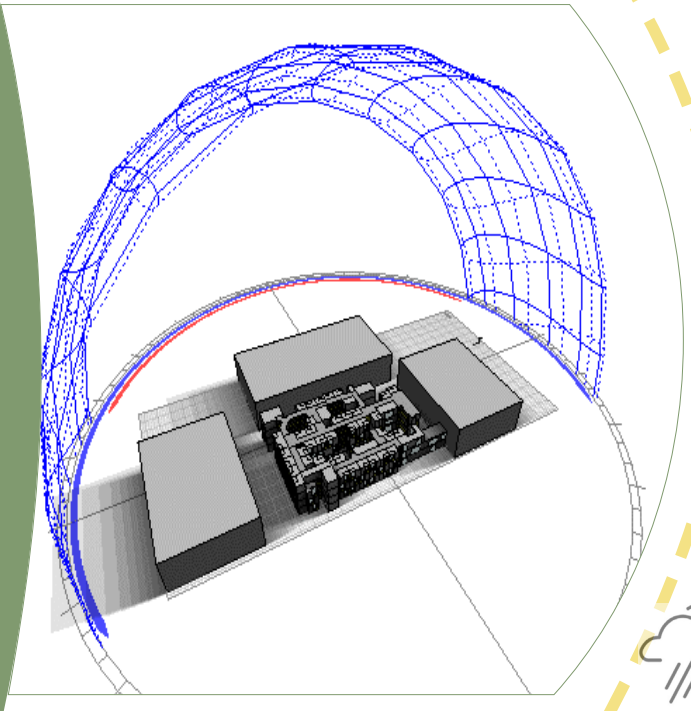
TEMPERATURE, RELATIVE HUMIDITY CARBON DIOXIDE

Sensors have been installed in the common areas of the project to monitor air quality

100%

Area of the project is naturally ventilated

Further 100% of the paint are all VOC free



Solar path diagram showing shading within the building blocks using staggered design

LIFESTYLE & INNOVATION

Universal accessibility implemented with measures of toilets, entrance ramps, lift with braille & dedicated parking spots

Dedicated waste segregation & collection area with six types of multicolour bins provided at site

Dedicated resting rooms & toilets for support staff has been provided at site

WATER USE OPTIMIZATION

Rain water harvesting at site with six recharging pits with appropriate filteration constructed at site

64.7% Reduction in water demand using low flow fixtures for kitchen & toilets

75.91% Annual site water requirements met through on-site treated wastewater & harvested rainwater

ANNEX BUILDING, EMPRI, Bengaluru, Karnataka

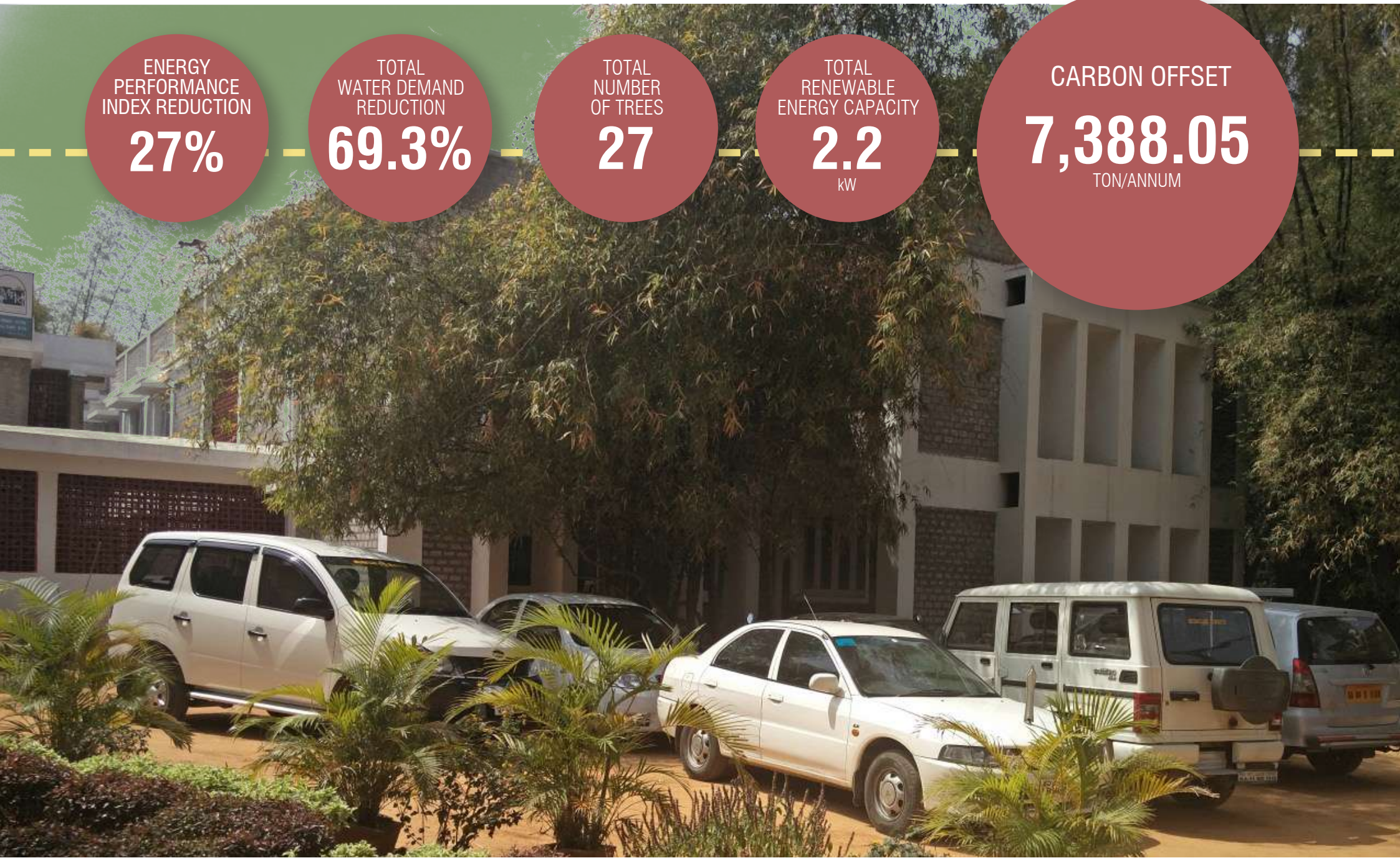
Site Area: **1,456.4 SQM**
Built-up Area: **1,283.4 SQM**
Occupancy: **46**
Client : **ENVIRONMENTAL MANAGEMENT & POLICY RESEARCH INSTITUTE**
Green Building Design & Certification : **THE ENERGY &RESOURCE INSTITUTE**

CLIMATE
WARM & HUMID

TYPE
COMMERCIAL

RATING
SVA GRIHA

★ ★ ★ ★



OPTIMIZATION OF SITE USING PASSIVE DESIGN STRATEGIES

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **71.8%**

Buffer spaces are strategically placed on the eastern and western facades to minimize heat gain

Exisiting six trees were preserved & number of new native trees planted at site is **21**

ENERGY-EFFICIENT DESIGN

Percentage of Total living area is day lit & meets daylight factor prescribed by NBC is **34%**

Reduction in embodied energy using CSEB blocks & PPC for construction is **29.55%**

LPD (W/sqm) of the project, achieved using LEDs, lower than the ECBC specificatio is **3.29**

Image showing ventilators in the facade of the building with appropriate shading & showcasing the light coloured facade

ORIENTATION

- The building open on three sides & all windows are oriented along the Northwest & North east façade for maximum exposure to wind &enhance ventilation.

- The interior layout of the building has integration of courtyard spaces, which are strategically placed for integration of daylight in the spaces.

- The building has buffer spaces of store room, toilets, & staircases in eastern, north eastern parts to reduce heat gain in regularly occupied spaces.

VENTILATION

- The predominant wind direction in Bangalore varies from West to North- Western Direction. The ventilation occurs through windows & ventilator above it.

OPTIMIZING ENVELOPE PERFORMANCE FOR COMFORT

125
sq. ft./TR

The thermal efficiency of the building envelope by providing following measures

- Compressed Soil Earth Blocks (CSEB) for external & internal walling application.

- Light coloured exterior facade & high SRI tiles used on the roof to reduce heat gain through envelope

- 32.13% reduction in overall insolation achieved by project using shading for openings.

Plan showing the buffer areas marked in red & the courtyards marked in green in the building

LIFESTYLE & INNOVATION

Efficient segregation & collection of waste generated using coloured bins on site

Environmental awareness initiatives through panels, brochures, magazines & newsletters at site

Dedicated resting rooms & toilets for support staff has been provided at site

WATER USE OPTIMIZATION

85.36% Annual water resuse in irrigation by harvesting rain water at site.

54.96% Reduction in water demand by using low flow fixtures for kitchen & toilets

75% of the two-day water demand can be met with a rainwater storage tank of 13,592 liters at site

O BY TAMARA HOTEL, Thiruvananthapuram, Kerela

Site Area: **5,849.12 SQM**
Built-up Area: **12,804.82 SQM**
Occupancy: **1730**
Client: **TAMARA GROUP HOTELS**
Principal Architect: **IYER & MAHESH**
Project management: **PROMAG**
HVAC Consultant: **ALEX SYRIAC ASSOCIATES**
Green Building Design & Certification: **TERRA VIRIDIS**

CLIMATE
HOT & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
69.8%

TOTAL WATER DEMAND REDUCTION
48.7%

TOTAL NUMBER OF TREES
45

TOTAL RENEWABLE ENERGY CAPACITY
15
kW

CARBON OFFSET
35,40,511.5
TON/ANNUM

STRATEGIC SITE PLANNING

Reduction in annual irrigation demand using palnting native species, drip & micro spray systems is **43.3%**

Utility corridors were strategically consolidated and aligned with pathways to enhance planning efficiency

Percentage of Site's outdoor lighting system is fully controlled by automatic controls to ensure efficiency, is **100%**

ENERGY-EFFICIENT DESIGN

Percentage of Total living area is day lit & meets daylight factor prescribed by NBC is **77.2%**

Reduction in embodied energy using AAC block in non structural construction application is **54.4%**

Materials used in the building interiors, such as UPVC for doors and window frames, are all low environmental impact materials, making up **90%**

Image showing jaali used for shading in the building

OPTIMIZING BUILDING DESIGN

ORIENTATION

- The building is a square plan, guest rooms are facing north-east, south-east, north-east &south-west based on the site to ensure no comprise for daylighting.

- The south-western façade is covered in Jalis used to screen the heat entering the banquet hall.

- The deck space is provided such that it is self-shaded by the two wings of the building.

FENESTERATION DESIGN

- Large windows are provided on the lower floors of the building with appropriate shading devices &high-quality glazing to decrease the heat gain.

- Windows in the guest rooms are reduced to optimum dimensions to reduce heat while ensuring optimum daylighting &fitted with low SHGC glass.

PASSIVE DESIGN FEATURES

1.62W/m²K
Uvalue of the external walls

2.3W/m²K
Uvalue of theRoof

20%
window wall ratio(WWR) for all buildings

0.23 SHGC
41 % VLT
1.4 W/m²K U value
for the facade glazing using Double glazed unit in the project, complying to requirements of ECBC 2007

Image showing self shading of building through chosen design form

LIFESTYLE & INNOVATION

Organic waste composter(OWC) of 400kg/ day provided for wet waste generated at site

Meters were installed for Utility, HVAC , PV, Raw water tank & STP outlet for monitooring

Dedicated parking, toilets & room were provided for for disabaled accessibility

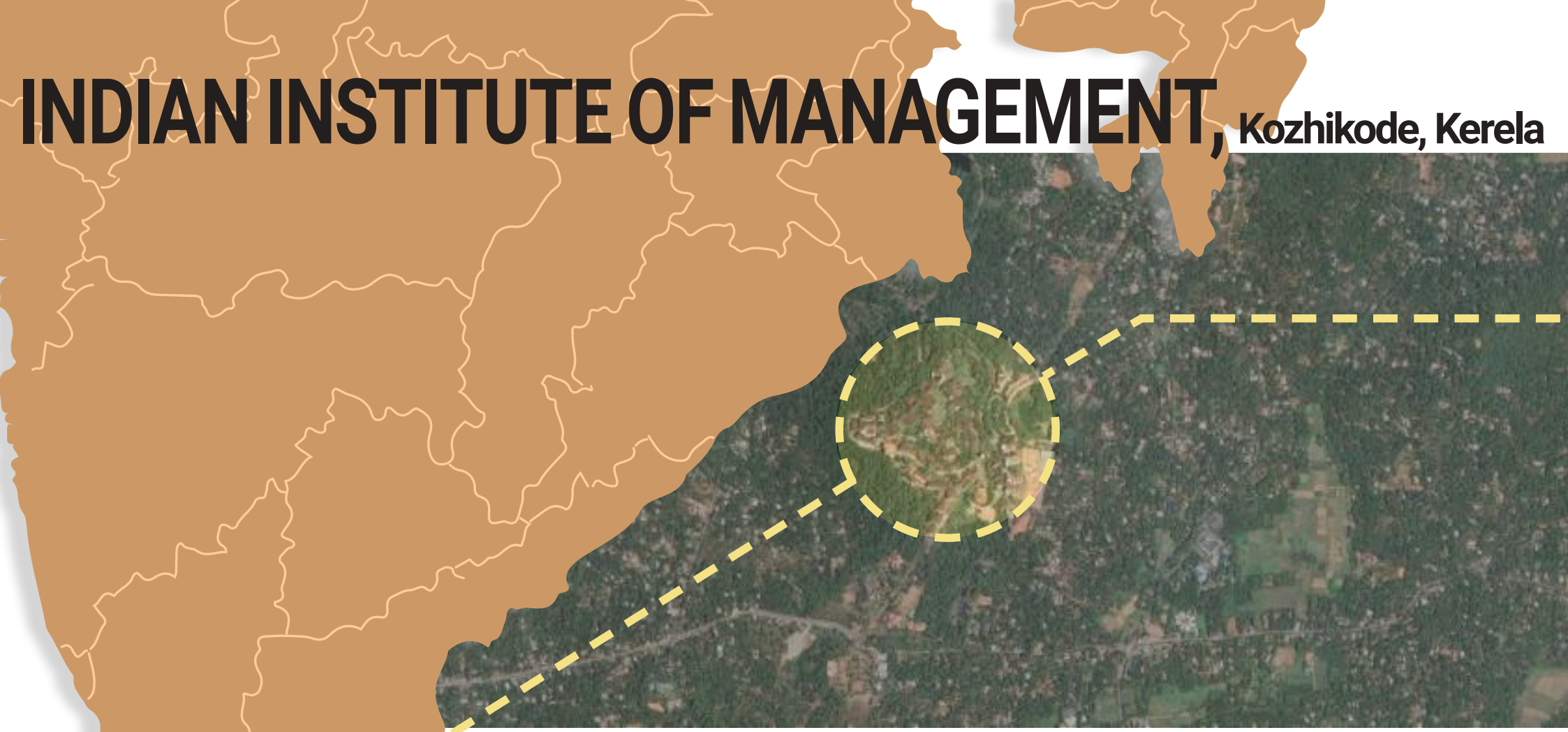
WATER USE OPTIMIZATION

45.7% Reduced water demand by using low flow fixtures for kitchens & toilets

Rain water tank of 200KLD along with 10 percolation pits provided for rain water harvesting & recharge

47.3% Annual water resuse on site for flushing &irrigation after treating from MBBR 150KLD STP

INDIAN INSTITUTE OF MANAGEMENT, Kozhikode, Kerela



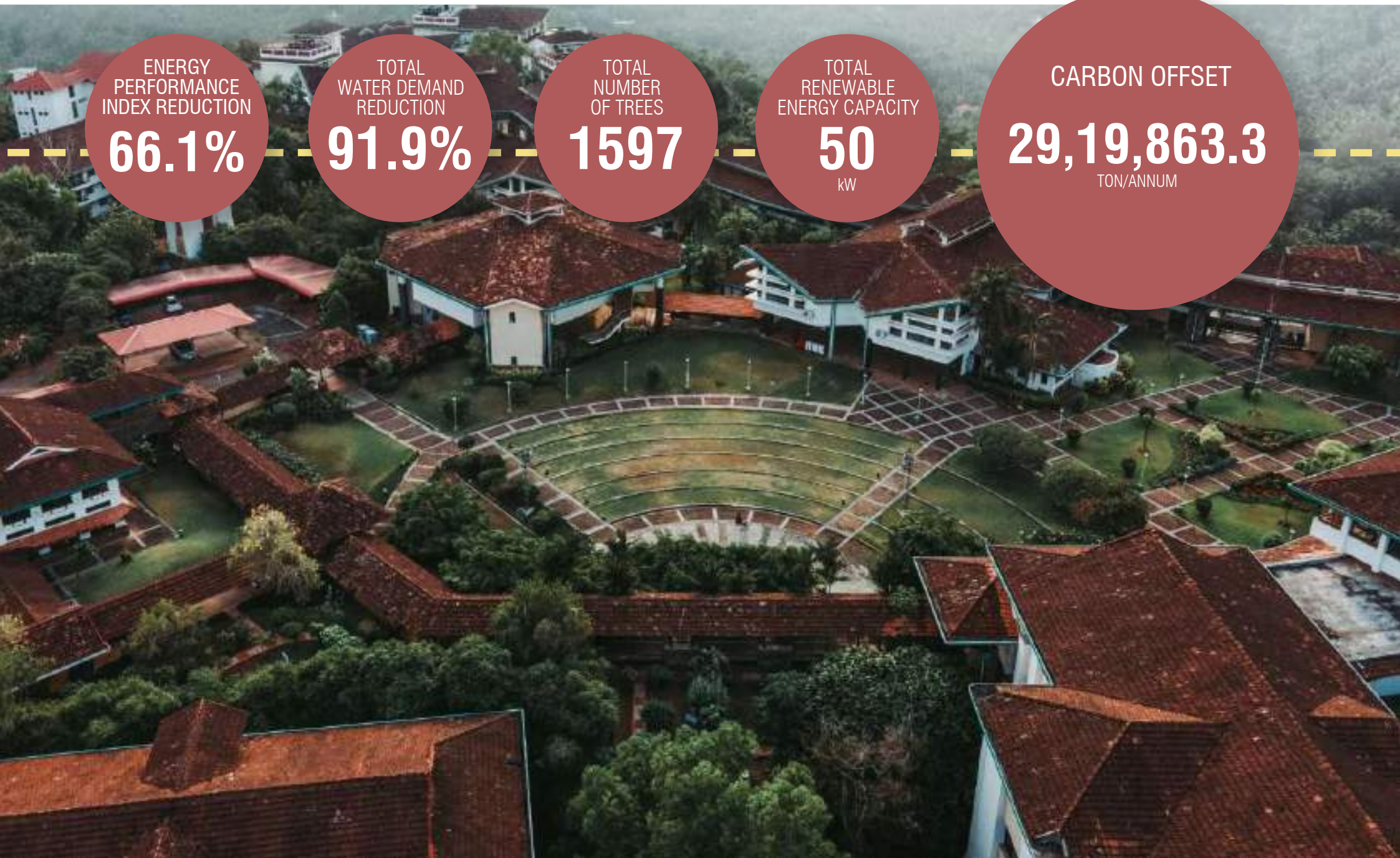
Site Area: **1,02,210 SQM**
Built-up Area: **29,599.41 SQM**
Number of Buildings**: 9**
Occupancy: **1175**
Client : **IIM KOZHIKODE**
Principal Architect: **URBAN ARCHITECTURE WORKS**
Landscape Architect: **VINYAS**
Structural Consultant: **VINTECH CONSULTANTS**
Green Building Design & Certification: **KALPAKRIT SUSTAINABLE ENVIRONMENTS PVT. LTD**

CLIMATE
HOT & HUMID

TYPE
INSTITUITIONAL

RATING
GRIHA

★ ★ ★ ★ ★



STRATEGIC SITE PLANNING

Pedestrian pathways in the project are fully shaded and covered, totaling **100%**

Percentage of the site area covered in landscape & green areas is **78.9%**

Exisiting 1012 trees were preserved & number of new trees planted at site is **585**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **52.3%**

Reduction of embodied energy of project using AAC blocks in the building is **40%**

Materials used in the building interiors for ineternal partitions, false cieling & built furniture are low environment impact materials

Site plan showing the drain channels at site in blue, culverts in red & the location of reservoir at site

INTEGERATED RAINWATER HARVESTING

- Rainwater runoff from the whole site is directed to the reservoir at site through trenches/ drain channels which are further connected to culverts

- Each building cluster has a rainwater recharge tank below the building for run off generated from roof tops & overflow

- Stored rainwater in recharge tank is treated & pumped to overhead tanks of the buildings for reuse

- The drainage pipes require no pumping as it is a gravity fed system, & the reservoir is located at the lowest point on site

- Excess over flow from the reservoir further collects into the retention pond at the site

PASSIVE DESIGN FEATURES

- Optimum orientation of buildings with longer facades facing north & South to avoid summer heat gain & allow maximum winter radiation, minimize east west sun.

- Adequately sized overhangs &effectively cut down summer radiations & rain lashians are used on southwestern side to prevent south sun.

- Entrances are sheltered from winds & direct radiation, & all walkways are covered to provide shelter to occupants

- Site designing is done to reduce cut & fill of natural slope during construction, thus reducing impact of building at site

- Thermal storage materials in glycol CTES system used for cooling

Image showing covered walkways marked in red & corridors with rain lashians

LIFESTYLE & INNOVATION

Dedicated & efficient waste segregation & collection area with six types of multicolored bins provided on-site

5% Total car parking is dedicated to alternative fuel vehicles & EV vehicles

Green education program, including campus tours and informational posters, is organized for occupants

WATER USE OPTIMIZATION

59.2% Reduction in water demand using low flow fixtures for kitchens & toilets

76.7% Reduction in annual landscape irrigation demand by planting native species plants & drip irrigation

100% Site water requirements met through 114.2 KL rain water reservoir & reuse of treated water from MBBR type 140KLD STP plant

ATULYA IT PARK, Indore, Madhya Pradesh

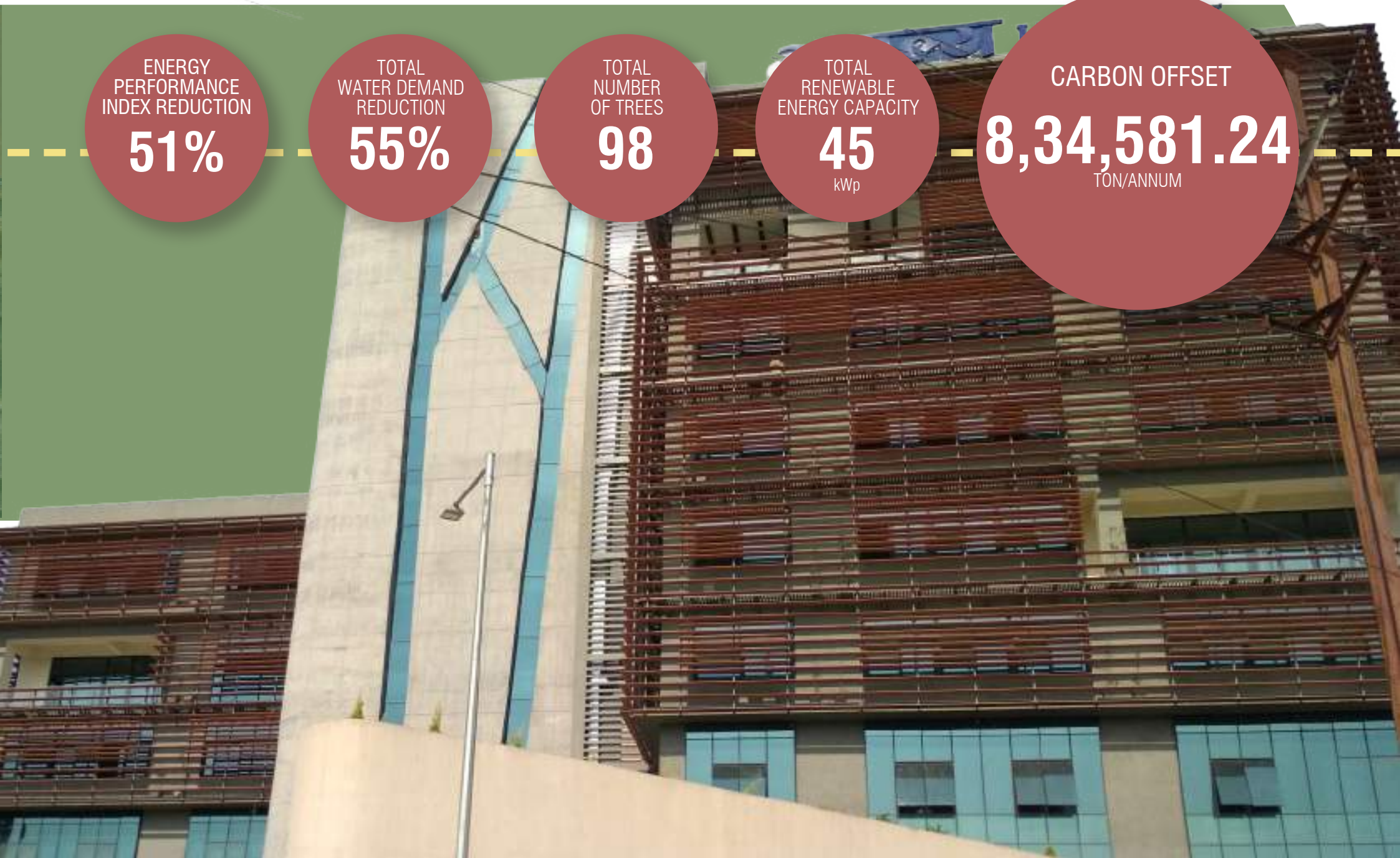
Site Area: **8,130 SQM**
Built-up Area: **14,050 SQM**
Year of completion: **2019**
Occupancy: **1450**
Client: **MP INDUSTRIAL DEVELOPMENT CORPORATION R. O. INDORE**
Principal Architect: **NINE SQUARE ARCHITECTS PVT. LTD.**
Landscape Architect: **NINE SQUARE ARCHITECTS PVT. LTD.**
Project management: **KUNAL STRUCTURE(INDIA) PVT. LTD.**
Green Building Certification: **TECTON PROJECT SERVICES PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★



ENERGY PERFORMANCE INDEX REDUCTION
51%

TOTAL WATER DEMAND REDUCTION
55%

TOTAL NUMBER OF TREES
98

TOTAL RENEWABLE ENERGY CAPACITY
45
kWp

CARBON OFFSET
8,34,581.24
TON/ANNUM

STRATEGIC SITE PLANNING

Pedestrian pathways are partially shaded, with all utility corridors integrated along the pathways for efficient space utilization

Percentage reduction in landscape water demand utilizing sprinkler system is **55%**

Automatic timer-based controls have been provided for 100% street outdoor lighting

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **56.2%**

Use of AAC blocks in non-structural applications has resulted in a reduction of embodied energy by **54 %**

Materials used for flooring on-site, including Kota stone, marble, granite, and vitrified tiles, are low-energy, accounting for **72%**

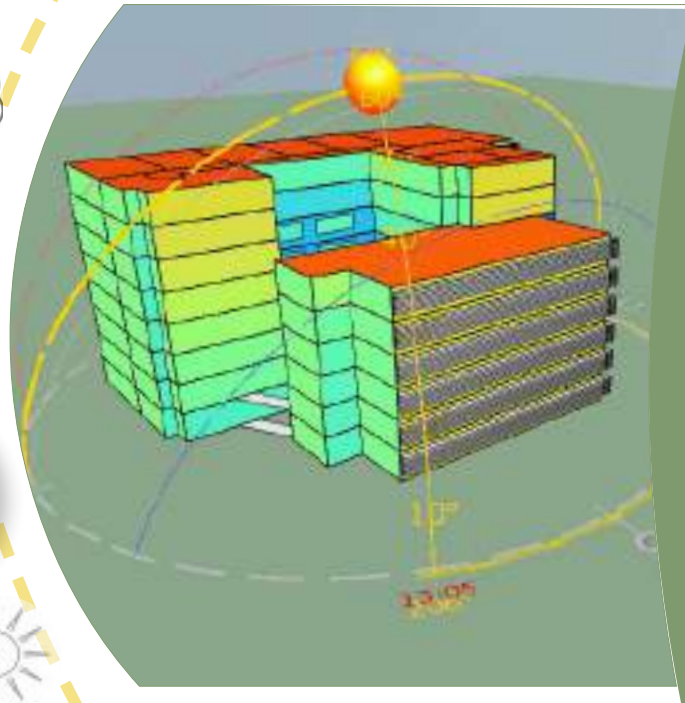


Image showing sunpath with heat gain on surfaces of the building with reduced surface heat gain in the courtyard because of shading

ENVELOPE PERFORMANCE FOR COMFORT

26.81%

Window Wall Ratio of the Building

0.22 SHGC

31% VLT

1.8 W/m²K U-value

Double Glazed units of above specifications installed in the building demonstrating the design for effcicency to reduce conventional energy demand in the building

PASSIVE DESIGN STRATEGIES

ORIENTATION

- The longer façade of the building is oriented in North-South direction; all the major active zones are provided in the North - South direction. The East- West face of the building houses service areas

- The building is designed with open corridors in the direction of prevailing wind to avail the channelization effect of wind, along the courtyards to reduce heat gain

SHADING

- During summers, the horizontal shading/ Louver devices do not allow direct sunlight to enter inside, therefore, the building does not receive any direct sunlight but reflected sunlight (glare free daylight)

- During winters, since the sun is at a lower angle, the building receives direct sunlight. Thus, the rooms are warm during the daytime

Close up image of horizontal louvres used installed at site to provide shading to the facade surfaces & reduce heat gain

LIFESTYLE & INNOVATION

Amenities such as a bus stop, bank, and post office are available within a ½ km radius of the project.

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Efficient waste segregation & collection area with six types of multicolored bins provided on-site

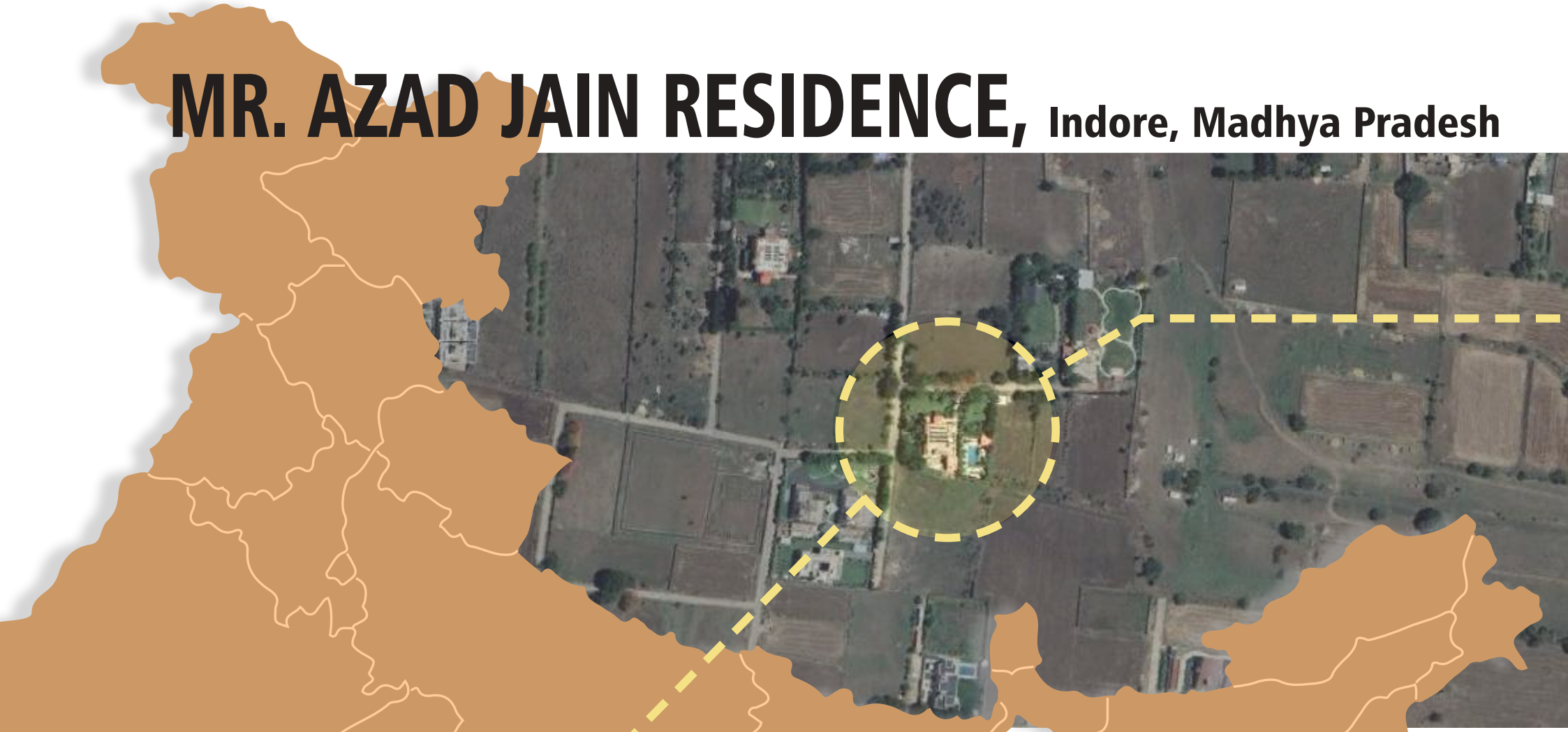
WATER USE OPTIMIZATION

Two rainwater recharge pits have been provided on-site to replenish the groundwater

54.6 % Reduced water demand by using low flow fixtures for kitchens & toilets

57% Annual water reuse in the project using DAFF+PVA gel MBBR type STP of 60 KLD capacity

MR. AZAD JAIN RESIDENCE, Indore, Madhya Pradesh



Site Area: **3,714 SQM**
Built-up Area: **541 SQM**
Occupancy: **10**
Client: **MR AZAD JAIN &MRS AASHA JAIN**
Principal Architect : **MR UMANG AGRAWAL & MR AZAD JAIN**
Green Building Consultant : **MR UMANG AGRAWAL**

CLIMATE
COMPOSITE

TYPE
RESIDENTIAL

RATING
SVAGRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
22%

TOTAL WATER DEMAND REDUCTION
56.4%

TOTAL NUMBER OF TREES
36

TOTAL RENEWABLE ENERGY CAPACITY
2.2
kWp

CARBON OFFSET
1,987.41
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **57%**

Exisiting 2 trees were preserved & number of new trees planted is **34**

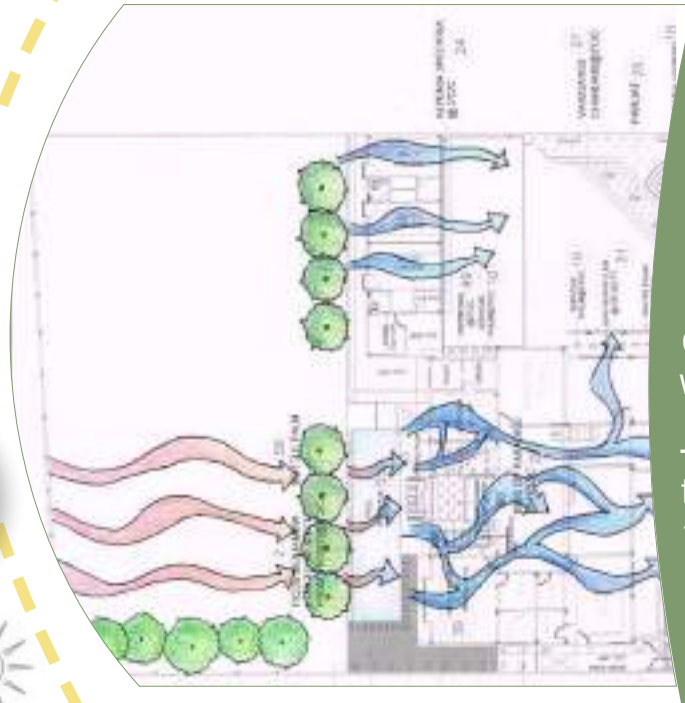
Dense vegetation cover and grass pavers are used to mitigate the Urban Heat Island Effect

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **91%**

Project achieves 3.13 LPD, which is significantly lower than the ECBC specified LPD limit of 10.80 W/sq.m, by using LED lights

The thermal efficiency of the building envelope is 119.63, effectively reducing heat gain and maintaining a low energy load.



Sketch showing courtyards with water feature for increasing day lighting & maintaining infoor comfort

VENTILATION THROUGH THE SITE

- The orientation of the building along east-west direction and the placement of openings on east west facades provided the opportunity to design the openings for enhanced cross ventilation

- The window openings are directly placed in the opposite directions of the rooms so that when the door-windows are opened, the air can flow from west-to-east

- With the predominant direction of incoming wind through the western façade of the building as per the wind rose diagram analysis, the wind ingress is tapped in by the western façade windows

- The air then flows from the western openings through the adjoining rooms before exiting from eastern façade

- This design thus promotes enhancednatural ventilation and contributes to effective architectural design for climate responsiveness

PASSIVE DESIGN FEATURES OF SITE

ORIENTATION

- The building is oriented east-west direction, thus increasing heat gain. This issue was mitigated by creating a dense vegetation cover on the west & east sides of the building

- With the presence of a number of trees, plants & shrubs in the vicinity of the building facades; the microclimate was affected to increase evapotranspiration & provide cooling effect. Also, with the presence of dense vegetation solar exposure of the incident wall is controlled

REDUCING HEAT GAIN

- Window overhangs have been designed to shade the window exposed to harsh west sun. Together with the use of DGU & adequately sized overhangs, the heat ingress is minimized from the west façade

Image showing grass pavers used on site & pergolas placed for shading

LIFESTYLE & INNOVATION

Organic waste generated on-site is treated through vermicomposting, converting it into manure

A dedicated kitchen garden is mainatained to provide organically grown vegetables/fruits for residents

Dediated resting rooms & toilets has been provided for support staff

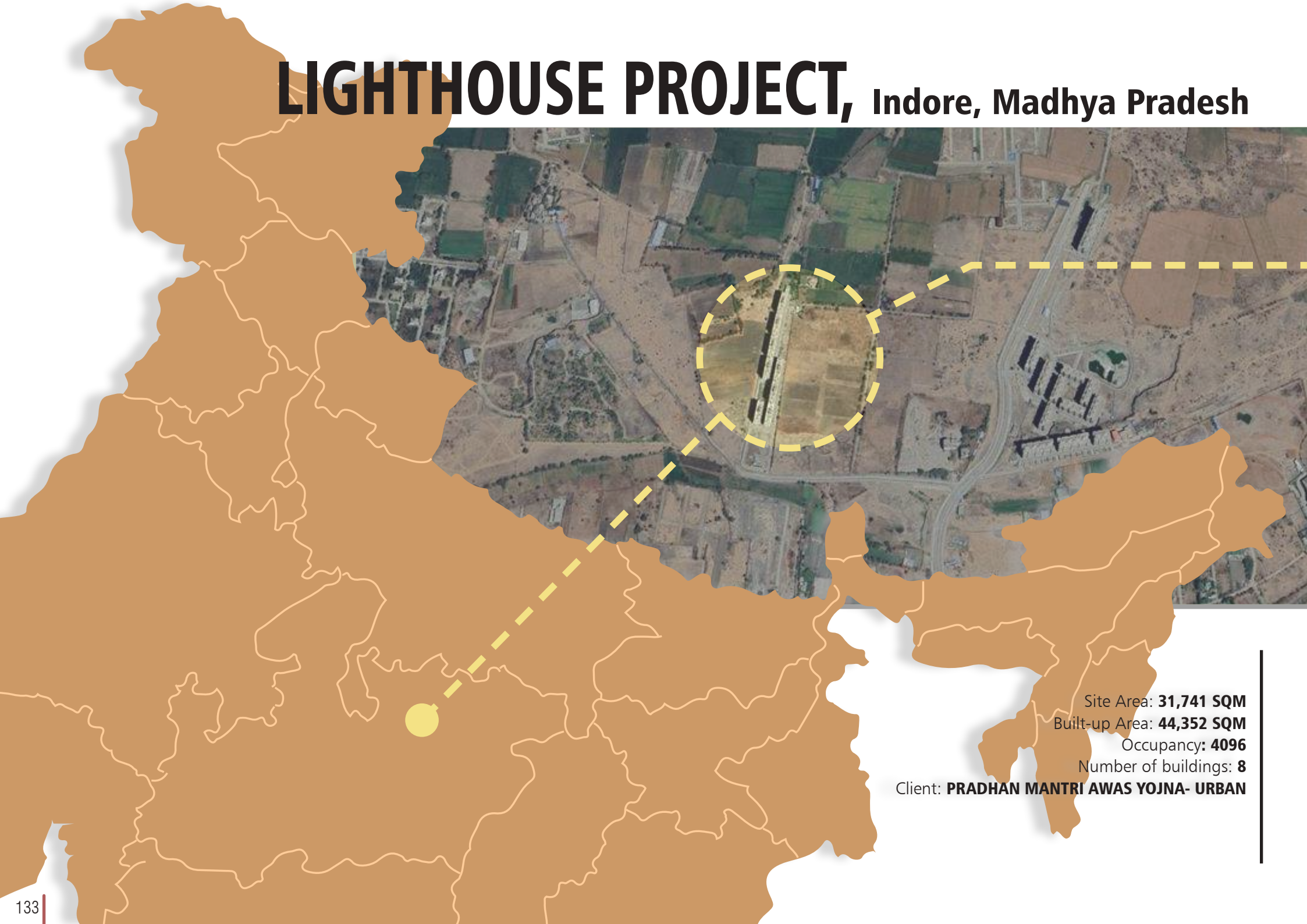
WATER USE OPTIMIZATION

Waste water generated on the site is treated & reused in landscape irrigation using on site STP

56.48% Reduced water demand by using low flow fixtures for kitchen & toilets

75.91% Rainwater storage capacity of 13,592 liters has been provided to fulfill the water demand for two days,

LIGHTHOUSE PROJECT, Indore, Madhya Pradesh



Site Area: **31,741 SQM**
Built-up Area: **44,352 SQM**
Occupancy**: 4096**
Number of buildings: **8**
Client: **PRADHAN MANTRI AWAS YOJNA- URBAN**

CLIMATE
COMPOSITE

TYPE
RESIDENTIAL

RATING
GRIHA AH

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
38%

TOTAL WATER DEMAND REDUCTION
41%

TOTAL NUMBER OF TREES
521

TOTAL RENEWABLE ENERGY CAPACITY
40
kW

CARBON OFFSET
11,76,954
TON/ANNUM

STRATEGIC SITE PLANNING

Reduction in irrigation water demand using sprinkler system and planting native species is **54%**

Number of new trees of native species planted at site along the periphery is **516**

Percentage of total site surface shaded &/or covered with high SRI paint is **53.2%**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **54%**

More than 25% OPC replaced with flyash used in structural construction to reduce environemental impact & embodied energy

Materials used for interiors are low energy comprising Kota stone, cermaic tiles, granite & vitrified tiles, accounting for **70%**

Photograph showcasing EPS cement panels constrcution for walls

OPTIMIZING BUILDING ENVELOPE TO REDUCE ENERGY DEMAND

EPS Cement sandwhich panels for internal & external wall construction with U value of

≥ 0.1 W/m2K

6mm Single glazed unit for facade glazing in the project, complying to requirements of ECBC 2007 of following values

5.3 W/m2K U value
0.85 SHGC
0.89 VLT

Reducing Peak heat gain of the building to 30.69 W/m2 using these measures

ACTIVE AND PASSIVE LOW IMPACT DESIGN STRATEGIES

LIGHT COLOURED EXTERNAL SURFACES:
- Light colour scheme used for all external surfaces to reduce heat gain through walls, reducing heat gain from envelope

ORIENTATION:
- All service areas are provided in areas located in unfavourable orientation to give buffer areas from direct solar heat gain

- Chajja provided for shading of windows and inset balconies to reduce direct heat gain

ACTIVE FEATURES:
- BEE 3-star equivalent appliances were installed in the project

- Renewable Energy installed as solar panels on rooftop 964 sw. meter roof top is shaded

- Solar powered street lights have been installed

Photograph showcasing light-colored exteriors with windows and inset balconies for shading to reduce heat gain and suffcient daylighting

LIFESTYLE & INNOVATION

Smart metering is implemented for energy consumption, renewable system and common area lighting

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Waste segregation is promoted on-site through dedicated chutes and separate coloured bins

WATER USE OPTIMIZATION

Water reuse at site after treatment from 440KLD Moving Bed Bio Reactor (MBBR) type STP for irrigation

28.5% Reduction water demand by using low flow fixtures for kitchen & toilets

Excess runoff managed on site through rainwater harvesting with storage capacity of 169.45 cubic meter

SMART DATA ENTERPRISES, Nagpur, Maharashtra

Site Area: **3000 SQM**
Built-up Area: **2972 SQM**
Year of completion: **2015**
Client: **SMARTDATA ENTERPRISES (I) LTD**
Principal Architect: **EKVEERA ARCHITECTS**
Project Management Consultant **: SMARTDATA ENTERPRISES (I) LTD**
Project Coordinator**: SMARTDATA ENTERPRISES (I) LTD PRINCIPAL**
Green Building Design & Certification: **AMAR NATH, SCUBE SOLUTION**

CLIMATE
HOT & DRY

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

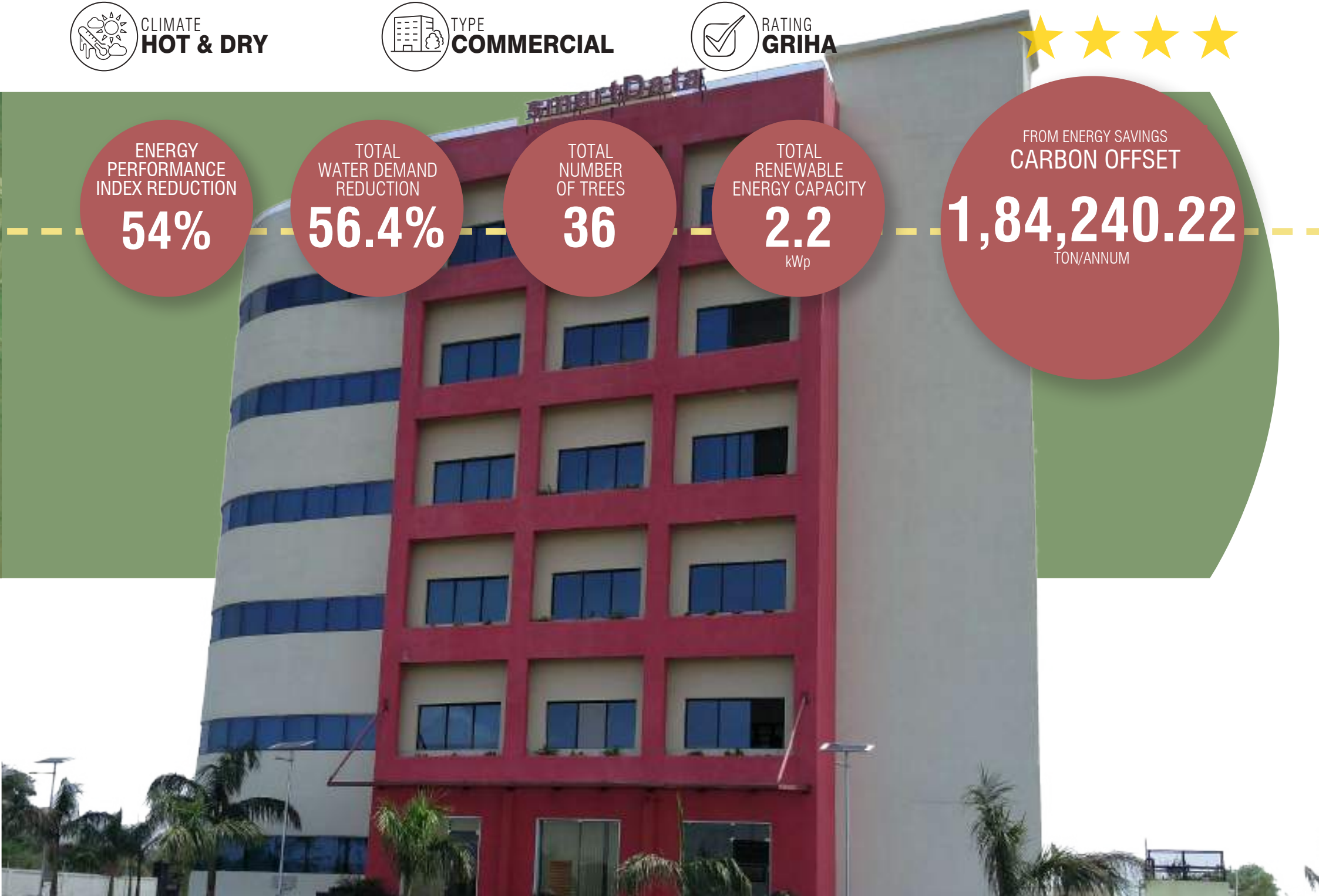
ENERGY PERFORMANCE INDEX REDUCTION
54%

TOTAL WATER DEMAND REDUCTION
56.4%

TOTAL NUMBER OF TREES
36

TOTAL RENEWABLE ENERGY CAPACITY
2.2
kWp

FROM ENERGY SAVINGS
CARBON OFFSET
1,84,240.22
TON/ANNUM



STRATEGIC SITE PLANNING

Height of the building utilized to place wind turbine at roof level to generate renewable energy

Utility corridors were strategically consolidated and aligned with pathways to enhance planning efficiency

Exisiting 3 trees were preserved & number of new trees planted is **90**

ENERGY-EFFICIENT DESIGN

Automatic timer installed for all outdoor lighting for enhancing efficiency of energy use.

Use of AAC & FlyAsh blocks in non-structural applications has resulted in a reduction of embodied energy by **69%**

Materials used for flooring on-site, including Kota stone, marble, granite, and vitrified tiles, are low-energy, accounting for **100%**

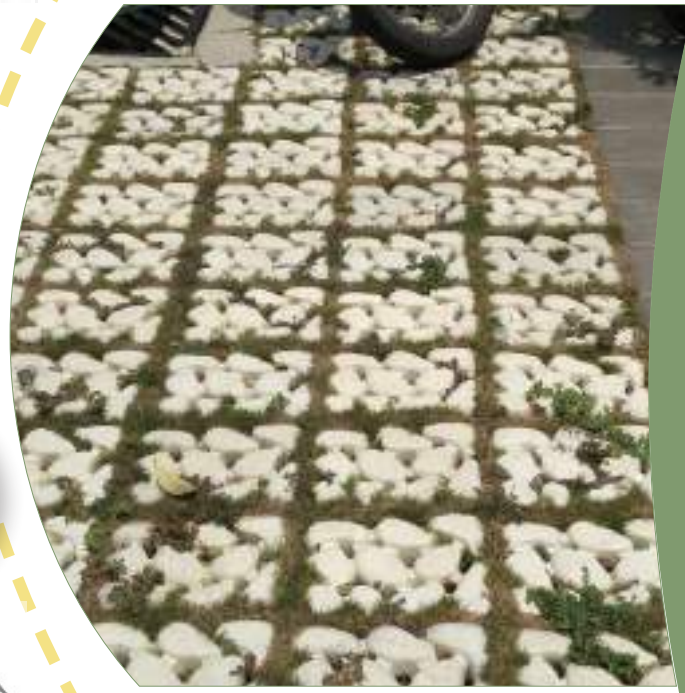


image showcasing the use of grass pavers for parking & rain water recharge pit constructed along it

ENVELOPE PERFORMANCE FOR COMFORT

12.57%

window wall ratio(WWR) for all buildings

85%

of total living area is day lit &meets daylight factor prescribed by NBC

0.23 SHGC

31 % VLT

1.76 W/m²K U value

for the facade glazing in the project, complying to requirements of ECBC 2007

PASSIVE DESIGN STRATEGIES

- The building is oriented along the Northeast–Southwest axis, following the plot orientation, with a compact square shape

- Services are placed towards the Southeast, acting as buffer spaces and preventing direct heat gain

- A corridor faces the southern side to reduce the direct impact of the sun on the workspace

- Each floor has a balcony facing Northeast, providing open air while avoiding the summer sun

- Open parking is placed on the Northeast side, with a green cover for shade

- The building also provides a natural canopy to shield from the Southwestern sun

- Vegetation is strategically planned to serve as a radiation-absorbent surface and for its evaporative cooling and shading properties

Image showing the wind turbine installed at the rooftop of the project for renewable energy generation

LIFESTYLE & INNOVATION

Smart metering and monitoring are implemented for energy & water usage in irrigation, the HVAC plant & lighting

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Green building awareness is promoted through company memos and website campaigns.

WATER USE OPTIMIZATION

57.7% Annual water resuse on site using treated water from STP &harvested rain water

56.86% Reduced water demand by using low flow fixtures for kitchen & toilets

42% Reduction in annual landscape water demand using drip irrigation &micro sprinkler systems

BHARAT PETROLEUM CORPORATION LTD. RESIDENTIAL BUILDING, Mumbai, Maharashtra

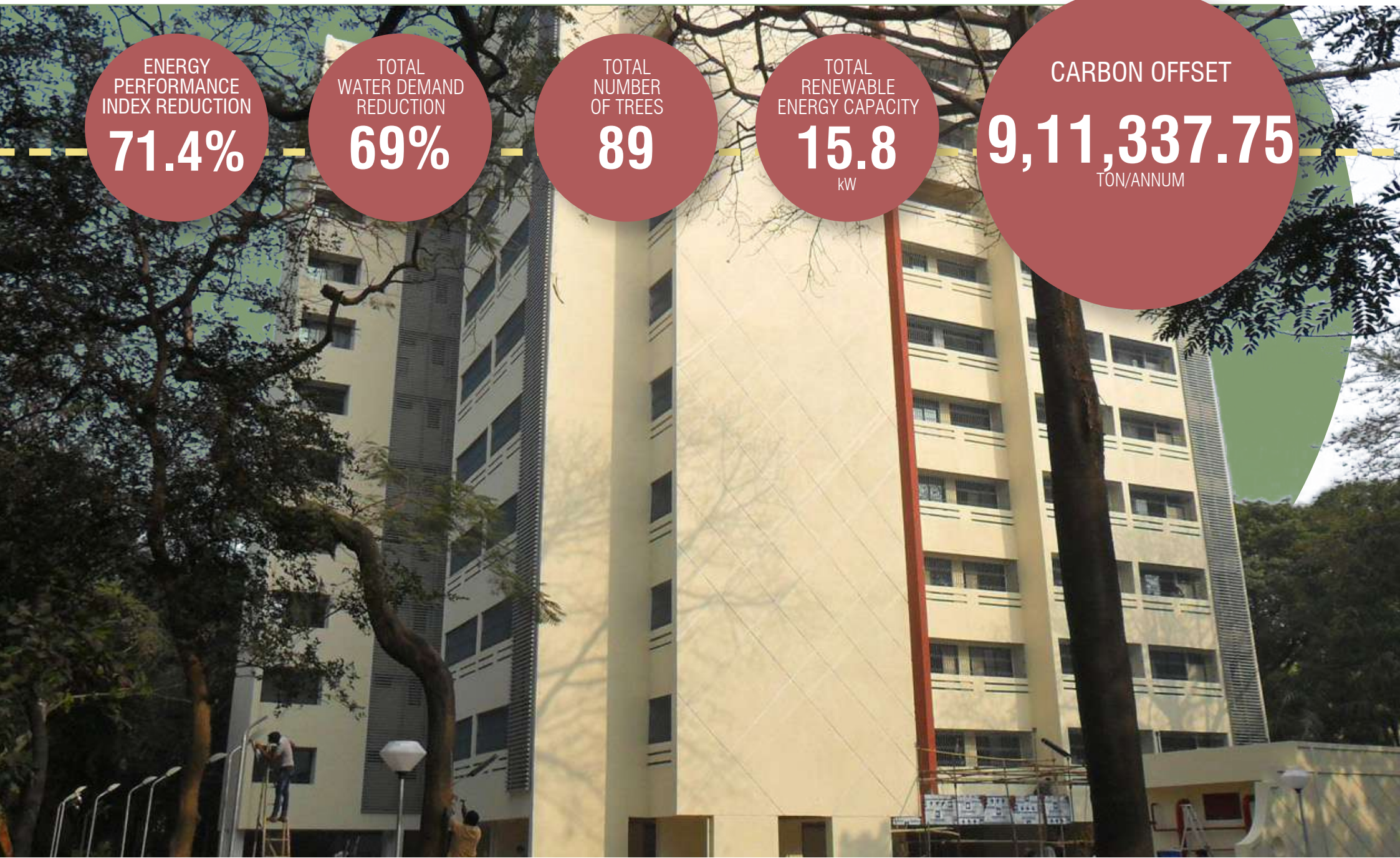
Site Area: **2,754 SQM**
Built-up Area: **6966 SQM**
Client: **BHARAT PETROLEUM CORPORATION LIMITED**
Principal Architect: **CNA ARCHITECTS**
Landscape Architect: **CNA ARCHITECTS**
Structural Consultant: **HDB DESIGN SERVICES**
Electrical Consultant: **NAT ENGG. CONSULTANT**
Green Building Design & Certification: **SURMOUNT ENERGY SOLUTIONS PVT. LTD. & CNA ARCHITECTS**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
GRIHA

★ ★ ★ ★



STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **38.8%**

Sewage and stormwater drainage systems are designed to follow the site's natural slope

Exisiting 33 trees were preserved & number of new trees planted is **55**

ENERGY-EFFICIENT DESIGN

Percenatge of Internal artifical lighting capacity & HVAC needs met by solar Photo Voltaic **20 %**

Use of AAC & FlyAsh blocks in non-structural applications has resulted in a reduction of embodied energy by **10.7%**

Materials used for flooring on-site, including Kota stone, marble, granite, and vitrified tiles, are low-energy, accounting for **80%**

Image illustrating a rooftop with high Solar Reflectance Index (SRI) tiles, effectively reducing heat absorption, while solar panels provide additional shading and generate renewable energy

ENVELOPE PERFORMANCE FOR COMFORT

23%
is the Window Wall Ratio of the Building

0.47W/m²K
Uvalue of the external walls

88%
Total living area is day lit & meets prescribed day lit factor by NBC 2005

0.42 SHGC
32 % VLT
The facade glazing in the project, complying to requirements of ECBC 2007

PASSIVE DESIGN STRATEGIES

- Building is irregularly shaped to accommodate the existing tress at site. Site disturbances were further minimized by reducing building footprint & maximizing open space

- Windows were provided in all directions to maximize ventilation & daylight in the interior spaces. Appropriate shading is provided to windows to reduce direct heat gain

- Hardscaped areas are kept to minimum to reduce urban heat island effect. The open area is covered with interlocking pavers &shaded by an existing cluster of mature trees at site

- Adequate ventilation is ensured in the open areas using stack effect to maintain optimal thermal comfort. Each flat receives minimum fresh air &ventilation as all windows have direct openings to the outdoors

image depicting the entrance of a building with a dedicated display showcasing and spreading awareness on builinding's green features

LIFESTYLE & INNOVATION

All organic waste generated on-site is processed through two vermi-composting pits

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Detailed leaflet is provided to visitors at the reception, highlighting the project's green feature

WATER USE OPTIMIZATION

Two rainwater recharge pits have been strategically constructed on-site to enhance groundwater replenishment

69% Reduction in water demand by using low flow fixtures for kitchen & toilets

79% Reduction in annual landscape water demand using micro drip irrigation & spray systems

ROYAL ORANGE COUNTY, Pune, Maharashtra

Site Area: **20,116.4 SQM**
Built-up Area: **23,967.53 SQM**
OCCUPANCY:
Client: **ECO SOLUTIONS**
Principal designer: **ABA ARCHITECTS**
Principal contractor: **HARIT DEVLOPERS**
Electrical Consultants: **VIRAJ ELECTRICALS**
Green Building Design & Certification: **ECO SOLUTIONS**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
GRIHA

★ ★ ★ ★ ★

STRATEGIC SITE PLANNING

Reduction in landscape water demand using drip irrigation and sprinkler systems is **50%**

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **54.8%**

Exisiting 3 trees were preserved & number of new trees planted is **239**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **73.7%**

Materials used in interiors on-site, including UPVC for doors & windows, are low-energy, accounting for **73.7%**

Use of AAC blocks & lime bricks in non-structural applications has resulted in a reduction of embodied energy by **25%**

Image showcasing inset windows and strategically designed shading balconies that minimize heat gain while enhancing natural ventilation

FENESTRATION DESIGN OF BUILDING

VENTILATION

- The narrow gap between buildings creates a high-pressure zone, while the open space on the other side forms a low-pressure zone, accelerating wind flow toward the next row of buildings.

- Balcony and terrace projections further reduce pressure, funneling wind and increasing velocity toward opposite terraces. The unobstructed gap ensures smooth airflow, enhancing natural ventilation.

SHADING

- Box projections on the north and south sides minimize direct solar penetration, while balconies act as external shading devices, reducing heat gain in summer.
- The facade is segmented into multiple elements, enhancing mutual shading. On the south, where heat gain is highest, balcony and facade projections further mitigate solar exposure.

PASSIVE DESIGN FEATURES OF SITE

ORIENTATION

- The building design is compact with a rectangular plan. The building orientation is optimum with respect to the orientation required in the tropics, which are longer sides along North South such that one face faces the North orientation.
- Buildings are planned such that there is unrestricted natural ventilation &re-radiate absorbed heat towards our site, thereby avoiding increased energy consumption.

VEGETATION

- The space on the periphery of the site is planted with various types of trees &shrubs to cool &filter the hot winds, before they enter the occupied interiors. More than 20% of the site area is under landscape. Hard paved area is Limited only for driveway for parking.
- Large evergreen trees are planted on the eastern boundary of the site, to deflect the winter winds. Tree shade provides comfort to the pedestrians.

Image highlighting buffer spaces, such as toilets, strategically placed on the west side of the building to reduce heat gain and enhance thermal comfort

LIFESTYLE & INNOVATION

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

User manual detailing the various sustainability measures implemented on-site is provided for awareness

100% Wet waste generated is treated through 300kg OWC on site

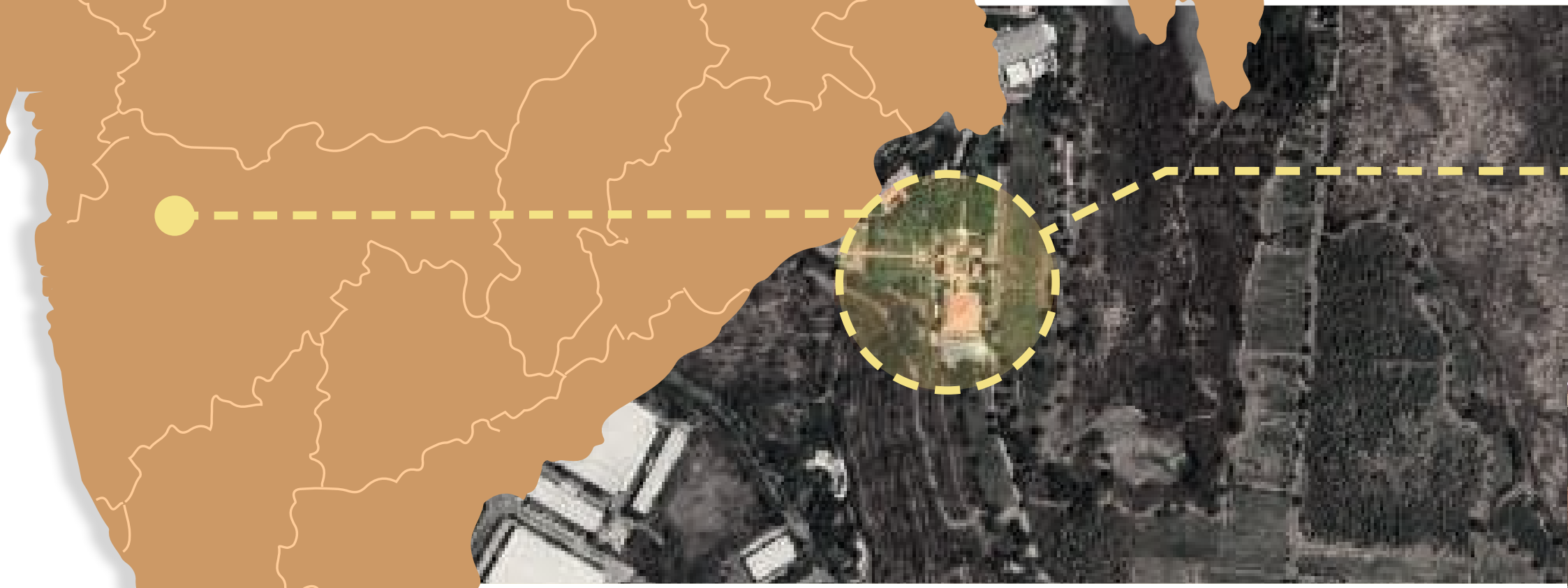
WATER USE OPTIMIZATION

Ten rainwater recharge pits with filtration systems have been constructed on-site to recharge groundwater

33.13% Reducetion water demand by using low flow fixtures for kitchen & toilets

27.37% Annual water resuse on site after treating from Phytorid system STP of 250KLD

GANDHI RESEARCH FOUNDATION, Jalgoan, Maharashtra



Site Area: **9,000 SQM**
Built-up Area: **6,000 SQM**
Occupancy: **118**
Client: **GANDHI RESEARCH FOUNDATION**
Principal Architect: **A MRIDUL**
Landscape Architect: **MR AJAY KALE**
Structural Consultant: **MR NARAYAN LALWANI**
Electrical Consultant: **MR VIKRANT BHANGALE**
Green Building Design & Certification: **MS DIPTI TALWAR**

CLIMATE
WARM & HUMID

TYPE
INSTITUTIONAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
65%

TOTAL WATER DEMAND REDUCTION
73%

TOTAL NUMBER OF TREES
25

TOTAL RENEWABLE ENERGY CAPACITY
20.2
kW

CARBON OFFSET
2,46,295.2
TON/ANNUM

SITE PLANING STRATEGIES

STRATEGIC SITE PLANNING

Building is strategically positioned to preserve the site's natural stormwater flow, ensuring efficient drainage

Exisiting 4 trees were preserved & number of new native tree species planted is 21

Basement is strategically placed in the low-lying areas of the contoured site, optimizing land use and minimizing excavation.

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of 85%

Materials used in interiors on-site are low-energy such as Unpoilished natural stone & Celluka sheets

Use of Fly ash blocks & lime plaster in non-structural applications has resulted in a reduction of embodied energy by 27.5%

mage highlighting the use of natural slopes in landscaping, seamlessly integrated with water bodies to enhance drainage & water conservation

- The site is contoured; hence planning is done in a way so that least cutting &filling is done. The low lying areas are used for constructing basement.

- Building has been designed to accommodate existing mature trees andto avoid cutting them.

- The site is naturally contoured &the building is placed on the ridge, not obstructing the natural storm water flow on the site. All the rain water has been diverted to an existing pond for collection through drain channels on site,

- The campus is planned for maximum pedestrian connectivity &the pathways are designed next to the building so that they remain shaded for most of the day.

PASSIVE DESIGN STRATEGIES

- The building's longer axis is oriented in the North – South axis in order to follow contours on site.

- The classrooms are inward facing with openings in North south directions, to increase the amount of natural daylight, with less heat & glare. This has direct effect on the reduction of energy consumption for artificial lighting &maintaining the comfort level in the rooms.

- A courtyard is designed in the centre of building to channelize air flow &break the mass of the building.

- Elongated eaves of the structure in the classroom &well recessed windows permits daylight & blocks the heat gain & glare.

Integration of water bodies on-site, along with minimal pervious paving, enhances natural drainage, mitigates heat buildup, and supports sustainability

LIFESTYLE & INNOVATION

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Efficient waste segregation and collection are ensured on-site through a color-coded bin system

Environmental awareness is promoted on-site through informational panels and brochures

WATER USE OPTIMIZATION

53.8% Annual water resuse from harvested rain water in irrigation

65% Redeuction in water demand by using low flow fixtures for kitchen & toilets

Rainwater is collected in natural ponds meets the annual water demand of the projects & cater to peak run-off from the site

PIMPRI CHINCHWAD NEW TOWN, Pune, Maharasthra

Site Area: **1,25,007.42 SQM**
Built-up Area: **53,173 SQM**
Number of buildings**: 16**
Occupancy: **600**
Client: **PIMPRI CHINCHWAD NEW TOWN DEVELOPMENT AUTHORITY**
Principal Architect: **LANDMARK DESIGN GROUP**
Electrical Consultant: **FEDERAL CONSULTANT**
Interior design: **LANDMARK DESIGN GROUP**
Green Building Design & Certification: **THE ENERGY &RESOURCES INSTITUTE, NEW DELH**

CLIMATE
HOT & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

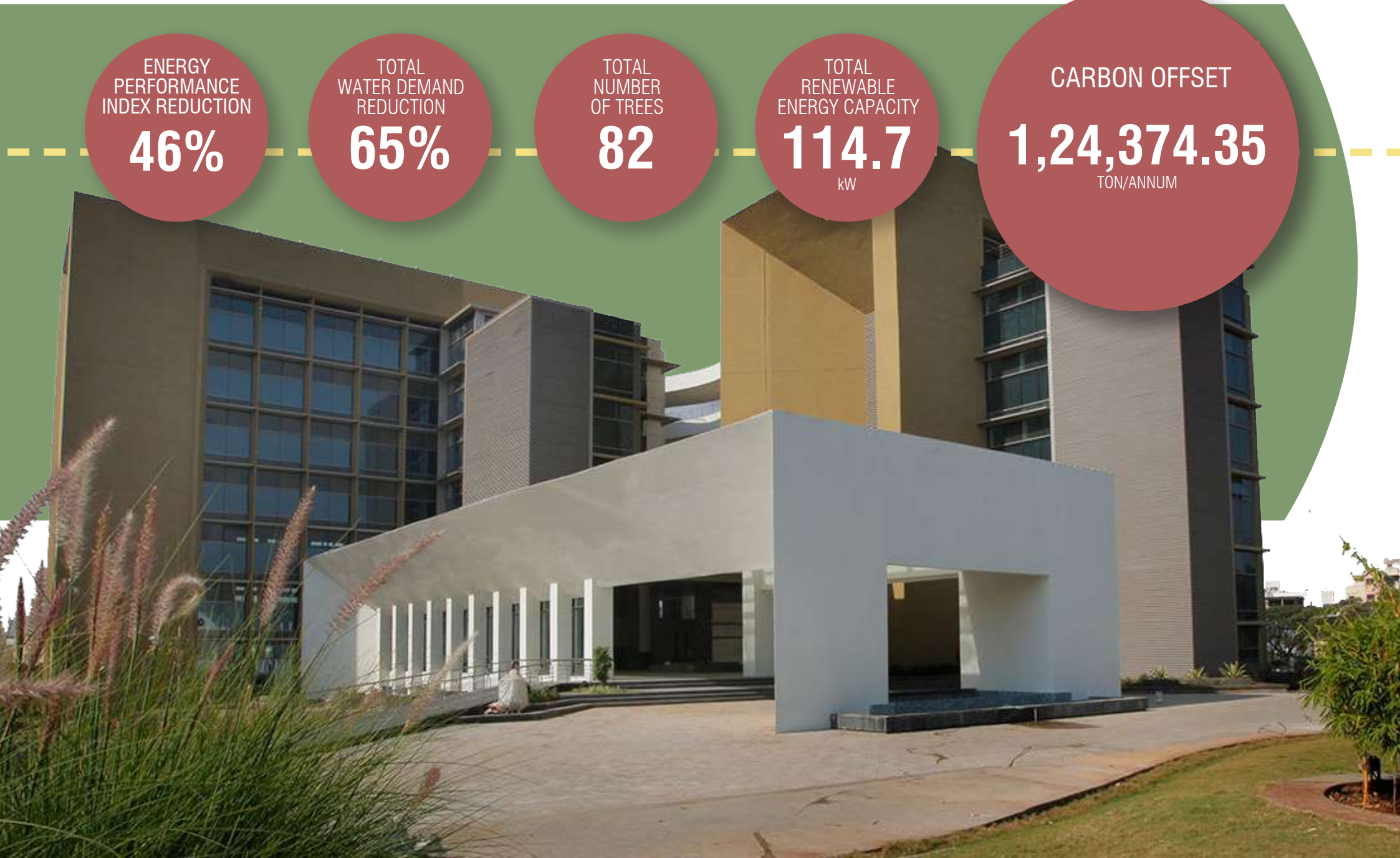
ENERGY PERFORMANCE INDEX REDUCTION
46%

TOTAL WATER DEMAND REDUCTION
65%

TOTAL NUMBER OF TREES
82

TOTAL RENEWABLE ENERGY CAPACITY
114.7
kW

CARBON OFFSET
1,24,374.35
TON/ANNUM



STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **43.5%**

Utility corridors are consolidated & strategically aligned with vehicular pathways for efficient planning

Reduction in annual irrigation demand by planting native species plants is **56.3%**

ENERGY-EFFICIENT DESIGN

Percentage of Fly ash content by weight in AAC blocks used to reduce embodied energy is **65%**

Percentage of indoor lighting and HVAC electricity needs met by the PV system is **82%**

Materials used in the building interiors for ineternal partitions, false cieling & built furniture, are low-energy, accounting for **74%**

Image showcasing the terrace garden on the east side, shaded by PV panels and complemented by a water body for evaporative cooling
Source: Landmark Design Group

OPTIMIZING BUILDING ENVELOPE

FENESTERATION DESIGN

- Full length openings on the North West & South East facades facilitate cross ventilation in the direction of natural wind patterns of site. Horizontal louvers shade these openings to prevent direct radiation from these critical facades.

- Light shelves are provided in all workspace areas to maintain glare free daylighting. Workspaces are of narrow depth to ensure daylight throughout the depth of the building.

REDUCING ENERGY CONSUMPTION

- Air-conditioned spaces were avoided, & fans are used to provide thermal comfort along with natural ventilation.

-All spaces are equipped with BEE 5-star appliances.

PASSIVE DESIGN FEATURES

ORIENTATION

- The building is designed to maximize daylighting & natural ventilation, so all workstations are in the East, South & East west axis &northwest axis. - PV panels are provided in the east to shade the roof along with the terrace garden. Further a water body is also provided for evaporative cooling in east.

REDUCING HEAT GAIN

- Window to wall ratio of the project is 38% &skylight to roof ratio is 2%, thus reducing direct heat gain.

- The U value of wall is 1.77 W/sq.m.C while U value of roof is 2.09 W/sq.m.C to ensure appropriate insulation of the envelope of building.

- DGU unit of U value 1.7 W/sq.m.C &SHBC of 0.34 for air-conditioned spaces while SGU unit of U value 5.8 W/sq.m.C &SHGC 0.59 is utilized. .for non- air-conditioned spaces.

Image displaying a typical floor plan, with the narrow workspace design highlighted in yellow Source: Landmark Design Group

LIFESTYLE & INNOVATION

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Organic waste is treated at site using 50kg/ day biogas plant for reuse as LPG & manure.

Meters are installed for utilities, HVAC, PV, raw water tanks, and STP outlets for effective monitoring

WATER USE OPTIMIZATION

71.3% Reduction in water demand by using low flow fixtures for kitchens & toilets

50.1% Annual water resuse on site after treating from MBR 24.3KLD STP for flushing & irrigation

100% Water on-site is efficiently treated and reused within the project, ensuring zero discharge and sustainable water management

GOVARDHAN ECO VILLAGE, Wada, Maharashtra

Site Area: **4,046 SQM**
Built-up Area: **2,400.65 SQM**
Client: **ISKCON GIRGAON CHOWPATY**
Project Coordinators: **CHITRA VISHWANATH, SHARATH NAYAK, ANSHU AHUJA**
Principal Architect: **BIOME ENVIRONMENTAL SOLUTIONS LIMITED**
Structural Consultant: **ALTERNATE TECHNOLOGIES - PROF MRYOGANANDA OF MRINMAYEE BANGALORE**
Project Management Consultant: **BIOME ENVIRONMENTAL SOLUTIONS PVT LTD & GEV**
Electrical Consultant: **MR SETLUR VEERARAGHAVAN NAGESH, MR THULASIDAS**

CLIMATE
WARM & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
57%

TOTAL WATER DEMAND REDUCTION
41%

TOTAL NUMBER OF TREES
1442

TOTAL RENEWABLE ENERGY CAPACITY
39
kW

FROM ENERGY SAVINGS
CARBON OFFSET
18,431.35
TON/ANNUM

STRATEGIC SITE PLANNING

buildings are thoughtfully planned to ensure minimal tree cutting and to preserve existing agricultural land, maintaining the site's natural ecology and sustainability

Buildings are strategically constructed on hard ground to enhance structural stability and reduce foundation costs, ensuring efficient and sustainable development

ENERGY-EFFICIENT DESIGN

Thermal comfort is ensured through double-tile roofing, along with shaded walls and openings, reducing heat gain

Locally sourced, low-energy materials are used in construction to minimize embodied energy and promote sustainability

Optimal window openings, light-colored flooring for better light diffusion, and soft landscaping to reduce reflected glare ensure visual comfort

Image showcasing GEV Biogas plant at site, used to convert all kitchen and landscape wate to bio gas for cooking , resulting in zero waste site

SUSTAINABLE MATERIALS UTILIZED

- Stabilized soil cement blocks are used for unplastered walls, and precast arch panels are utilized for roofs.

- The building blocks consist of stabilized mud blocks with a mixing ratio of 1:4:6 (cement/lime, quarry dust, soil) and an 80:20 cement-lime ratio. Soil replaces fly ash in the composite mortar, mixed in a 1:11 ratio (1 part cement to 11 parts site soil and stone dust/sand). This mortar is used throughout the construction, eliminating plastering and resulting in exposed stabilized mud block walls.

- Foundations feature stone walls built with composite mortar of cement, quarry dust, and soil.

- U-blocks are employed for sills and lintels, reducing the need for concrete. Intermediate roofs, except in toilets, consist of arch panels made of stabilized mud blocks, with precast concrete beams minimizing concrete usage in the buildings.

REDUCING EMBODIED ENERGY

- The final roofs of all buildings feature double-tiled sloping designs, eliminating the need for concrete, while steel members can be easily reused.

- The yoga hall is topped with a thatch roof made from sugarcane thatch, grown on-site, utilizing agricultural waste.

- Stabilized mud blocks are used for non-load-bearing walls, replacing fired clay bricks, with plastering avoided by using proper pointing and roof projections to prevent rain splashes.

- All doors and windows are crafted from reused wood sourced from old buildings. Floors are made from cow dung with a rammed earth subfloor. Locally available marble stone is used for flooring.

- A combination of flamed Sira stone, ceramic, and vitrified tiles has been utilized for flooring. Bison boards fixed on aluminum angles serve as false ceilings in the auditorium and toilets.

Image highlighting natural building materials, featuring a rain chain that directs water from the roof to a sump for efficient rainwater management

LIFESTYLE & INNOVATION

Biogas plant on-site processes food and animal waste, generating up to 30 cu.m of gas for cooking

The slurry produced after biogas extraction is used as a natural fertilizer for organic farming

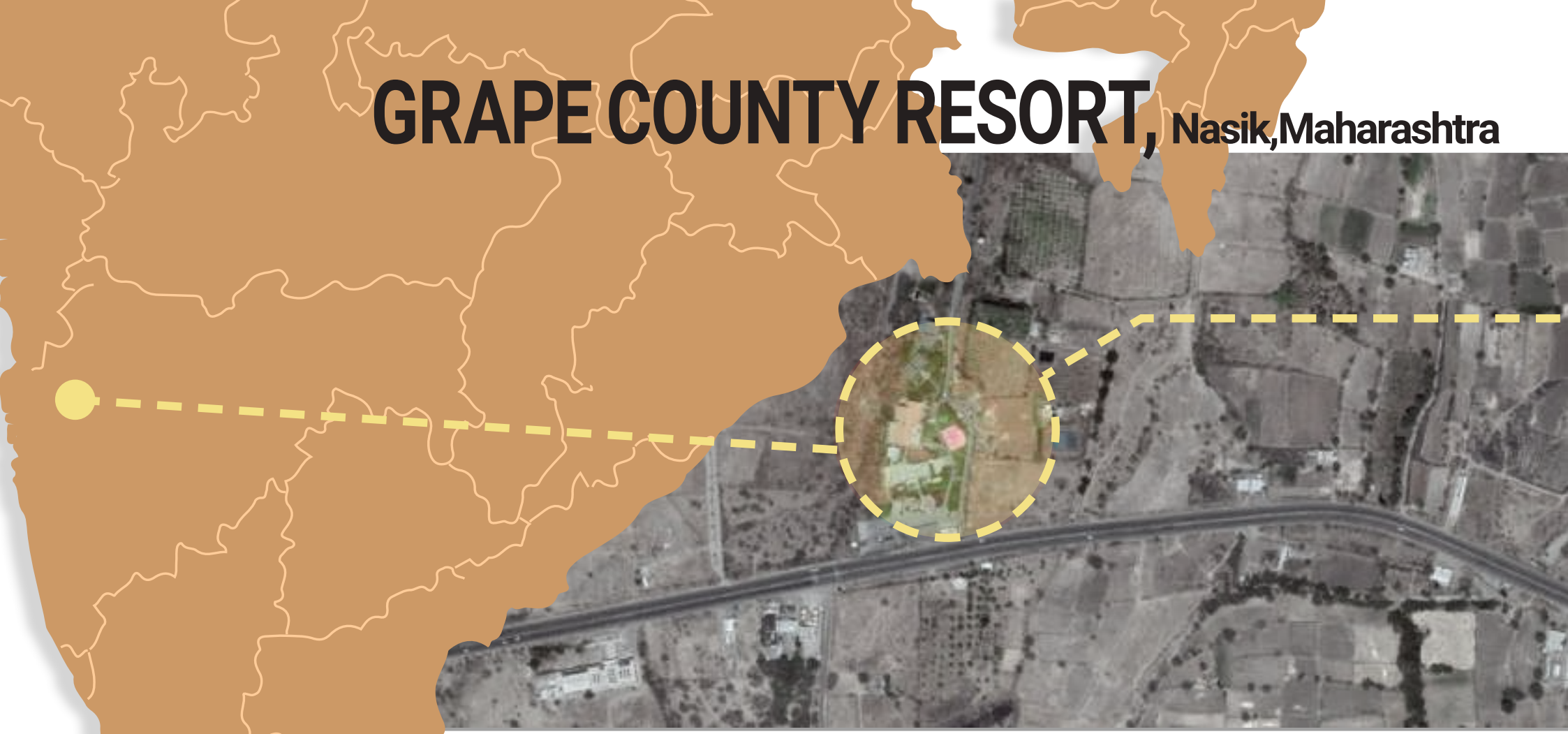
Organic waste, including kitchen and horticultural waste, is collected and vermi-composted

WATER USE OPTIMIZATION

95% Sewage water is treated using Soil Biotechnology, an eco-friendly sewage management technology, and reused for landscaping

A one acre pond is created for rainwater storage, with the layout designed based on hydrogeological survey inputs to protect water recharge and discharge zones

GRAPE COUNTY RESORT, Nasik,Maharashtra



Site Area: **21,433 SQM**
Built-up Area: **1475 SQM**
Occupancy: **72**
Client: **GREEN SPACES REALTORS, NASHIK**
Principal Architect: **AR. SANJAY PATIL &AR. SHABBIR UNWALA**
Green Building Design & Certification: **VK:E ENVIRONMENTAL LLP, PUNE**

CLIMATE
HOT & DRY

TYPE
COMMERCIAL

RATING
SVAGRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
33%

TOTAL WATER DEMAND REDUCTION
58%

TOTAL NUMBER OF TREES
7025

TOTAL RENEWABLE ENERGY CAPACITY
3.7
kW

CARBON OFFSET
9216.03
TON/ANNUM

STRATEGIC SITE PLANNING

Reduction in landscape water demand using sprinkler systems & planting native species is **79%**

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **61%**

Exisiting 50 trees were preserved & number of new trees planted is **6975**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **73.2%**

Project has a Lighting Power Density (LPD) of 3.18 W/sq.m, significantly lower than the ECBC-specified limit of 10.80 W/sq.m

Reduction in embodied energy using AAC blocks, Godhra bricks, Basalt stone & PPC for walling application, is **67.7%**

Building section highlighting areas with earth berm construction, marked in blue, showcasing enhanced insulation and thermal stability

OPTIMIZATION OF SITE USING PASSIVE & ACTIVE DESIGN STRATEGIES

- In the project, earth berming is done for Seminar Hall area & the adjacent zones. Considering the hot & dry climatic conditions of Nashik where the project is located, the earth berming will help in reducing the indoor temperature &reduce the cooling loads for the occasional operation of AC.

- Each of the dwelling units have window areas more than 14% of their respective carpet areas with overall insolation of 55%.

- The windows in both Cottages &the Restaurant building are facing the Windward side of the site. Also, the longer side of the building face the windward side.

- The cottages are two storied &have simple linear plans with decks facing the windward side.

-The shallow plans & large shaded windows &provision of ventilators allow for good cross ventilation.

REDUCING CARBON EMISSIONS OF BUILDING

- The buildings are placed in the ridge across the slope facing where the longer sides of the buildings are facing the Western (windward side) of the site because of the direction of slope towards west.

- Though the longer side of the building face the Western & the Eastern side, these facades are considerably shaded by the deep overhang.

- A reservoir has been created on the North-Western side of the building & the landscape is so designed to have vegetation on the Western side of the site along the valley. This enables evaporative cooling. Also, as per the contour of the site, the rainwater is channelized &finally collected in this reservoir for water harvesting.

- To reduce the solar heat gain due to direct solar radiations on Eastern facade, buffer spaces are provided in the form of store room & loading &unloading bay.

Image showcasing a deep overhang on the west-facing façade, effectively providing shade and reducing heat gain

LIFESTYLE & INNOVATION

Project's proximity to amenities such as a bus stop, bank, and post office helps reduce car dependence

Handbook on environmental awareness is provided to visitors, detailing the project's sustainability measures

Dedicated resting rooms & toilets for support staff has been provided in the project

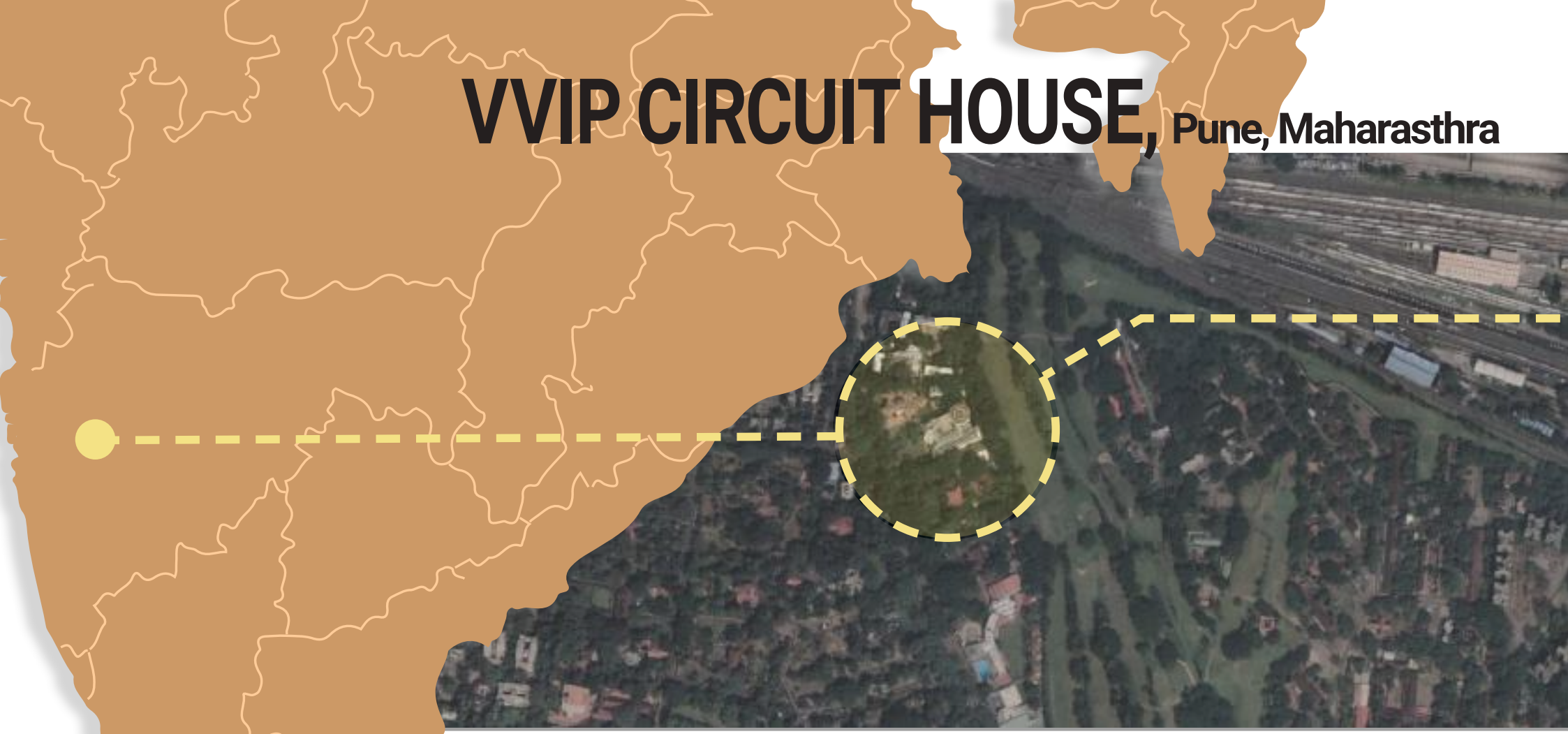
WATER USE OPTIMIZATION

Rainwater is harvested through on-site reservoirs, eliminating dependency on external water supply

57.95% Reduction in water demand by using low flow fixtures for kitchen & toilets

100% Annual water resuse on site after treating using reed bed based STP for irrigation & washing.

VVIP CIRCUIT HOUSE, Pune, Maharasthra



Site Area: **9584.24 SQM**
Built-up Area: **4886.9 SQM**
Occupancy: **119**
Client: **PWD PUNE PROJECT COORDINATOR**
Principal Architec: **AR. SUNIL PATIL**
Landscape Architect: **AR. SUNIL PATIL**
Project management consultant: **PWD**
Structural Consultant: **DR. A. B. KULKARNI &ASSOCIATES**
Green Building Design & Certification: **ENVIRONMENTAL DESIGN SOLUTIONS PVT LTD**

CLIMATE
HOT & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

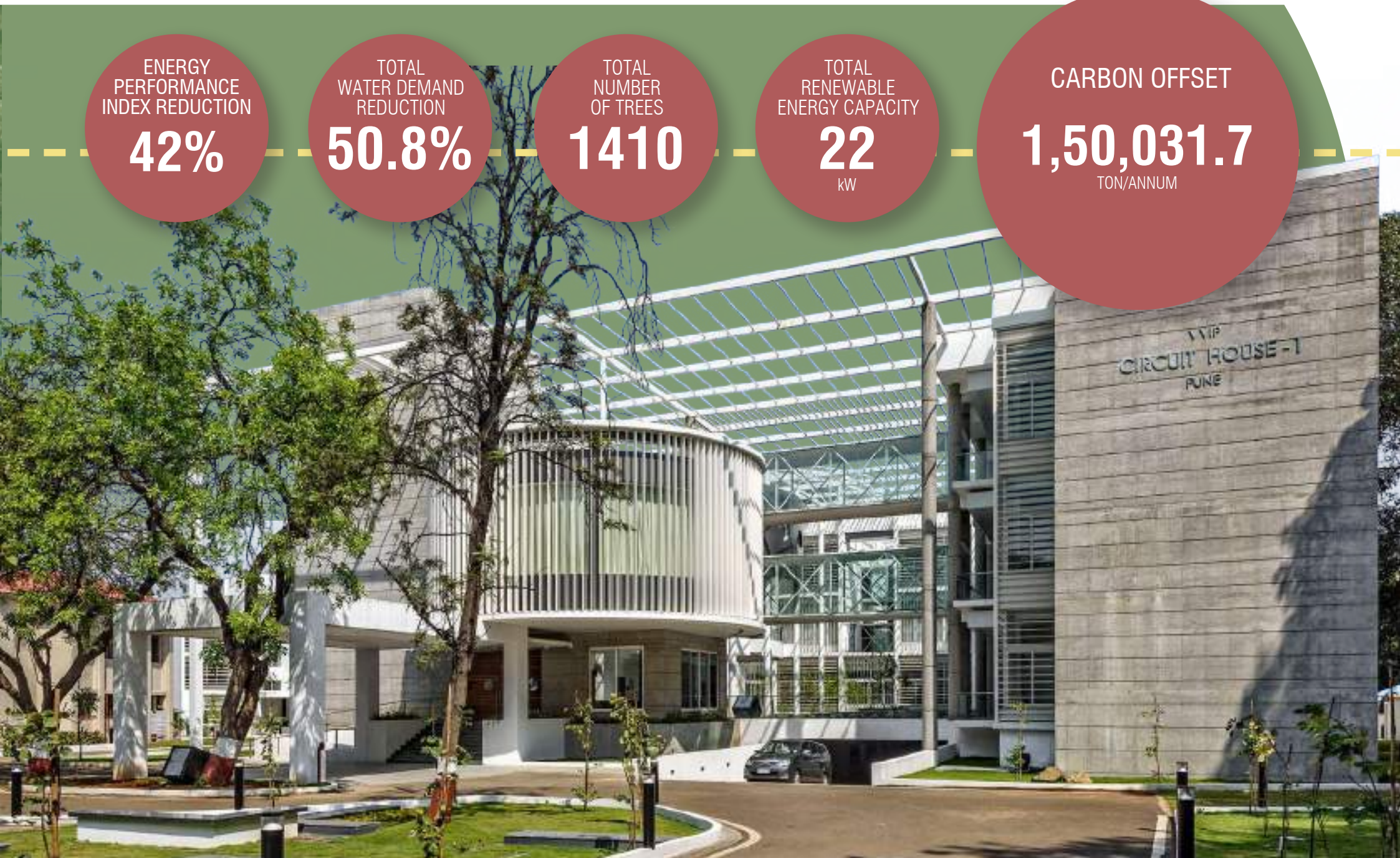
ENERGY PERFORMANCE INDEX REDUCTION
42%

TOTAL WATER DEMAND REDUCTION
50.8%

TOTAL NUMBER OF TREES
1410

TOTAL RENEWABLE ENERGY CAPACITY
22
kW

CARBON OFFSET
1,50,031.7
TON/ANNUM



STRATEGIC SITE PLANNING

Percentage of total paved site surface shaded &/or covered in high SRI tiles is **50%**

Total site area is paved area, maximixing landscape & green areas. **21.3%**

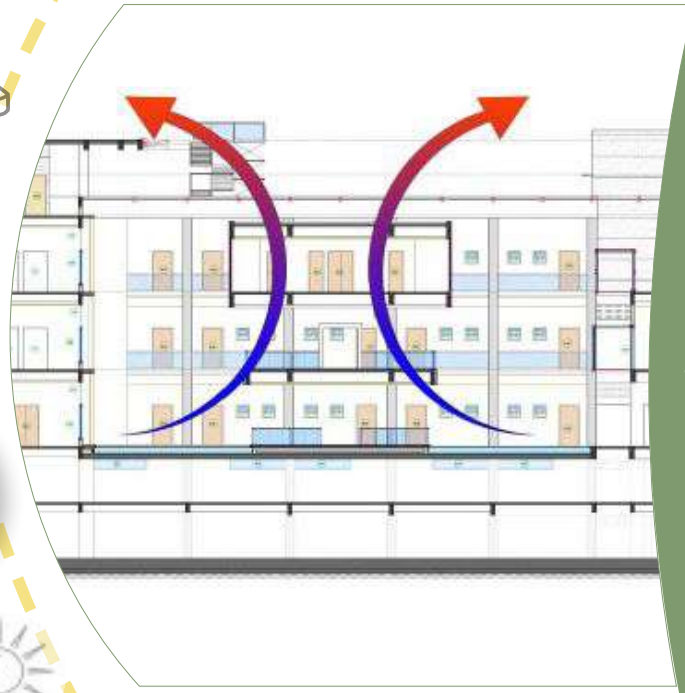
Exisiting trees were preserved & number of new trees planted is **1410**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **80%**

Fly ash content by volume flyash bricks used in walling to reduce embodied energy. **40%**

Materials used in the building interiors for ineternal partitions, false cieling & built furniture, are low-energy, accounting for **32%**



A building section illustrating the courtyard and the stack ventilation effect, highlighting natural airflow and passive cooling

OPTIMIZING BUILDING ENVELOPE

FENESTERATION DESIGN

- The location &size of apertures increases daylighting levels, causes cross ventilation &connect outer environment.

- Daylighting is studied to efficiently decreases the expenses on the electrical energy during the daytime. At the same time, controlled solar access with the help of shading devices reduces cooling load.

VENTILATION

- The building is designed with a courtyard in the center with water bodies to cool temperatures with evaporative cooling, reducing urban heat isl&effect. The court also works for stack ventilation & improves cross ventilation.

- All the Services &corridors &waiting areas are naturally ventilated which effectively decreases the cooling load

PASSIVE DESIGN FEATURES

ORIENTATION

- Site is proportionate along east west axis. This allows building layout to be elongated along North- South face to have maximum day lighting, solar access in winters at the same time adequate sun protection & ventilation in summer.

- Designed to create an organized pattern of roads, open spaces, paths &activities creating compact pedestrian friendly development.

- All services are planned for the east- west side. These spaces act as buffer spaces to habitable spaces in the building.

- All the suites are planned on the north &south face of the building, ensuring daylighting.

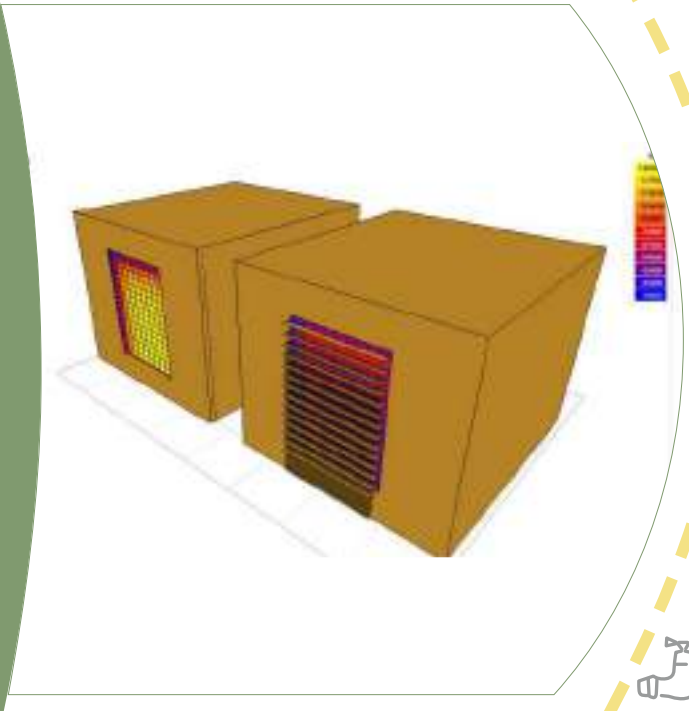


Image showcasing simulation study used to design shading devices for fenestrations, optimizing solar control and energy efficiency

LIFESTYLE & INNOVATION

Efficient waste segregation of waste at site with multiple-colored bins & dedicated waste sorting area

Designated electrical vehicle parking & charging points provided in basement parking

Public tour showcasing the building's green features is conducted for visitors, promoting awareness and sustainability

WATER USE OPTIMIZATION

53.1% Reduced water demand by using low flow fixtures for kitchens &toilets.

48.6% Reduction in annual landscape irrigation demand by planting native species plants & drip irrigation system

42% Annual water resuse on site after treating from Phytorid technology 25KLD STP & 35 KL rainwater storage tank for flushing & irrigation

VASTUKAR DESIGN STUDIO, Bhubaneswar, Odisha

Site Area: **308 SQ M**
Built-up Area: **453 SQ M**
Occupancy: **35**
Client: **PROFESSOR S.S. RAY, PRESIDENT & FOUNDER, VASTUKAR FOUNDATION**
Principal Architect: **S.S. RAY, DIRECTOR, VASTUKAR DESIGN STUDIO**
Green Building Certification: **SUDIPTA SINGH, SUSTAINABLE BUILDINGS & HABITAT, ODISHA**

CLIMATE
WARM & HUMID

TYPE
COMMERCIAL

RATING
SVAGRIHA

★ ★ ★ ★ ★

OPTIMIZATION USING PASSIVE & ACTIVE DESIGN STRATEGIES

STRATEGIC SITE PLANNING

Percentage of total paved site surface shaded &/or covered in high SRI tiles is **35%**

Reduction in landscape water demand by planting native plant species is **50.7%**

Green roofs and vegetative pergolas help moderate the microclimate and mitigate the Urban Heat Island Effect

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **88%**

Project has a LPD of 2.19 W/sq.m, significantly lower than the ECBC-specified limit of 10.80 W/sq.m, ensuring energy efficiency

Reduction in embodied energy using autoclaved AAC blocks &PPC for walling application. **40.06%**

Sketch illustrating direct evaporative cooling on-site, highlighting the strategic placement of water bodies and the role of natural ventilation in enhancing thermal comfort

PASSIVE DESIGN FEATURES

- The internal spatial layout is carefully planned to position buffer zones such as storerooms, staircases, and toilets along the eastern and western facades, effectively minimizing heat gain and enhancing indoor thermal comfort.

- A portion of the roof is designed as a green roof, providing additional insulation, reducing heat absorption, and contributing to improved microclimatic conditions.

ACTIVE LOW-ENERGY COOLING/HEATING

- Ceiling fans are strategically installed in office spaces to enhance air circulation, improve occupant comfort, and support energy-efficient cooling.

- Direct evaporative cooling is facilitated by a water body thoughtfully integrated at the building's entrance, helping to lower ambient temperatures and improve thermal comfort.

ENVELOPE PERFORMANCE FOR COMFORT

105
sq. ft./TR

The thermal efficiency of the building envelope by providing following measures:

- Single glazed unit glass window of VLT 6%, SHGC of 0.16 & U-value of 3.16 W/m²K.

- Further glazing coated with High performance solar film to reduce direct heat gain.

- Window to Wall ratio of 24% to maintain balance beween daylighting &heat gain to maintain comfort.

A 3D view showcasing the shading of hardscaped areas through vegetative pergolas, enhancing thermal comfort and reducing heat buildup on-site

LIFESTYLE & INNOVATION

Project's proximity to amenities such as a bus stop, bank, and post office helps reduce car dependence

Books available in the office library to promote awareness of sustainable building practices

Dedicated resting rooms & toilets for support staff has been provided in the project

WATER USE OPTIMIZATION

Rainwater recharge pit provided on site, along with filtration system, to recharge the ground water

39.86% Reduction water demand by using low flow fixtures for kitchen & toilets.

75% 13,592-litre rainwater storage & harvesting tank is installed to meet the site's water demand for two days

GRATITUDE ECOVILLA, Puducherry

Site Area: **306.10 SQM**
Built-up Area: **474 SQM**
Year of Award: **2022**
Occupancy: **3**
Client: **MR. PRABODH DOSHI &MRS ROMA DOSHI**
Integrated Design Team: **MS. TRUPTI DOSHI, AUROMA ARCHITECTURE**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
SVA GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
24%

TOTAL WATER DEMAND REDUCTION
50%

TOTAL NUMBER OF TREES
2

TOTAL RENEWABLE ENERGY CAPACITY
1.4
kW

FROM ENERGY SAVINGS
CARBON OFFSET
1,663.55
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface softscaped &/or covered in high SRI tiles is **83.25%**

Reduction in irrigation demand using native species of plants is **76.7%**

Green roofs and vegetative pergolas help moderate the microclimate and mitigate the Urban Heat Island Effect

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **92.8%**

Project has a LPD of 3.22 W/sq.m, significantly lower than the ECBC-specified limit of 10.80 W/sq.m, ensuring energy efficiency

Percentage reduction in the embodied energy of project using AAC blocks for non structural application accounts for **41.35%**

A sectional view illustrating the strategic placement of buffer spaces in unfavorable directions, minimizing heat gain and enhancing thermal comfort in occupied areas

OPTIMIZING BUILDING ENVELOPE TO REDUCE ENERGY DEMAND

450.22
sq. ft./TR

The thermal efficiency of the building envelope by providing following measures:

-Single glazed unit(SGU) with SHGC of 0.68 were installed in the project.

-AAC blocks were used for walling. Also, rat trap bond was used in the project to provide air gap in the enevelope providing insulation.

-Roof of the project was insulated & high SRI roof tiles were installed to reduce heat gain.

ACTIVE AND PASSIVE LOW IMPACT DESIGN STRATEGIES

INTERNAL DISTRIBUTION OF SPACES:
Buffer zones, including storages, bathrooms, walk-in closets, and staircases, are strategically placed along critical orientations such as the west and east facades to minimize heat gain. This is illustrated in the project sketch on the left.

CROSS VENTILATION:
Windows are positioned on opposite sides of interior spaces to enable effective cross-ventilation, enhancing natural airflow and thermal comfort. This is depicted in the project sketch on the right.

ACTIVE FEATURES:
High-efficiency BEE 5-star equivalent fans are installed to improve air circulation and reduce energy consumption.

A sectional view illustrating the integration of cross ventilation and stack ventilation strategies within the project, enhancing natural airflow and indoor thermal comfort

LIFESTYLE & INNOVATION

100% of the organic waste generated is treated in composting drums, ensuring sustainable waste management

Environmental awareness signage and banners are prominently displayed on-site to promote sustainability

Dedicated resting rooms & toilets for support staff has been provided in the project

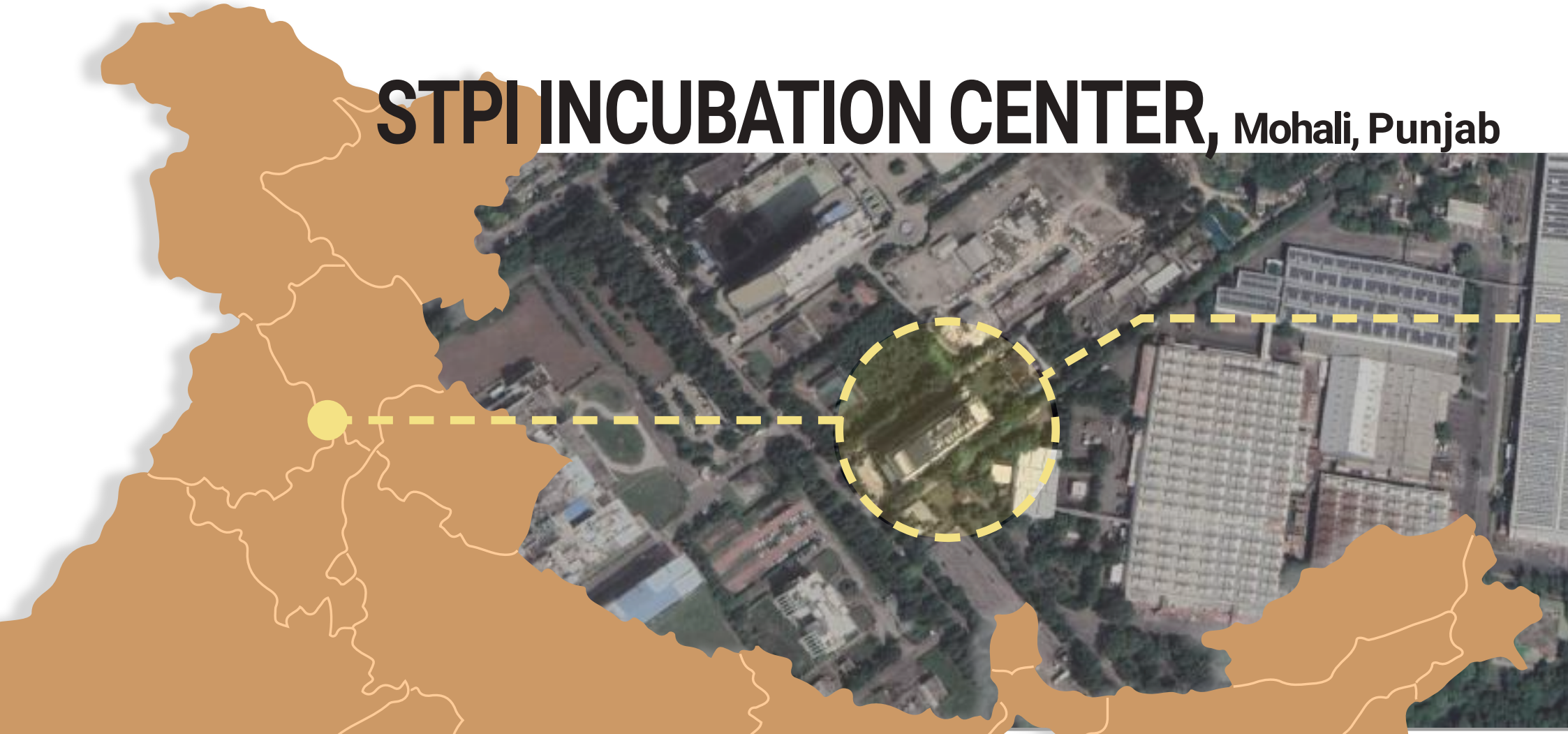
WATER USE OPTIMIZATION

A rainwater recharge pit with a proper filtration system is provided to replenish the groundwater aquifer efficiently.

50.19% Reduction building water consumption by use of water efficient & low flow fixtures

75% 30% of the two-day building water demand is met through a 1,120-liter rainwater storage system for reuse within the building

STPI INCUBATION CENTER, Mohali, Punjab



Site Area: **4,153.10 SQM**
Built-up Area: **10,699.68 SQM**
Year of completion: **2012**
Occupancy: **1000**
Client: **SOFTWARE TECHNOLOGY PARKS OF INDIA**
Principal Architect: **PLANNERS GROUP**
Landscape Architect: **PLANNERS GROUP**
Structural Consultant: **M/S DESIGN ACCREDITS**
Green Building Design & Certification: **ENERGETIC CONSULTING PVT. LTD**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

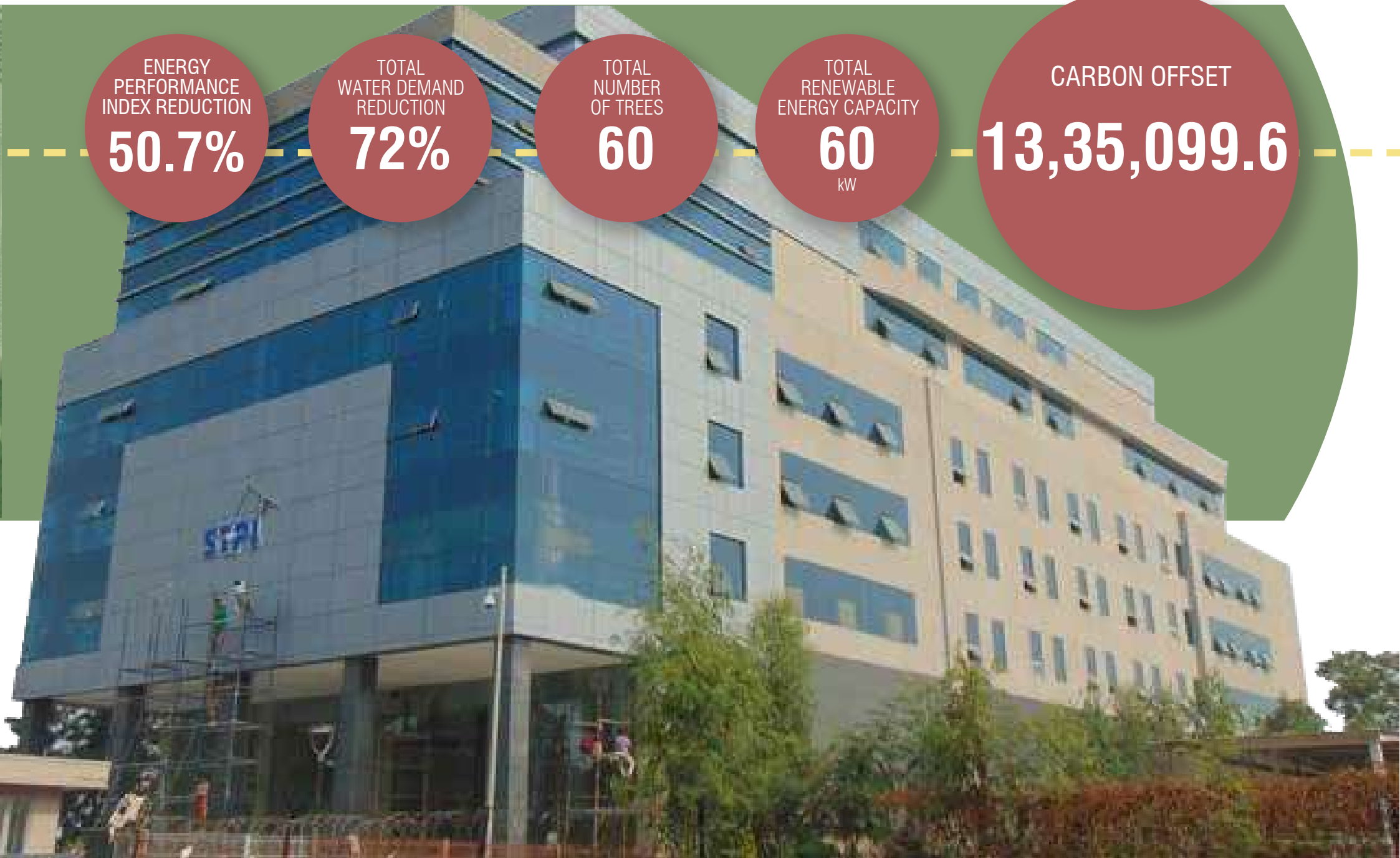
ENERGY PERFORMANCE INDEX REDUCTION
50.7%

TOTAL WATER DEMAND REDUCTION
72%

TOTAL NUMBER OF TREES
60

TOTAL RENEWABLE ENERGY CAPACITY
60
kW

CARBON OFFSET
13,35,099.6



STRATEGIC SITE PLANNING

Percentage of total site surface softscaped/ shaded &/or covered in high SRI tiles is **63.5%**

Number of new trees of native species planted at site along the periphery to reduce traffic noise is **60**

The impervious factor of the site prescribed by NBC 2005 is **87.4%**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **75.7%**

Percentage reduction in the embodied energy of project using AAC blocks for non structural application accounts for **21.56%**

Materials used in the building doors & windows are low environment impact materials like UPVC. **90.94%**

Image showcasing high-reflective DGU glass used for external glazing, effectively reducing heat gain and improving energy efficiency

OPTIMIZATION ENVELOPE PERFORMANCE WITH GLAZING

119.63
sq. ft./TR

The thermal efficiency of the building envelope by providing following measures:

- Double glazed unit glass window of VLT 32%, SHGC of 0.2 & U-value of 1.5 W/m^{2}K.

- Further glazing coated with reflective external coating of 10% to reduce heat gain.

- Window to Wall ratio of 38.8% to maintain balance beween daylighting & heat gain to maintain comfort.

STRATEGIES FOR MAINTAINING INDOOR COMFORT LEVEL

- MERV13 filters are installed in the ventialtion system of the building.

- On site testing report demonstrated that

PM1 - 0:4 ug/m^3

PM2 - 5:4 ug/m^3

PM5 - 0:4 ug/m^3

Indoor air quality levels under acceptable under CPCB National Ambient Air Quality Standard(NAAQS)

- Sensors installed at AHU level via BMS in conditioned spaces to monitor

CO2

Temperature

Relative humidity

- 100% of the paints, adhesives &sealants are Low VOC

image showcasing the shading of the roof with installed solar panels, effectively reducing heat gain and enhancing energy efficiency on-site

LIFESTYLE & INNOVATION

Smart metering and monitoring systems are implemented for energy and water usage across irrigation, the HVAC plant, and lighting

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Provision for campus visits is made to generate awareness and promote sustainable practices

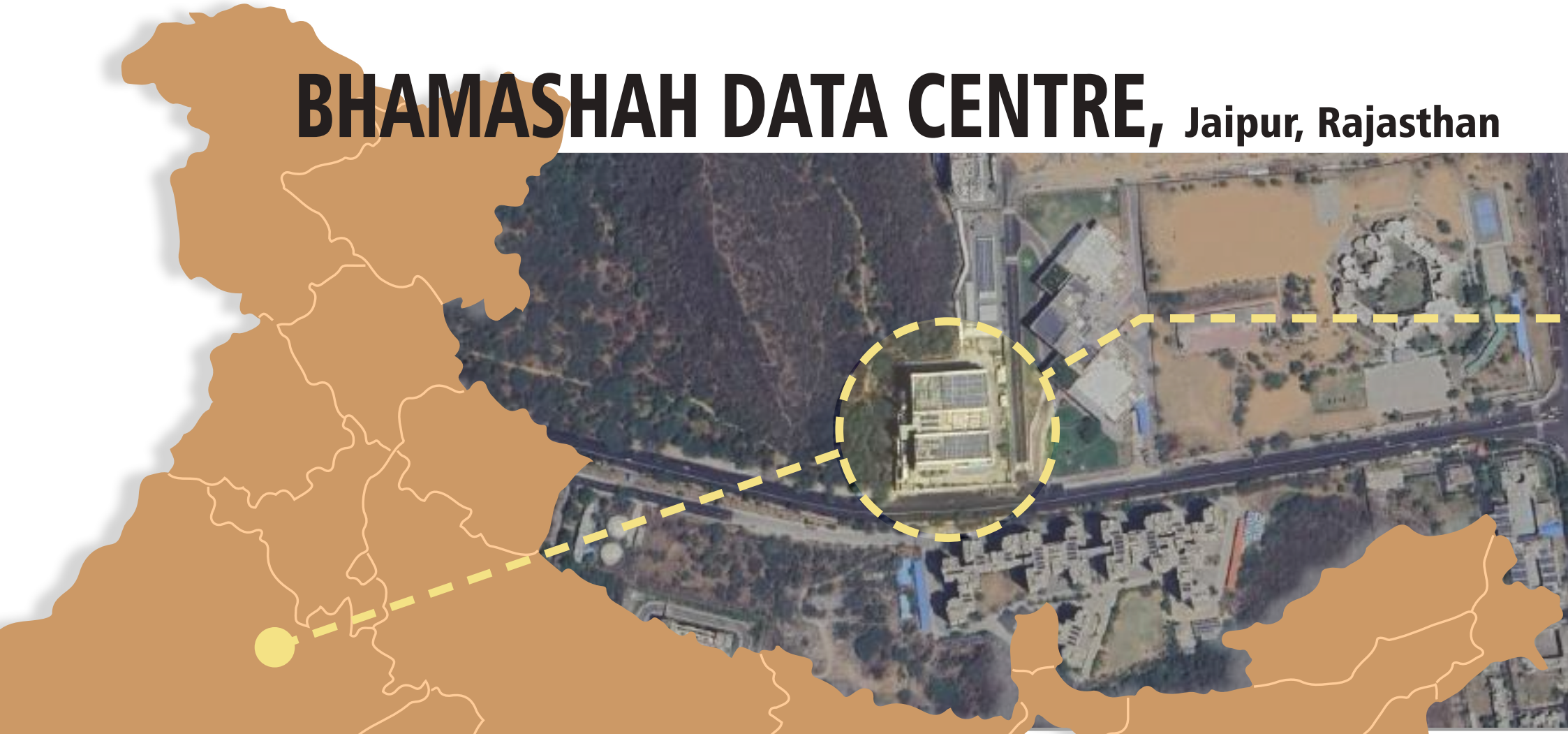
WATER USE OPTIMIZATION

72.67% Reduction in water demand by using low flow fixtures for kitchen & toilets.

Two aquifer recharge pits with a proper filtration system are provided to enhance groundwater recharge

65.51% Reduction in annual landscape water demand using drip irrigation & planting native species of plants

BHAMASHAH DATA CENTRE, Jaipur, Rajasthan



Site Area: **13,187.43 SQM**
Built-up Area: **23,920 SQM**
Year of completion: **2020**
Occupancy: **1600**
Client: **DEPARTMENT OF INFORMATION TECHNOLOGY & COMMUNICATION**
Principal Architect: **AXES ARCHITECTURE, JAIPUR**
Landscape Architect: **AXES ARCHITECTURE, JAIPUR**
Structural Consultant: **AXES ARCHITECTURE, JAIPUR**
Electrical Consultant: **STERLING & WILSON**
Green Building Design & Certification: **ECO ENERGY EXPERT SERVICES LLP, NEW DELH**

CLIMATE
HOT & DRY

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
40.1%

TOTAL WATER DEMAND REDUCTION
52.2%

TOTAL NUMBER OF TREES
39

TOTAL RENEWABLE ENERGY CAPACITY
208
kW

CARBON OFFSET
11,20,810.8
TON/ANNUM

STRATEGIC SITE PLANNING

Pedestrian pathways connecting the two buildings and surface parking areas are fully shaded, enhancing thermal comfort and reducing heat buildup

Percentage reduction in landscape water demand by planting native species of plants is **60.7%**

Percentage of construction waste repurposed and diverted from landfills is **82.5%**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **39.2%**

Materials used for flooring on site are low energy comprising Kota stone, marble, granite & vitrified tiles, accounting for **88.54%**

Percentage reduction in the embodied energy of project using AAC blocks for non structural application accounts for **25.8%**

Image showcasing roof pergolas supporting solar panels, which also provide shade to the services and roof below, effectively reducing heat gain

ENVELOPE PERFORMANCE FOR COMFORT

0.61 W/m²K
U-value of the external walls

19.91%
Window Wall Ratio(WWR) for all buildings

0.23 SHGC
42% VLT
1.5 W/m²K U value
for the facade glazing in the project, complying to requirements of ECBC 2007.

PASSIVE & ACTIVE DESIGN STRATEGIES

PASSIVE STARTEGIES:

- A solar PV system is installed after analyzing the sun-path pattern, with solar arrays strategically arranged to maximize electricity generation

- Water drainage follows the natural slope of the site, utilizing gravity for efficient movement

ACTIVE STRATEGIES:

- Outdoor lighting is controlled through automatic shutoff using microprocessor-based and digital timer controls

- Interior lighting is managed with manual switches and occupancy sensors for energy efficiency

- A BMS system is implemented for localized temperature control, while a VRV system with chillers (COP 3.61) is used for space conditioning

Image showcasing the shading devices integrated into the building façade, effectively minimizing direct heat gain and enhancing energy efficiency

LIFESTYLE & INNOVATION

Smart metering and monitoring systems are implemented for energy and water usage across irrigation, the HVAC plant, and lighting

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Online monitoring of the PV system is implemented, with real-time performance details displayed at the building entrance

WATER USE OPTIMIZATION

50.4% Reduction in building water consumption by use of water efficient & low flow fixtures

Two Fluidized Bed Reactor (FBR) type STPs with a capacity of 90 KLD each are installed on-site for efficient wastewater treatment

47.95% Annual water reuse on-site is achieved for flushing and irrigation demand through treated water from the STP

MANIPAL UNIVERSITY CAMPUS, Jaipur, Rajasthan

Site Area: **1,25,007.42 SQM**
Built-up Area: **53,173 SQM**
Number of Buildings**: 3**
Occupancy: **5029**
Client: **MANIPAL UNIVERSITY JAIPUR**
Principal Architect: **SUNDARAM ARCHITECTS PVT LTD**
Landscape Architect**: MASTERPLAN LANDSCAPE ARCHITECTS**
Project Management Consultant: **DILIGENT PMC**
Structural contractor: **TRC/SUNDARAM ARCHITECTS PVT. LTD.**

CLIMATE
HOT & DRY

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

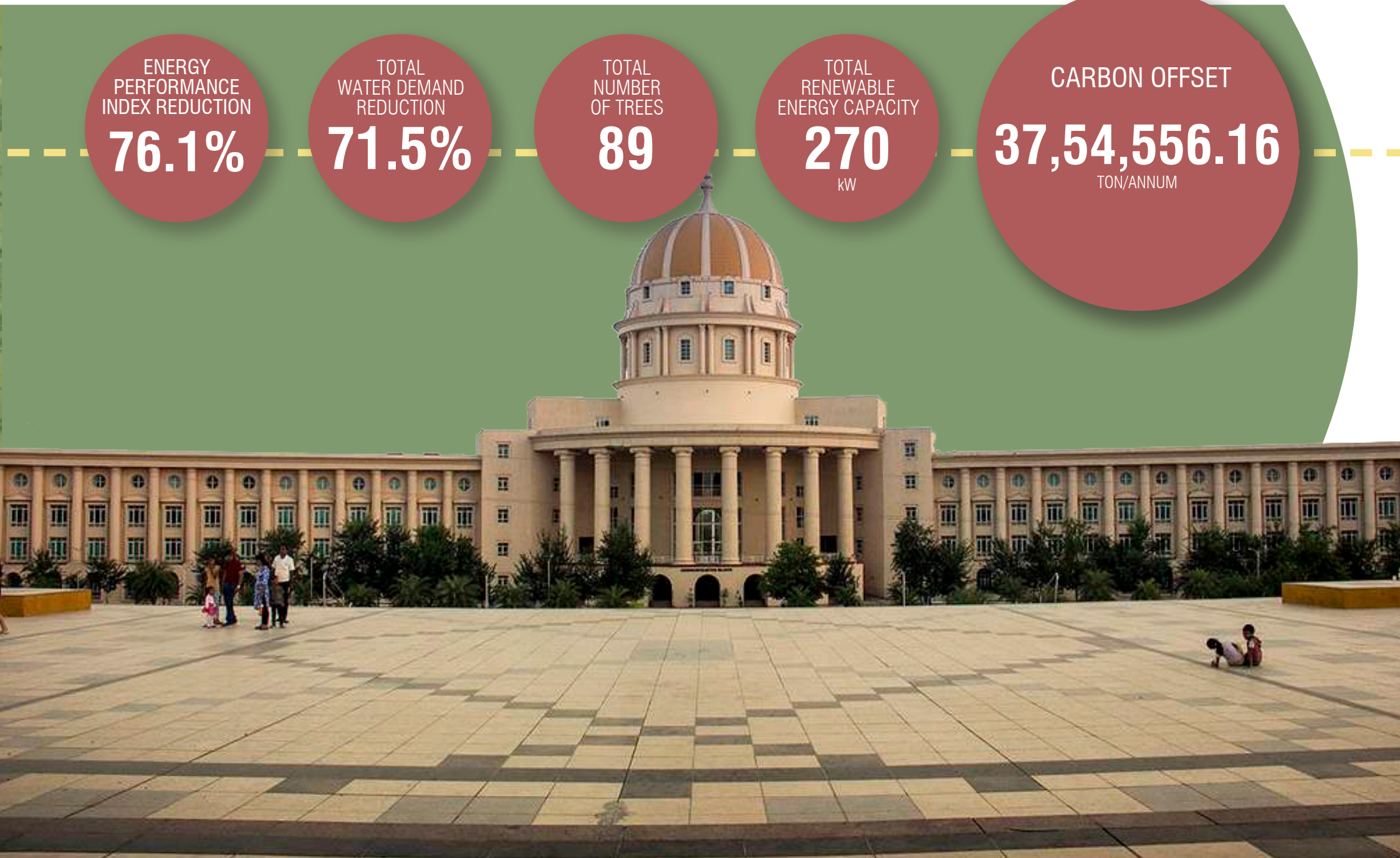
ENERGY PERFORMANCE INDEX REDUCTION
76.1%

TOTAL WATER DEMAND REDUCTION
71.5%

TOTAL NUMBER OF TREES
89

TOTAL RENEWABLE ENERGY CAPACITY
270
kW

CARBON OFFSET
37,54,556.16
TON/ANNUM



STRATEGIC SITE PLANNING

Percentage of total site surface softscaped/ shaded &/or covered in high SRI tiles is **63.7%**

Landscaping is designed to minimize the urban heat island effect, guided by irradiation and wind studies

Reduction in annual irrigation demand by planting native species plants is **84.2%**

ENERGY-EFFICIENT DESIGN

Fly ash content by weight AAC blocks have been used to reduce embodied energy. **50%**

Materials used in the building doors & windows are low environment impact materials like compressed wood, veneer wall & gypsym partitions

Percentage reduction in the embodied energy of project using AAC blocks for non structural application accounts for **43.3%**

Image showing external façade of the building with shaded walkways along the edge of the building & extensive jalis to provide shade to windows

OPTIMIZING DESIGN FOR REDUCED HEATGAIN

- Covered pathway was provided all along the perimeter of building block for higher pedestrian comfort

- One large courtyard is broken up into two small ones to improve the self-shading of the blocks With max amount of thermal mass on external walls & courtyard facing walls

- Irradiation mapping was used to arrive at areas that require dense vegetation to minimise urban heat island effect. The intent was also to ensure that spaces between building had enough shade so the pedestrians can walk under the shade

- Both external walls & internal walls are well buffered either with corridors or jalis to offset heat gain. On south face window massing was done to shade the window area. On west façade jaali's were used to shade the exposed window areas to provide effective shade against afternoon sun

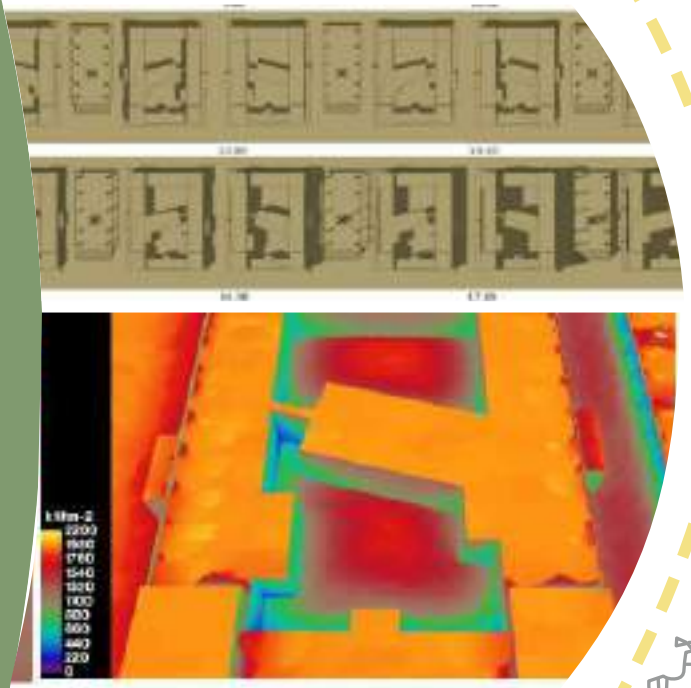
OPTIMIZATION PASSIVE DESIGN FEATURES IN PROJECT

ORIENTATION

- The massing of this building is done in response site contours such that uniform plinth level is maintained across the length of building. This configuration allowed for use of minimal amount of cut & fill on site.
- The building has two parts- one oriented north-south &other oriented north-west & south east for favourable conditions

VENTILATION

- Design has considered the direction of day & night wind patterns. The primary wind direction in Jaipur is West to East
- The large lobby openings on the east & west, along with the open food court along the east & west access allows for free flow of through the courtyard, & around the building.
- The free wind flow through the space along with the lush green vegetated courtyard acts as a cool air pond, helping in the natural cooling of the building



Solar shading study &irradiance mapping of the courtyard to understand shading patterns. Further also find appropriate areas need for passive cooling

LIFESTYLE & INNOVATION

Smart metering and monitoring systems are implemented for energy and water usage across irrigation, the HVAC plant, and lighting

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Organic waste treated at site using 500 kg/ day biogas plant for reuse as LPG & manure

WATER USE OPTIMIZATION

58.7% Reduction water demand by using low flow fixtures for kitchens & toilets

79.4% Annual water resuse on site after treating from MBR 150 KLD STP for flushing & irrigation

Surface rainwater runoff is collected in tanks for reuse, while stormwater is managed through swales for effective groundwater recharge

Singareni power project 2x600 MW SERVICE BUILDING, Pegadapalli, Telangana

Site Area: **1,905 SQM**
Built-up Area: **6,086.5 SQM**
Occupancy: **500**
Client: **THE SINGARENI COLLIERIES COMPANY LTD. (SCCL-STPP)**
Principal Architect: **M/S GREENTREE BUILDING ENERGY PVT. LTD. & BHARAT HEAVY ELECTRICAL LTD. (BHEL)**
Landscape architect: **M/S GREENTREE BUILDING ENERGY PVT. LTD.**
Project management: **BHARAT HEAVY ELECTRICAL LIMITED (BHEL)**

CLIMATE
HOT & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
47.8%

TOTAL WATER DEMAND REDUCTION
57.6%

TOTAL NUMBER OF TREES
97

TOTAL RENEWABLE ENERGY CAPACITY
10
kW

CARBON OFFSET
40,17,959
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface softscaped/shaded &/or covered in high SRI tiles, to reduce UHIE is **51%**

Excavated topsoil was systematically preserved and effectively reused for landscaping within the site

Number of new trees of native species planted at site along the periphery to reduce traffic noise is **97**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **62.9%**

Percentage reduction in the embodied energy of project using AAC blocks for non structural application is **30%**

Materials used in the building interiors are low environment impact materials like pressed WPC for door & windows, stone for flooring & counters and, tiles, accounting for **100%**

Image showcasing a polycarbonate-covered courtyard designed to maximize natural daylighting within the building

OPTIMIZATION OF BUILDING USING PASSIVE DESIGN STRATEGIES

FENESTERATION DESIGN

- Windows of the building have been placed on all four sides with adequate provision for shading to prevent heat gain

- All the regularly occupied spaces are day-lit properly as the window openings are free from any obstructions that may block a clear view of the sky from them

- The Central space of the building have adequate natural daylight as the atrium has been designed which is covered from the top

REDUCING ENERGY CONSUMPTION

- All sewage from the building is directed to a Sewage Treatment Plant through a network of gravity-fed sewer pipes reducing energy need for pumps

- All the regularly occupied spaces are day-lit properly reducing energy load from electrical lighting

OPTIMIZING DESIGN FOR REDUCING HEAT GAIN

ORIENTATION

- The longer axis of the building is facing the north –south direction. West direction receives maximum solar radiation during summer; therefore, the building is oriented to minimize west facing façade

REDUCING HEAT GAIN

- The façade also has been designed in various levels for aesthetic as well as for minimizing the heat & glare effect through shading of windows

- Façade with cavity walls has been utilized to ensure insulation from heat gain from walls in the façade

- Pergolas have been provided on the rooftop of the building which adds on the building to look more appealing & shade the façade. This minimizes the heat gained from windows & facade

Close-up image of the façade highlighting window shading and self-shading achieved through varied building levels

LIFESTYLE & INNOVATION

Smart metering and monitoring systems are implemented for energy and water usage across irrigation, the HVAC plant, and lighting

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

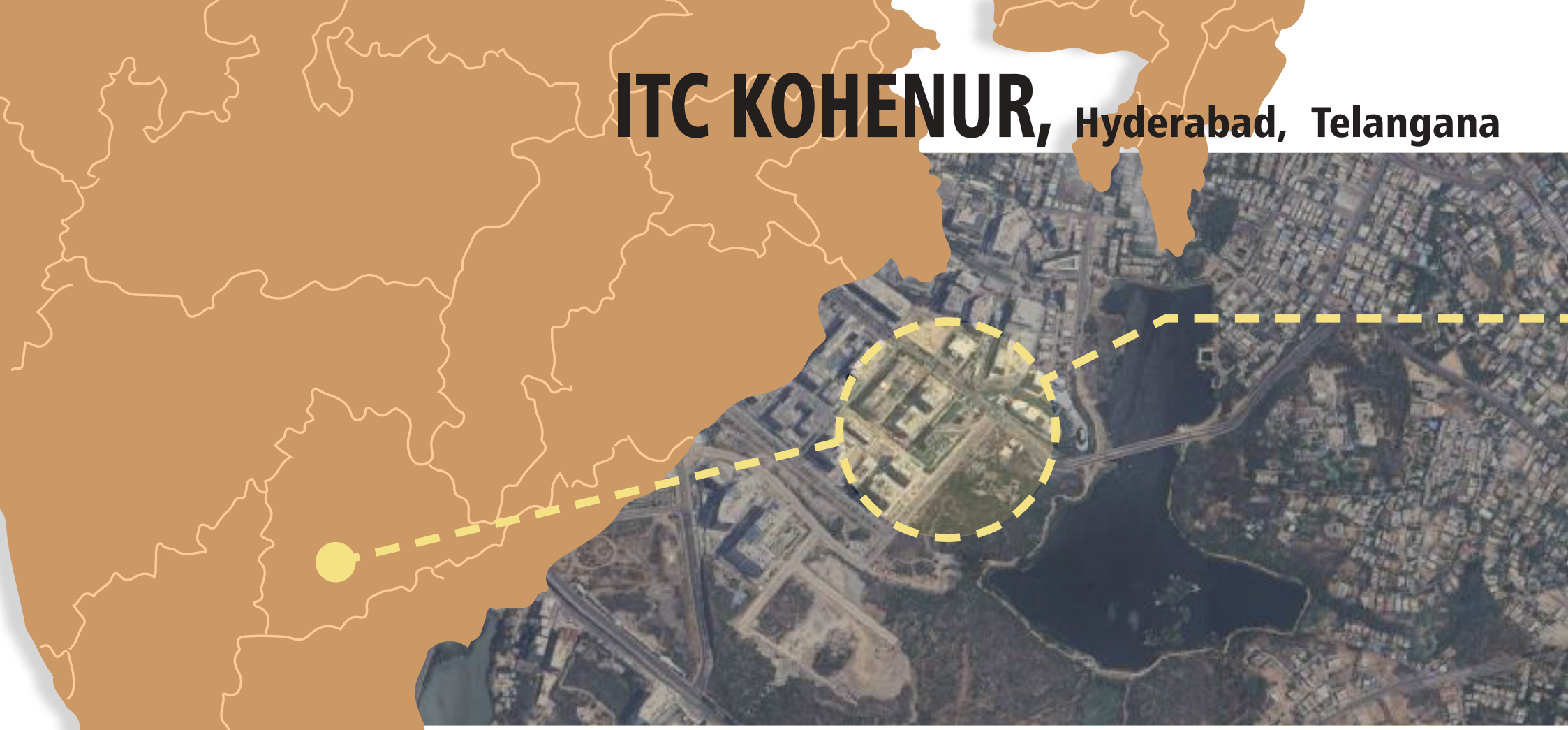
Signages have been installed at multiple locations across site to highlight the green measures implemented

WATER USE OPTIMIZATION

58.2% Reduction in water demand by using low flow fixtures for kitchen & toilets

56% Reduction in landscape water demand using drip irrigation, native tree plantation & reduced turf area.

ITC KOHENUR, Hyderabad, Telangana



Site Area: **20,257 SQM**
Built-up Area: **49,594.99 SQM**
Occupancy**: 1400**
Client: **ITC LIMITED**
Integerated design team: **ATKINS GLOBAL, DUBAI**
Green Building Design & Certification: **ENVIRONMENTAL DESIGN SOLUTIONS PVT. LTD.**

CLIMATE
WARM & HUMID

TYPE
RESIDENTIAL

RATING
GRIHA

★ ★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
82.2%

TOTAL WATER DEMAND REDUCTION
58%

TOTAL NUMBER OF TREES
258

TOTAL RENEWABLE ENERGY CAPACITY
6
kW

CARBON OFFSET
1,50,52,406
TON/ANNUM

PASSIVE DESIGN STRATEGIES AT SITE

STRATEGIC SITE PLANNING

Basic amenities are located within a 0.5 km radius of the project, minimizing transportation needs and reducing the carbon footprint.

Reduction in landscape water deamnd using efficient irrigation is 63.8%

Number of new trees of native species planted at site is 258

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of 83.4%

Reduction in embodied energy replacing brick with concrete block & drywall for interior partitions is 68%

Materials used in the building interiors for false ceiling, internal partitions & paneling are low environment impact materials like , accounting for 71%

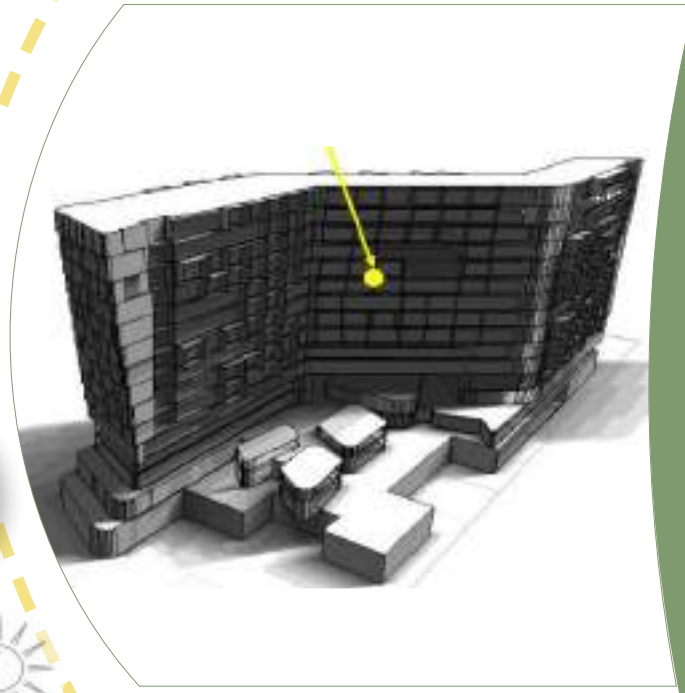


Image showcasing the shadow study conducted to optimize shading strategies for different facades based on solar angles

- The tower design is rotated to align it with the optimum orientation defined by the sun angles which is 93 degrees from North. This enables minimum solar gain in summer & highest in winter

- Adequate provision of shading has been done on the Eastern facade &the western facade to prevent heat gain. Also, East & West facades have vertical shading devices according to the low sun angle

- All the windows in the facades are recessed with overhangs & with vertical louvers, which make them completely shaded

INTEGERATED LANDSCAPE DESIGN REDUCING UHIE EFFECTS

- The site slopes have been judiciously used for rain water drainage by gravity, ensuring no expenditure on the energy consumption.

- Trees & shrubs have been planted throughout the site that provide some shade to the building's exterior, roads & hard paving surface. The paved areas/roads are of grass pavers to minimize hardscape UHIE

- The mass of the building is folded to fit within the allowable setbacks, as well as maximize the views toward the lake. Also it is tapered downwards to further reduce solar heat gain on East & West facades. The podium greens creating a clear canvas of green landscape in the building

Close-up image of the facade highlighting diverse shading strategies tailored to different orientations

LIFESTYLE & INNOVATION

Biodegradable waste generated is treated on site through 300kg Organic Waste Composter

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

8% of parking spaces in project are dedicated to carpooling vehicles

WATER USE OPTIMIZATION

53.9% Reduction in water demand by using low flow fixtures for kitchen & toilets

Rainwater storage of 192 KLD provided at site along with desilting chambers & grease traps

46.5% Annual water reuse on site after treating from FBR type STP of 320 KLD for irrigation & flushing purpose, the remaining sludge will be used as manure

AIRPORT TERMINAL BUILDING, Agartala, Tripura

Site Area: **1,13,835 SQM**
Built-up Area: **53,173 SQM**
Occupancy**: 6032**
Client: **AIRPORT AUTHORITY OF INDIA**
Integerated design team: **CREATIVE GROUP LLP**
Green Building Design & Certification: **DESIGN2OCCUPANCY SERVICES LLP**

CLIMATE
HOT & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★
(PROVISIONAL)

ENERGY PERFORMANCE INDEX REDUCTION
46.4%

TOTAL WATER DEMAND REDUCTION
64%

TOTAL NUMBER OF TREES
1,117

TOTAL RENEWABLE ENERGY CAPACITY
250
kW

CARBON OFFSET
6,21,176
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface softscaped/ shaded &/or covered in high SRI tiles, is **77.5%**

Net impervious factor of the project, reducing run off of storm water is **70.5%**

Exisiting 171 trees were preserved at site & number of new native trees planted is **946**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **93%**

Materials used in the building interiors are low environment impact materials, accounting for **75%**

Reduction in embodied energy through the use of Fly Ash and AAC blocks in wall construction accounts for **70%**

Rendered image showcasing extensive shading on the east-facing front façade

ACHIEVING & MAINTAINING COMFORT FOR OCCUPANTS

- Various shading devices are provided to reduce exposure to radiant heat gain.

- The overall Window Wall Ratio (WWR) is 88%, ensuring that 93% of total habitable area is under recommended daylighting factor.

- The artificial lighting in the project meets the minimum required lux levels criteria and also meets the uniformity ratio of 0.4 as specified in NBC 2005.

- The project has installed Double Glazed Glass with SHGC of 0.2 for all the fenestrations in the East, West, South, and North Direction to reduce heat gain while ensuring daylighting.

- Relative humidity and temperatures are monitored through BMS system to ensure thermal comfort of occupants.

OPTIMIZATION PASSIVE DESIGN FEATURES IN PROJECT

- The Terminal Building plan is rectangular, because of site constraints (i.e., already existing runway) building a longer facade is oriented on the East-West axis which could lead to heat gain. Therefore, to mitigate unfavorable orientations like West, all the regularly occupied spaces such as ticket counters, immigration, &security hold areas are located on the east side of the ground floor.

- More than 50% of the unfavorable orientations are abutted with buffer zones &service areas such as restrooms, stairwells,&baggage segregation areas

- Along with buffer spaces, East &West facades are shaded by a projection of more than 11m which will reduce solar gain & will increase the amount of diffused daylighting.

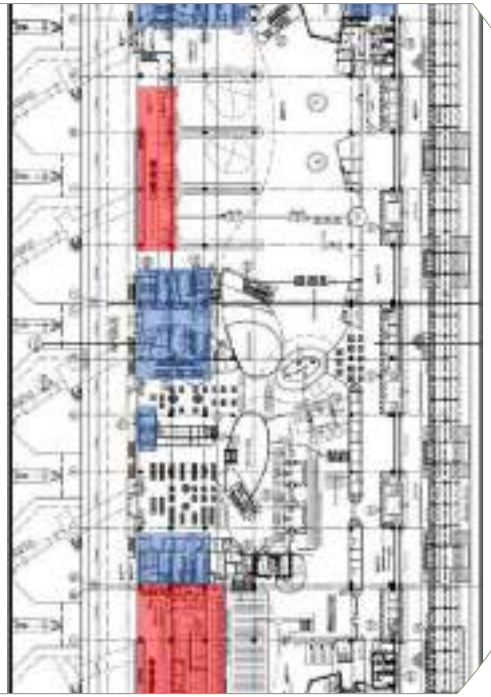


Image showcasing the ground floor plan with buffer spaces clearly highlighted

LIFESTYLE & INNOVATION

Smart metering and monitoring systems are implemented for energy and water usage across irrigation, the HVAC plant, and lighting and relative humidity, CO_2 & temperature

Universal accessibility implememted with toilets, entrance ramps, lift with braille & dedicated parking spots

Dedicated electric vehicle parking and charging stations are provided for up to eight vehicles

WATER USE OPTIMIZATION

57.2% Reduction in annual landscape irrigation demand by planting native species plants

70.9% Annual water resuse on site after treating from FAB type 440KLD STP for flushing & irrigation

Shallow drainage channels (swales) are constructed on-site to reduce and store surface runoff while filtering out organic waste and sediments

OFFICE BUILDING, DESIGN ASSOCIATES INC., Noida, Uttar Pradesh

Site Area: **1000 SQM**
Built-up Area: **1002 SQM**
Occupancy: **115**
Client: **DESIGN ASSOCIATES INC.**
Principal Architect: **DESIGN ASSOCIATES INC.**
Green Building Design & Certification**: TECTON PROJECT SERVICES PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
SVAGRIHA

★★★★★

ENERGY PERFORMANCE INDEX REDUCTION
33%

TOTAL WATER DEMAND REDUCTION
37.7%

TOTAL NUMBER OF TREES
37

TOTAL RENEWABLE ENERGY CAPACITY
3
kW

FROM ENERGY SAVINGS
CARBON OFFSET
5,924.02
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered with high SRI tiles is **43.4%**

The carbon footprint is reduced by offering accessible basic amenities nearby, thereby reducing car dependence

Pervious landscaping has been incorporated to minimize runoff and reduce the UHIE in the project

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **94.9%**

The LPD of the project is 3.59 W/sq.m., which is below the ECBC-specified LPD limit of 10.80 W/sq.m.

Embodied energy is reduced throughout the entire construction of the project by using Portland Pozzolana Cement (PPC)

Imgae showing various greening & paving startegies used at site for landscaping

PASSIVE DESIGN STRATEGIES IN PROJECT

- Space planning is such that all services, non-regularly occupied areas such as staircases & toilets are in south & west orientations. Acting as buffer spaces & reducing heat gain in regularly occupied areas

- The size of openings & glazing is judiciously planned i.e. minimum opening/ glazing on the west & south façade to minimize solar heat gain &maximize daylight in regularly occupied areas. Further inset windows, horizontal & vertical shading is provided to ensure reduced heat gain from windows

- Light shelfs provided in all office spaces ensuring glare free diffused daylight for all depth of office, ensuring reduced heat gain from light & reduction of energy load

- Dense vegetation planted &water body proposed to moderate site microclimate &reduce effects of Urban heat island effect

ENVELOPE PERFORMANCE FOR COMFORT

114.38

W/sqm.

The thermal efficiency of the building envelope by providing following measures:

- Cavity wall constructed with 230mm air gap & 230 mm clay bricks on exterior &115 mm clay brick wall in interior in all directions of the project except the north.

- Single glazing unit with low-e coating of SHGC 0.28 is used in the building

- Overall insolation reduction by 63.2% achieved in the project by appropriate window sizing according to orientation & providing shading to windows

Image showing vertical fins for shading windows & natural light in the office space.

LIFESTYLE & INNOVATION

maintained kitchen garden is cultivated on-site to grow fruits and vegetables for use within the project

Dedicated toilets and resting rooms are provided on-site for service staff comfort

WATER USE OPTIMIZATION

57% Percentage reduction in landscape water demand by planting native species

70.6% Reduction in water demand by using low flow fixtures for kitchen & toilets

75% Two day water demand can be met through 6380 litres of rainwater storage tank & 5000 litre open to sky waterbody

Hindustan Petroleum Corporation Ltd

ADMINISTRATIVE BLOCK, Kanpur, Uttar Pradesh

Site Area: **10169 SQM**
Built-up Area: **1875 SQM**
Occupancy: **51**
Client: **HINDUSTAN PETROLEUM CORPORATION LIMITED**
Developer : **HINDUSTAN PETROLEUM CORPORATION LIMITED**
Green Building Design & Certification **: M/S MECON LIMITED**

CLIMATE
COMPOSITE

TYPE
COMMERCIAL

RATING
SVAGRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
43%

TOTAL WATER DEMAND REDUCTION
36.2%

TOTAL NUMBER OF TREES
151

TOTAL RENEWABLE ENERGY CAPACITY
7
kW

CARBON OFFSET
1,957.766
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered in high SRI tiles is **23%**

Number of new native trees planted in the project all around the site is **151**

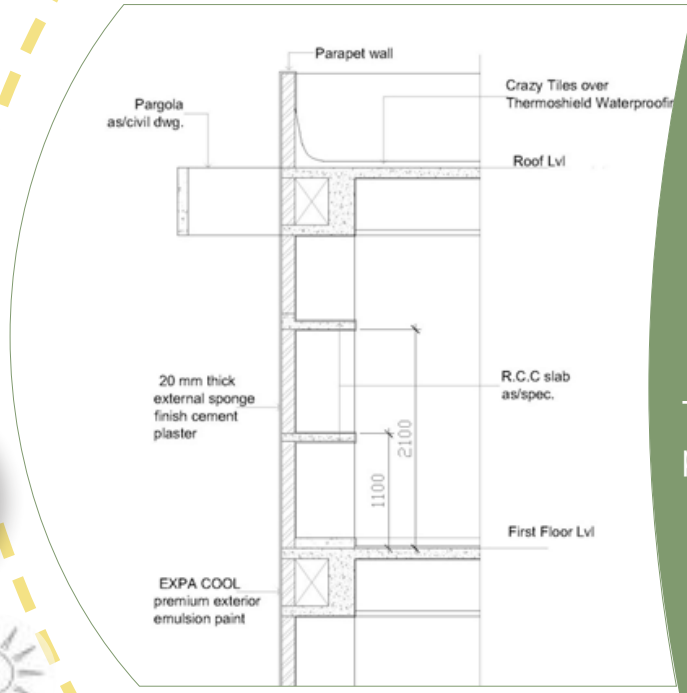
Septic tank is provided within the project boundary to treat sweage generated

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **83%**

The LPD of the project is 6.68 W/sq.m., which is below the ECBC-specified LPD limit of 10.80 W/sq.m.

The reduction in embodied energy for non-structural applications is achieved by using AAC blocks, resulting in decrease of **56%**



Sketch showing section through external envelope with shading pergolas

ENVELOPE PERFORMANCE FOR COMFORT

304.87
sq. ft./TR

The thermal efficiency of the building envelope by providing following measures:

- Double glazed unit (DGU) with SHGC of 0.35 were installed in the project

- Horizontal & vertical shading provided for each window

- 72% reduction in overall insoaltion achieved in the project using shading of windows

PASSIVE & ACTIVE DESIGN STRATEGIES

PASSIVE ARCHITECTURAL DESIGN MEASURES:

- Cool roofs have been implemented as a passive design strategy to minimize direct heat gain from the roof

- Buffer spaces on the eastern and western facades help reduce direct heat gain, thereby lowering the cooling load

ACTIVE FEATURES:

- BEE 5-star equivalent fans have been installed to enhance energy efficiency throughout the building

- Fans have been strategically placed in office areas to improve air circulation and provide better cooling

Image showing roof placed with high SRI tiles mosiac to reduce heat gain &solar panels

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Building's green features have been prominently displayed to raise awareness among occupants and visitors

Dedicated toilets & resting rooms are provided on-site for the comfort of service staff

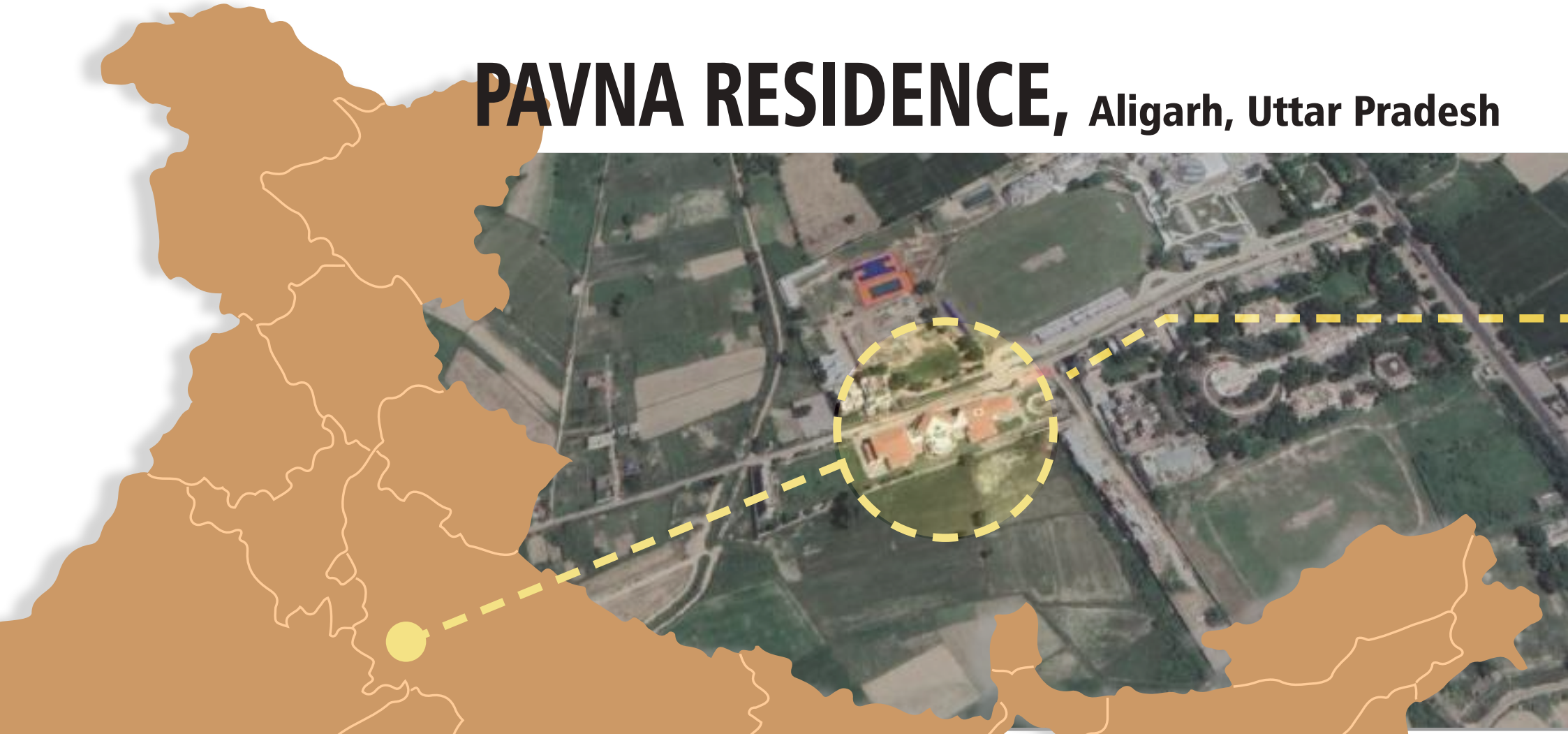
WATER USE OPTIMIZATION

25% Reduction in landscape water demand by planting native species

47.41% Reduction in building water demand by use of water efficient & low flow fixtures

Rainwater storage tank with a capacity of 15,000 liters and a recharge pit have been constructed on-site to collect and recharge rainwater

PAVNA RESIDENCE, Aligarh, Uttar Pradesh



Site Area: **9,012 SQM**
Built-up Area: **2,406 SQM**
Year of completion: **2012**
Occupancy: **5**
Client: **MS. AASHA JAIN & MS. PRIYA JAIN**
Principal Architect: **SPACE I DESIGN**
Green Building Design & Certification: **GREEN TREE BUILDING ENERGY PVT. LTD.**

CLIMATE
COMPOSITE

TYPE
RESIDENCE

RATING
SVA GRIHA

★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
32%

TOTAL WATER DEMAND REDUCTION
75%

TOTAL NUMBER OF TREES
61

TOTAL RENEWABLE ENERGY CAPACITY
3.5
kW

CARBON OFFSET
2,919.92
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered with high SRI tiles is **84.2%**

The carbon footprint is reduced by offering accessible basic amenities nearby, thereby reducing vehicle dependence

Number of new native trees planted in the project all around the site is **61**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of **83.25%**

The LPD of the project is 6.02 W/sq.m., which is below the ECBC-specified LPD limit of 7.5 W/sq.m.

The reduction in embodied energy for non-structural applications is achieved by using AAC blocks, resulting in decrease of **43.84%**

Image showing ventilators used for lighting & ventialtion in double height space

ENVELOPE PERFORMANCE FOR COMFORT

405.06
sq. ft./TR

The thermal efficiency of the building envelope by providing following measures

-Double glazed unit(DGU) with SHGC of 0.32

-63.2% reduction in overall insoaltion achieved in the project using shading of windows

-AAC (Autoclaved Aerated Concrete) Blocks used in the entire construction of the project

PASSIVE DESIGN STRATEGIES UTILIZED

- The design emphasizes the integration of natural sunlight and ventilation through carefully considered fenestration to enhance the indoor environment

- Skylights and ventilators are strategically incorporated to maximize natural daylight and reduce the reliance on electrical lighting

- Windows are placed on alternate or opposite walls to facilitate optimal cross-ventilation in rooms

- The living room and multipurpose halls feature double-height ceilings with skylights, enhancing daylight penetration

- High Solar Reflective Index (SRI) tiles are used on exposed roof surfaces to minimize heat gain through the albedo effect

Image showing shaded ventilators & light coloured exterior to reduce heat gainin interiors

LIFESTYLE & INNOVATION

Building's green features have been prominently displayed to raise awareness among occupants and visitors

Dedicated toilets & resting rooms are provided on-site for the service staff

Dedicated electric vehicle parking and charging stations are provided for vehicles

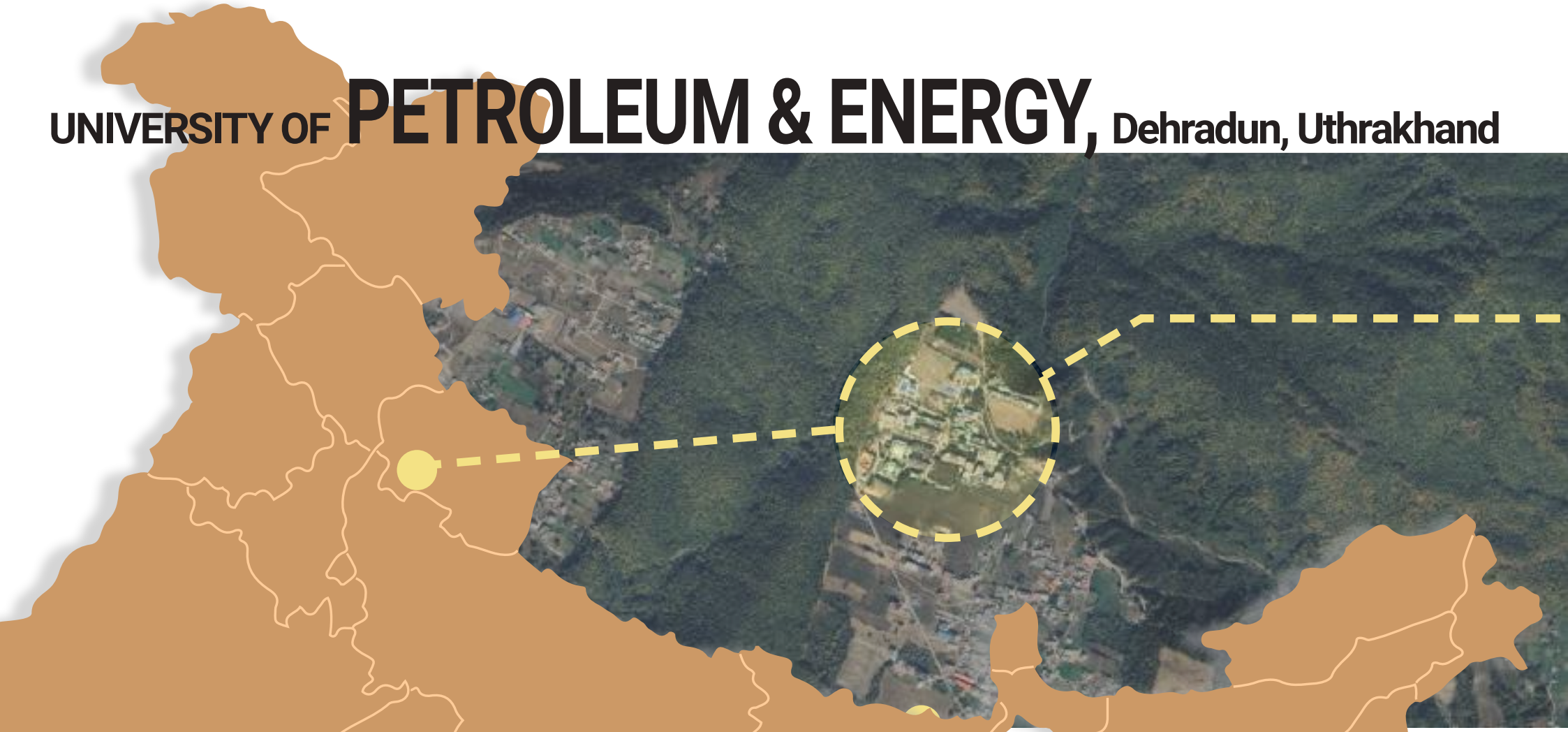
WATER USE OPTIMIZATION

A rainwater recharge pit has been created on-site, complete with a filtration system, to replenish the groundwater table

36.21% Reduction in water demand by using low flow fixtures for kitchen & toilets

75% Project's water demand is met through rainwater harvesting and the storage of runoff water

UNIVERSITY OF PETROLEUM & ENERGY, Dehradun, Uthrakhand



Site Area: **1,08,717 SQM**
Built-up Area: **33,787 SQM**
Number of Buildings**: 16**
Occupancy: **10,000**
Client: **UNIVERSITY OF PETROLEUM &ENERGY STUDIES**
Principal Architect: **DESIGN ASSOCIATES INC.**
Green Building Design & Certification: **GREENTREE BUILDING ENERGY (P) LTD.**

CLIMATE
COLD

TYPE
INSTITUTIONAL

RATING
GRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
45%

TOTAL WATER DEMAND REDUCTION
41%

TOTAL NUMBER OF TREES
1,410

TOTAL RENEWABLE ENERGY CAPACITY
100
kW

CARBON OFFSET
8,11,577.02
TON/ANNUM

STRATEGIC SITE PLANNING

Percentage of total site surface soft paved, shaded &/or covered with high SRI tiles is **50%**

Site is designed to reduce stormwater runoff with a net impervious factor of **70.5%**

Number of new native trees planted in the project all around the site is **1410**

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total habitable area of **45%**

Percentage of fly ash content by volume in fly ash bricks used for walling to reduce embodied energy is **40%**

The materials used for internal partitions, false ceilings, and built-in furniture in the building are selected for their low environmental impact

Image showcasing the recessed box windows in facade of buildings in project

OPTIMIZING BUILDING ENVELOPE & DESIGN

- The building's orientation is carefully designed to minimize passive solar heat gain. The larger sections, primarily used during the day, feature longer sides facing the north and south

- The office building, located behind the auditorium, is designed with maximum openings on the northern and southern facades for optimal daylight penetration.

- All windows are recessed box windows, ensuring the openings remain shaded throughout the year

- The building's design minimizes the footprint and hard-paved areas, allowing for expansive landscaped courtyards on both sides of the structure.

PASSIVE DESIGN STRATEGIES

-The roads are fully shaded due to the presence of existing trees and newly planted ones across the site. Additionally, the building walls are shaded by mature trees positioned on the east and west sides of the structure

- A double-skin façade has been incorporated across the entire building façade to enhance thermal performance

- The microclimate around the building has been improved through the installation of a water fountain and the planting of dense, tall trees on the south and west sides

- Heat gain has been carefully addressed in the planning process by placing the service core on the south and west sides of the building, preventing direct heat exposure to the office areas

Image showcasing the integerated green cover with trees along all buildings

LIFESTYLE & INNOVATION

Universal accessibility provided with toilets, entrance ramps, lift with braille & dedicated parking spots

Organic waste generated in the project is treated on-site to produce biogas and manure

Only electrical & bio diesel vehicles provided for transport within the campus

WATER USE OPTIMIZATION

50% Reduced water demand by using low flow fixtures for kitchens & toilets

33.1% Reduction in annual landscape irrigation demand by planting native species plants

25% Annual water resuse on site after treating from MBBR type 200 KLD STP, for flushing & irrigation

Office Complex for **COAL INDIA LIMITED,** Kolkata, West Bengal

Site Area: **20,235 SQM**
Built-up Area: **13,892 SQM**
Occupancy: **900**
Year of completion: **2014**
Client: **COAL INDIA LIMITED**
Principal Architect: **RAJ REWAL ASSOCIATES + URBAN DESIGN CONSULTNATS**
Project Management Consutlant**: NBCC LIMITED**
Structural consultants: **ACME CONSULTANTS**
Landscape consultants: **RAJ REWAL & ASSOCIATES**
Green Building Design & Certification: **ELA GREEN BUILDING & INFRASTRUCTURE CONSULTANTS**

CLIMATE
HOT & HUMID

TYPE
COMMERCIAL

RATING
GRIHA

★ ★ ★ ★

ENERGY PERFORMANCE INDEX REDUCTION
37.9%

TOTAL WATER DEMAND REDUCTION
50.1%

TOTAL NUMBER OF TREES
198

TOTAL RENEWABLE ENERGY CAPACITY
140
kW

CARBON OFFSET
11,11,610
TON/ANNUM

STRATEGIC SITE PLANNING

The building is designed to harmonize with the natural contours, minimizing cut and fill

Utility corridors were aggregated with aligned with pathways & exisiting slope to enhance efficiency

Outdoor lighting is controlled by an automatic timer-based system, ensuring efficiency of 100%

ENERGY-EFFICIENT DESIGN

Project is daylit and meets the daylight factor prescribed by NBC for total area of 82%

Reduction in embodied energy of the structure by use of coffered slab reducing the material utilized in construction

Low-energy materials, such as natural stone, vitrified tiles, & hardonite tiles with recycled content, are used for interior flooring upto 85%

Image of the building showcasing BIPV along the stepped levels

OPTIMIZING BUILDING ENVELOPE

40%

the Window Wall Ratio of the Building

0.47 W/m²K

Uvalue of the external walls

0.25 SHGC
32% VLT

The facade glazing in the project, complying to requirements of ECBC 2007

PASSIVE DESIGN STRATEGIES

- The project has provided for North lighting with toilets arranged on the east & west facades of the building. This allows for maximum daylighting & views with minimal heat ingress

- Location of windows & shading elements: Majority of windows are located on the North & south facades to provide adequate shading elements

- The building has been designed to allow for internal courtyards spaces to bring in maximum daylight & provide shading

- The floor plate of office is designed to allow light penetration to the whole area

- Innovative design of Building integrated photovoltaics (BIPV) approach adopted in the building to ensure maximum solar generation

Close up image of facade of building showcasing shading of glazing

LIFESTYLE & INNOVATION

Greywater is sent to the municipal water treatment plant, and the recovered sludge is used as manure for landscaping

Universal accessibility implemented with toilets, entrance ramps, lift with braille & dedicated parking spots

Green features of the building have been displayed & guided tours of building for visitors

WATER USE OPTIMIZATION

78% Reduced water demand by using low flow fixtures for kitchens & toilets

50.1% Reduction in annual landscape irrigation demand by planting native species plants

Runoff rainwater is stored for reuse in a 4,501 cu.m. tank, with the rest used for recharge after appropriate filtration

ABOUT TERI

We are an independent, multi-dimensional organization with capabilities in research, policy, consultancy, &implementation. We are innovators &agents of change in energy, environment, climate change &sustainability space, having pioneered conversations &action in these areas for over four decades.

We believe that resource efficiency &waste Management is the key to smart, sustainable, &inclusive development. Our work across sectors is focused on

- Promoting efficient use of resources
- Increasing access &uptake of sustainable inputs &practices
- Reducing the impact on the environment &climate

Our research &research-based solutions have had a transformative impact on industry as well as communities. We have fostered international collaboration on sustainability action by creating a number of platforms &forums. We do this by translating our research into technology products, technical services, as well as policy advisory &outreach.

Headquartered in New Delhi, we have regional centres &campuses in Gurugram, Bengaluru, Guwahati, Mumbai, Panaji, &Nainital. Our 750-plus team of scientists, sociologists, economists &engineers delivers insightful, high-quality action-oriented research &transformative solutions supported by state-of-the-art infrastructure.

MISSION

Our mission is to serve as innovators &agents of change to enable policies &practices for an equitable &sustainable future through conservation &efficient use of energy &other resources.

AREAS OF EXPERTISE

A multi-dimensional organization, TERI functions across domains of policy, technology development, consultancy, &implementation. Working tirelessly to find solutions for the ailing planet, TERI's myriad areas of expertise range from engagement in clean energy transitions, advanced biofuels, climate change, sustainable use of l&&water, sustainable agriculture, transport, &buildings.

KEY GOALS

- Enhance access to clean energy for all
- Enable a just transition to renewable energy pathways
- Enhance energy efficiency in industries, public utilities, &buildings
- Facilitate efficient use of materials, especially iron, steel, &cement
- Enable sustainable food production through smart agri inputs &nutritional security
- Enhance ecosystem services, especially in forestry &biodiversity
- Enhance conservation, utilization of, &access to water, including watershed management
- Develop innovative solutions for clean air, regionally &in cities
- Enable planning &governance of environmentally sustainable cities
- Build resilience to adverse impacts of climate change
- Accelerate pollution abatement
- Develop technologies for generation of advanced biofuels &value-added biocommodities
- Develop the regulatory framework &alternate technology adoption roadmap for green shipping in India
- Enhance livelihood through nature-based solutions under carbon finance mechanism
- Development of innovative solutions by use of microbes for environmental protection

KEY AREAS

ABBREVIATIONS

EPI	Energy Performance Index
LPD	Litres Per Day
WWR	Window to wall ratio
VOC	Volatile organic component
CO2	Carbon dioxide
PM	Particulate matter
HVAC	Heating Ventilation &Air Conditioning
CPCB	Central Pollution Control Board
MERV	Minimum Efficiency Reporting Value
BMS	Building Management System
KLD	Kilo Litre Per day
STP	Sewage treatment plant
kW	Kilo Watt
kWh	Kilo-Watt-hour
SHGC	Solar heat gain coefficient
VLT	Visible light transmittance
ETP	Effluent treatment plant
OWC	Organic waste composter
NBC	National Building Code
ECBC	Energy conservation building code
ECBC-R	Energy conservation building code for residential
VRV	Variable refrigerant volume
TR	Tonne of Refrigeration
AAC	Autoclave aerated concrete
UPVC	Unplasticized polyvinyl chloride
UHIE	Urban Heat Island Effect

DEFINITIONS

CARBON OFFSET: A carbon offset is a reduction or removal of emissions of carbon dioxide or other greenhouse gases made to compensate for emissions made elsewhere.

ENERGY PERFORMANCE INDEX (EPI): As per ECBC, The Energy Performance Index (EPI) of a building is its annual energy consumption in kilowatt-hours per square meter of the building. While calculating the EPI of a building, the area of unconditioned basements shall not be included.

WINDOW TO WALL RATIO (WWR): The Window-to-Wall Ratio (WWR) is a percentage metric representing the proportion of a building's façade composed of windows compared to solid walls. It is calculated by dividing the total window area by the total wall area on a specific façade.

SOLAR CHIMNEY: A solar chimney is a way of improving the natural ventilation of buildings by using convection of air heated by passive solar energy. It is an open-ended vertical shaft utilizing solar energy to enhance the natural stack ventilation through a building.

SHADING COEFFICIENT: It is the ratio of solar heat gain through glazing due to solar radiation at normal incidence to that occurring through 3 mm thick clear, double-strength glass. The shading coefficient, as used herein, does not include interior, exterior, or integral shading devices.

SOLAR HEAT GAIN COEFFICIENT (SHGC): SHGC is defined as the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat &absorbed solar radiation, which is then reradiated, conducted, or convected into space.

U VALUE: U-value defines the amount of heat that gets transmitted through a unit area of a material for a unit difference in temperature. The U-value is therefore also called thermal transmittance. Determining the U-value is particularly important for the building's envelope.

RELATIVE HUMIDITY: Relative Humidity is defined as a percentage ratio of the quantity of atmospheric moisture present to the amount that would be present if the air was saturated. It is typically stated as a percentage.

SET POINT: The desired temperature (°C) of the heated or cooled space that must be maintained by mechanical heating or cooling equipment.

UNCONDITIONED BUILDINGS: Buildings in which more than 90% of spaces are unconditioned spaces (ECBC 2017).

CARPET AREA: It is defined as the net area measured between external walls, from the inner faces of walls. The thickness of internal or partition walls is excluded

BUILT UP AREA (BUA): Sum of the covered areas of all floors of a building, other than the roof, &areas covered by external walls &parapets on these floors.

GRIHA Council
Core 1B, 3rd Floor
India Habitat Centre, Lodhi Road
New Delhi – 110003

Tel: (+91 11) 46444500/24339606-08)
Email id: info@grihaindia.org
Website: www.grihaindia.org