INTEGRATING SDG 11 PRINCIPLES FOR SUSTAINABLE PERI-URBAN DEVELOPMENT: A CASE OF LUCKNOW

A Thesis Submitted

in Partial Fulfilment of the Requirements

for the Degree of

MASTER OF PLANNING

by

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Under the Supervision of

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I hereby declare that the work presented in this report entitled "**INTEGRATING SDG 11 PRINCIPLES FOR SUSTAINABLE PERI-URBAN DEVELOPMENT: A CASE OF LUCKNOW**", was carried out by me. I have not submitted the matter embodied in this report for the award of any other degree or diploma from any other University or Institute.

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In my capacity as supervisor of the candidate's thesis, I certify that the above statements are true to the best of my knowledge.

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UNDERTAKING

I, Mr. GAURAV MISHRA, the author of the thesis titled “INTEGRATING SDG 11 PRINCIPLES FOR SUSTAINABLE PERI-URBAN DEVELOPMENT: A CASE OF LUCKNOW”,
hereby declare that this is an independent work of mine, carried out towards fulfilment of the requirements for the award of the Masters in Planning at the Department of Architecture and Planning, BBDU, Lucknow. The work has not been submitted to any other organization / institution for the award of any Degree/Diploma.

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ABSTRACT

This thesis examines the integration of Sustainable Development Goal (SDG) 11 principles for sustainable peri-urban development in the rapidly growing city of Lucknow, India. Using a comprehensive research methodology including literature review, data analysis, field surveys, and stakeholder interviews, the study investigates the current state of peri-urban development in Lucknow and identifies the challenges, opportunities, and strategies for promoting sustainable practices in this context.

The research uncovers key obstacles to sustainable peri-urban development in Lucknow, such as inadequate infrastructure, informal settlements, environmental degradation, and governance deficiencies. Socioeconomic factors like population growth, rapid urbanization, and economic disparities contribute to these challenges. To address these issues, the thesis proposes a set of strategies and policy recommendations that focus on integrating SDG 11 principles into peri-urban planning and development processes. The recommendations span various aspects, including spatial planning, land use management, provision of basic services, environmental conservation, and community participation. This research contributes valuable empirical insights into applying SDG 11 principles to peri-urban development, specifically within Lucknow. The proposed strategies and policy recommendations offer practical guidance to urban and regional planners, policymakers, and other stakeholders involved in peri-urban development, not only in Lucknow but also in similar urbanizing regions worldwide. By incorporating SDG 11 principles into peri-urban planning, the thesis aims to foster sustainable development, enhance the quality of life for peri-urban residents, and ensure long-term well-being for the city and its surrounding areas. This study underscores the importance of holistic and inclusive urban planning approaches that prioritize environmental sustainability, social equity, and economic prosperity, thus contributing to the achievement of the United Nations' Sustainable Development Goals.

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CHAPTER 1. INTRODUCTION

1.1. Background of the Study

Urbanization is a global phenomenon with significant implications for sustainable development. According to the United Nations, in 2020, more than half of the world's population lived in urban areas, and this number is expected to increase in the coming decades. The process of urbanization often leads to the expansion of cities and the emergence of peri-urban areas.

Lucknow, the capital city of Uttar Pradesh, India, has experienced rapid urban growth in recent years. According to the Census of India 2011, the population of Lucknow was approximately 2.8 million, and by 2021, it is estimated to have surpassed 3.5 million. This population growth has put immense pressure on the city's infrastructure, services, and resources, leading to the development of peri-urban areas around Lucknow.

Peri-urban areas are characterized by a mixture of urban and rural features. They typically consist of a patchwork of agricultural lands, informal settlements, and small-scale industries. These areas serve as a transition zone between urban and rural regions, often facing unique challenges related to land use, infrastructure provision, environmental degradation, and socio-economic disparities.

The Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 provide a comprehensive framework for addressing global challenges and achieving sustainable development by 2030. SDG 11 specifically focuses on making cities and human settlements inclusive, safe, resilient, and sustainable. It calls for sustainable urban planning, improved access to basic services, housing and transportation, and the protection of cultural and natural heritage.

In the context of Lucknow, integrating the principles of SDG 11 into peri-urban development is crucial for addressing the specific challenges faced by these areas. The expansion of urban boundaries and the rapid growth of peri-urban regions in Lucknow have resulted in increased demand for housing, infrastructure, and services. However, the unplanned and unregulated nature of peri-urban development has often led to

inadequate provision of basic amenities, environmental degradation, and social inequalities.

According to a report by the Lucknow Development Authority (LDA), peri-urban areas in Lucknow are characterized by a lack of proper planning and infrastructure. Many residents in these areas face challenges related to access to clean water, sanitation facilities, healthcare, and education. Additionally, agricultural lands are being converted into residential and commercial zones, leading to a loss of green spaces and agricultural productivity.

Therefore, this research aims to explore the integration of SDG 11 principles into peri-urban development in Lucknow, considering the specific challenges and opportunities faced by the city. By analyzing the peri-urban dynamics, assessing existing planning strategies, and providing recommendations aligned with SDG 11 principles, this study seeks to contribute to the knowledge and practice of urban and regional planning, enabling policymakers and planners to address the complex issues of peri-urban development and work towards creating inclusive, safe, resilient, and sustainable peri-urban environments in Lucknow and beyond.

1.2. Need of the Study

Addressing Peri-Urban Challenges: Peri-urban areas, being transitional spaces between urban and rural regions, face unique challenges that require attention and intervention. Lucknow, like many other cities, is experiencing rapid peri-urban expansion, leading to issues such as haphazard development, inadequate infrastructure, environmental degradation, and social inequalities. This study is necessary to understand and address these challenges in the context of sustainable peri-urban development.

- **Aligning with Global Sustainability Goals:** The United Nations' Sustainable Development Goals (SDGs) provide a comprehensive framework for achieving sustainable development worldwide. SDG 11 specifically emphasizes the importance of sustainable cities and communities. By integrating SDG 11 principles into peri-urban development, cities like Lucknow can contribute to the global sustainability agenda and work towards creating inclusive, safe, resilient, and sustainable peri-urban areas.

- **Guiding Policy and Planning:** Effective urban planning and policy formulation are crucial for sustainable peri-urban development. This study aims to provide evidence-based recommendations and strategies for policymakers and urban planners in Lucknow to guide their decision-making processes. By identifying best practices, successful case studies, and potential interventions, this research can support the formulation of policies that promote sustainable peri-urban development in the city.

- **Enhancing Quality of Life:** The well-being and quality of life of peri-urban residents are often compromised due to inadequate infrastructure, limited access to services, and environmental degradation. Integrating SDG 11 principles can help improve the living conditions in peri-urban areas by ensuring access to basic services, promoting environmental sustainability, and reducing socio-economic disparities. This study aims to contribute to enhancing the quality of life for peri-urban residents in Lucknow.

- **Filling the Research Gap:** While there is a growing body of literature on urban development and sustainable cities, there is a relative lack of studies specifically focusing on peri-urban areas and their sustainable development. This research will contribute to filling this gap by providing insights into sustainable peri-urban development strategies, with a specific focus on Lucknow. It will generate new knowledge and contribute to the existing literature on peri-urban development, urban planning, and the integration of SDG 11 principles.

- **Stakeholder Engagement and Collaboration:** Sustainable peri-urban development requires the active involvement of multiple stakeholders, including government agencies, local communities, non-governmental organizations, and academic institutions. This study will facilitate stakeholder engagement and collaboration by bringing together different actors involved in peri-urban development in Lucknow. It will foster dialogue, knowledge sharing, and cooperation among stakeholders, thereby strengthening the collective effort towards sustainable peri-urban development.

This study's need lies in addressing the peri-urban challenges in Lucknow, aligning with global sustainability goals, guiding policy and planning, enhancing quality of life, filling the research gap, and promoting stakeholder engagement and collaboration. By investigating sustainable strategies and integrating SDG 11 principles, this research aims to contribute to the sustainable development of peri-urban areas in Lucknow and serve as a reference for other cities facing similar challenges.

1.3. Research Problems

The research problem addressed in this study is the pressing need for sustainable peri-urban development in Lucknow, supported by factual evidence and figures that illustrate the challenges and opportunities presented by the city's expanding peri-urban areas. The following facts and figures provide a comprehensive understanding of the research problem:

Rapid Urbanization and Population Growth:

- Lucknow, the capital city of Uttar Pradesh, has witnessed significant urbanization in recent years. The city's population has been growing at a rapid pace, increasing the pressure on peri-urban areas (Lucknow Municipal Corporation).
- The rate of urbanization in India is substantial, with the urban population expected to reach 600 million by 2031 (Ministry of Housing and Urban Affairs, Government of India).

Challenges in Peri-Urban Areas:

- Haphazard and Unplanned Development: The expansion of peri-urban areas in Lucknow has often occurred without adequate planning and regulation, resulting in irregular land use patterns and fragmented development (Lucknow Development Authority).
- Inadequate Infrastructure: Peri-urban areas typically lack basic infrastructure such as roads, water supply, sanitation facilities, and waste management

systems, hindering the quality of life for residents (Centre for Science and Environment).

- Environmental Degradation: Unplanned urbanization in peri-urban areas leads to environmental degradation, including deforestation, loss of agricultural land, and increased pollution, impacting the overall ecological balance (Indian Institute of Technology, Kanpur).
- Socio-economic Disparities: Peri-urban areas often face socio-economic disparities, with marginalized communities experiencing challenges in accessing essential services, education, healthcare, and livelihood opportunities (Lucknow Urban Resource Centre).

Sustainable Development Goals (SDGs):

- SDG 11: SDG 11, as defined by the United Nations, aims to make cities and human settlements inclusive, safe, resilient, and sustainable.
- Alignment with SDG 11: By integrating the principles of SDG 11 into peri-urban development, Lucknow can work towards creating sustainable and resilient peri-urban areas, contributing to the global sustainability agenda.

1.4. Aim and Objectives of Study

1.4.1. Aim

To identify the potential for integrating Sustainable Development Goal 11 (SDG 11) principles into urban planning practices in peri-urban areas of Lucknow City.

1.4.2. Objectives

Objective 1: Conduct a comprehensive analysis of the existing peri-urban areas in Lucknow, considering their demographic, economic, and environmental characteristics, as well as the infrastructure and service provision status.

Objective 2: Identify and analyze the challenges and barriers hindering the achievement of sustainable peri-urban development in Lucknow. These may include issues related to unplanned growth, inadequate infrastructure, environmental degradation, and socio-economic disparities.

Objective 3: Explore the principles outlined in SDG 11 and their relevance to peri-urban development. Assess how these principles can be effectively integrated into the peri-urban planning and development processes in Lucknow.

Objective 4: Propose Sustainable Strategies based on the assessment of the current peri-urban landscape, challenges, and SDG 11 principles, propose sustainable strategies and recommendation for peri-urban development in Lucknow. Scope and Limitations

1.4.3. Scope

The scope of this study is to explore and analyze the integration of Sustainable Development Goal 11 (SDG 11) principles into urban planning practices, specifically focusing on peri-urban areas in Lucknow. It will examine various dimensions of peri-urban development, including socio-economic, environmental, and governance aspects. The study aims to understand the current status of peri-urban areas, identify challenges and opportunities, and propose strategies to effectively incorporate SDG 11 principles into urban planning processes. The scope also includes assessing the socio-economic impacts, environmental sustainability, and governance frameworks required for achieving sustainable peri-urban development in Lucknow.

1.4.4. Limitations

- The study will cover a range of peri-urban areas in Lucknow, including both developed and developing areas as per Master Plan 2031.
- Thesis only consider the SDG 11th Goal and specific peri-urban area of Lucknow City.

1.5. Significance of the Study

This study holds significant importance for various stakeholders and fields:

- **Urban Planning and Policy:** The study will provide valuable insights and recommendations for urban planners and policymakers involved in peri-urban development in Lucknow. It will offer practical strategies for integrating Sustainable Development Goal 11 (SDG 11) principles into urban planning practices, enabling the formulation of effective policies and sustainable development frameworks.

- **Sustainable Development Goals (SDGs):** By examining the relevance of SDG 11 principles to peri-urban development in Lucknow, this study directly contributes to the global sustainability agenda. It highlights the local application of SDG 11 and showcases how peri-urban development can align with broader sustainable development objectives.
- **Environmental Sustainability:** The study will emphasize the significance of environmental sustainability in peri-urban development. It will propose strategies to mitigate environmental degradation, promote sustainable land use, and conserve natural resources. These recommendations will foster ecological resilience and contribute to the long-term sustainability of peri-urban areas.
- **Social Inclusion and Equity:** Addressing socio-economic disparities is a crucial aspect of peri-urban development. This study will highlight the importance of social inclusion and equity, offering interventions to improve access to basic services and opportunities for marginalized communities. It will contribute to creating more inclusive and equitable peri-urban environments.

1.6. Research Questions

This study will address the following research questions:

- What are the key characteristics and challenges of peri-urban areas in Lucknow?
- What are the principles outlined in SDG 11, and how are they relevant to peri-urban development?
- How can SDG 11 principles be effectively integrated into peri-urban planning and development processes in Lucknow?
- What are the potential socio-economic, environmental, and governance impacts of integrating SDG 11 principles into peri-urban development in Lucknow?

1.7. Definition of Terms

To ensure clarity and consistency throughout the thesis, the following key terms will be defined:

Urban Planning: Urban planning refers to the discipline and practice of designing and shaping cities and urban areas. It involves the development of comprehensive plans and policies to guide the growth and development of urban spaces.

Peri-Urban: Peri-urban refers to the transitional zone between urban and rural areas. It typically encompasses the areas surrounding cities or urban centers, characterized by a mix of urban and rural features.

Sustainable Development Goals (SDGs): The Sustainable Development Goals (SDGs) are a set of 17 global goals established by the United Nations (UN) in 2015 as part of the 2030 Agenda for Sustainable Development. The SDGs aim to address the world's most pressing economic, social, and environmental challenges to create a more sustainable and equitable future for all.

SDGs (Goal 11):"Sustainable Cities and Communities," aims to create inclusive, safe, resilient, and sustainable urban areas. It focuses on ensuring access to affordable housing, sustainable urban planning, efficient transportation systems, and inclusive public spaces. The goal also promotes environmental sustainability, disaster resilience, and participatory decision-making in urban development. By pursuing SDG Goal 11, we can create cities and communities that are livable, environmentally friendly, socially inclusive, and economically prosperous.

1.8. Methodology

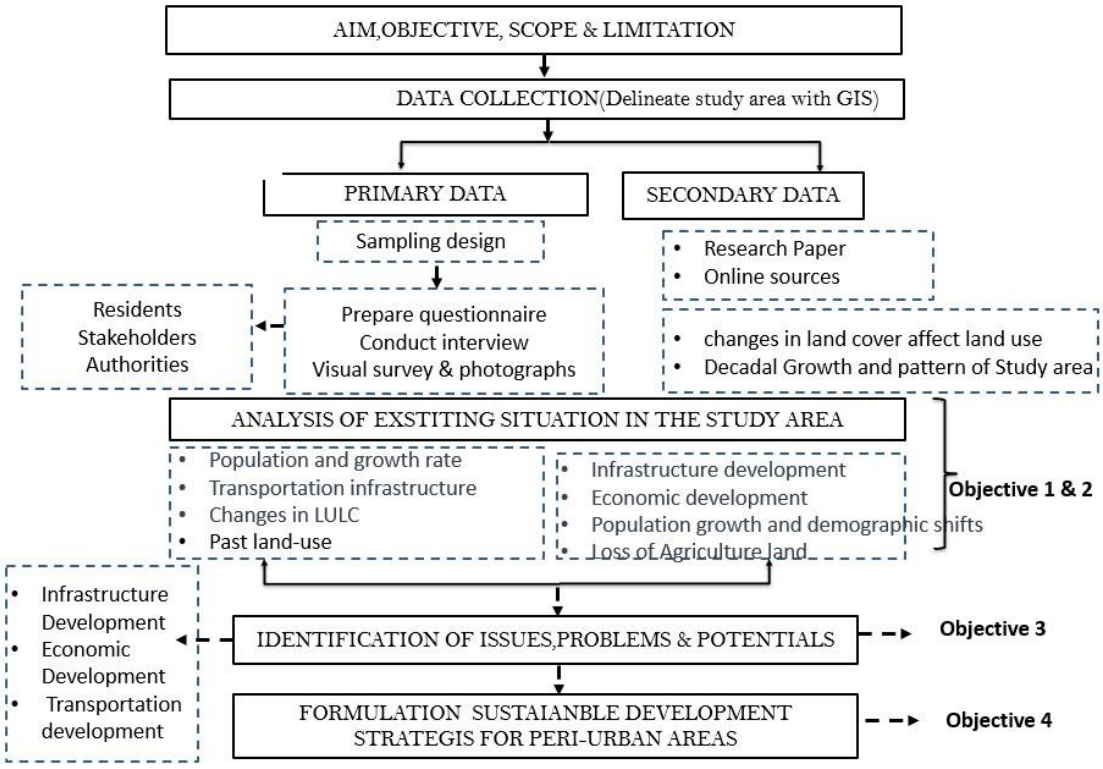

Figure 1-1 Methodology

CHAPTER 2. LITERATURE REVIEW

2.1. Overview of Integrating SGDs Principles for sustainable Development for Peri-urban Areas

This study revolves around integrating Sustainable Development Goal 11 (SDG 11) principles into peri-urban planning and development processes in Lucknow. Peri-urban areas, located at the outskirts of urban centers, are experiencing rapid growth and transformation. This expansion often brings challenges related to inadequate infrastructure, environmental degradation, and socio-economic disparities.

According to recent data, Lucknow, the capital city of Uttar Pradesh in India, has been witnessing significant urbanization. The city's population has been steadily increasing, with an estimated population of over 3 million in peri-urban areas alone (source: Census of India, 2011). This population growth has put immense pressure on the existing infrastructure, leading to inadequate access to basic services such as water supply, sanitation, and healthcare.

In terms of environmental challenges, peri-urban areas in Lucknow have witnessed increased deforestation, encroachment on agricultural land, and depletion of natural resources. This has resulted in ecological imbalance, loss of biodiversity, and heightened vulnerability to natural disasters.

Socio-economic disparities also persist in peri-urban areas of Lucknow. The lack of job opportunities, inadequate social amenities, and limited access to quality education and healthcare services have exacerbated the divide between the urban and peri-urban populations.

The study aims to explore the principles outlined in SDG 11, which focuses on making cities inclusive, safe, resilient, and sustainable. By analyzing the relevance of these principles to peri-urban development in Lucknow, the research seeks to propose strategies for effectively integrating SDG 11 principles into urban planning practices.

With respect to SDG 11, it is crucial to note that affordable housing remains a significant challenge in peri-urban areas. As per the National Sample Survey (NSS)

2018-19, around 30% of households in peri-urban regions of India live in inadequate housing conditions, lacking basic amenities like water, sanitation, and proper ventilation.

To address these challenges, the study will propose sustainable strategies for peri-urban development, encompassing aspects such as urban planning and design, resource management, social inclusion, and governance frameworks. It will leverage best practices and international experiences in implementing SDG 11 principles to provide a practical and context-specific approach for Lucknow's peri-urban areas.

By aligning local efforts with global sustainability goals, the study aims to provide a framework for sustainable peri-urban development in Lucknow. It will contribute to policy formulation and implementation by offering practical recommendations and insights for urban planners and policymakers.

Overall, the study seeks to bridge the gap between theory and practice by examining the integration of SDG 11 principles and providing actionable recommendations for sustainable peri-urban development in Lucknow. It aims to promote the city's progress towards global sustainability goals, enhance socio-economic equity, and create resilient and livable peri-urban environments.

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2.2. Peri-urban

Peri-urban areas refer to the transitional zones located on the outskirts of cities and towns. These areas lie between urban and rural spaces and experience the effects of both urbanization and rural transformation. Peri-urban areas are characterized by a dynamic and evolving landscape, influenced by the expansion of urban areas and the encroachment of urban activities into previously rural or agricultural spaces.

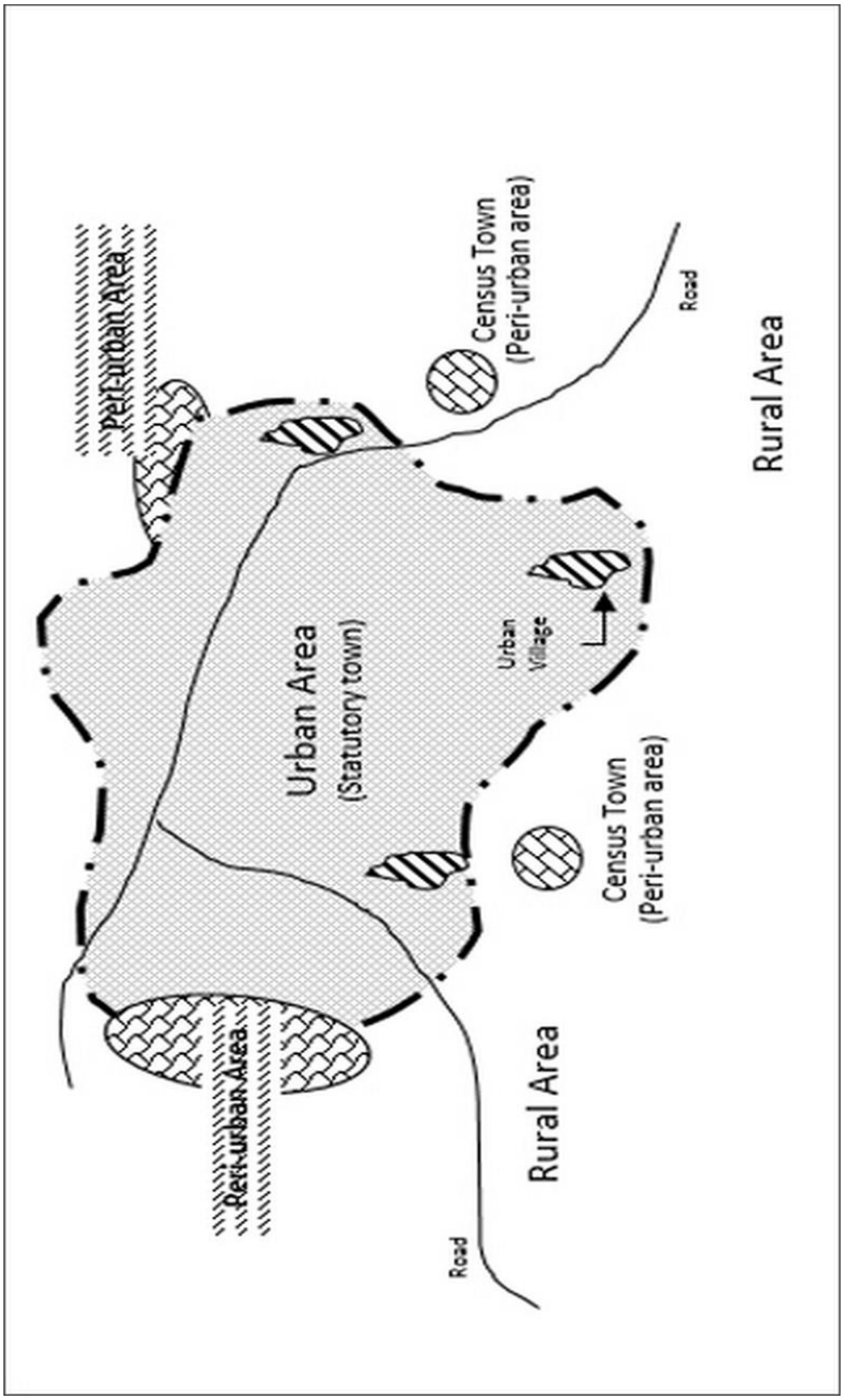


Figure 2-1 Visualization of Peri-urban areas

Sourcewww.re-thinkingthefuture.com

Characteristics define peri-urban areas:

- **Spatial transformation**: Peri-urban areas often witness rapid changes in land use patterns, with agricultural land being converted for non-agricultural purposes such as residential, commercial, and industrial uses. This transformation can lead to fragmented land holdings and loss of agricultural productivity.

- **Population dynamics:** Peri-urban areas experience a significant influx of people seeking employment opportunities, better infrastructure, and improved living conditions. This population growth can put pressure on existing resources and infrastructure, leading to challenges in service provision and urban planning.

- **Infrastructure and service gaps:** Peri-urban areas often face inadequate infrastructure and basic services such as water supply, sanitation, electricity, and transportation. The existing infrastructure may struggle to keep up with the demands of a growing population, resulting in service gaps and disparities.

- **Informal settlements:** The expansion of peri-urban areas often leads to the formation of informal settlements or slums, characterized by inadequate housing, limited access to services, and poor living conditions. These settlements are typically established by migrant populations and marginalized communities seeking affordable housing options.

- **Environmental challenges:** Peri-urban areas in India often face environmental degradation due to haphazard development, encroachment on natural habitats, pollution from industries and transportation, and improper waste management practices. These challenges impact the ecological balance, water resources, and overall environmental sustainability of the peri-urban regions.

- **Socio-economic disparities:** Peri-urban areas can exhibit significant socio-economic disparities, with pockets of wealth and poverty coexisting. Income inequalities, access to education, healthcare, and employment opportunities can vary widely within these areas, contributing to social challenges and disparities.

- *Characteristics that can help in understanding the nature of peri-urban areas:*
  - Proximity to urban centers
  - Mixed land uses
  - Population dynamics
  - Infrastructure challenges
  - Environmental vulnerabilities
  - Governance complexities

2.3. SUSTAINABLE DEVELOPMENT GOALS (SDGs)

WSDG stands for Sustainable Development Goals. It is a set of 17 global goals established by the United Nations (UN) in 2015 as part of the 2030 Agenda for Sustainable Development. These goals aim to address some of the world's most pressing social, economic, and environmental challenges in order to achieve a more sustainable and equitable future for all.

The 17 SDGs cover a wide range of interconnected issues, including poverty, hunger, health, education, gender equality, clean water and sanitation, affordable and clean energy, decent work and economic growth, industry innovation and infrastructure, reduced inequalities, sustainable cities and communities, responsible consumption and production, climate action, life below water, life on land, peace, justice, and strong institutions, and partnerships for the goals.

Each goal has specific targets and indicators to measure progress. The SDGs are designed to be inclusive and comprehensive, addressing the needs of both developing and developed countries. They recognize the interconnectedness of various challenges and emphasize the importance of integrated approaches to sustainable development.

The SDGs build upon the earlier Millennium Development Goals (MDGs) and expand the focus to include environmental sustainability, social inclusion, and economic development. They provide a framework for governments, businesses, civil society, and individuals to work together and take action towards achieving a more sustainable and prosperous future for everyone.

The deadline for achieving the SDGs is 2030, and countries around the world are working towards implementing policies, programs, and initiatives aligned with the goals. Progress on the SDGs is regularly tracked and reported by the UN and other organizations to ensure accountability and facilitate global cooperation.

Figure 2-2 Sustainable Development Goals

2.3.1. GOAL 11 "SUSTAINABLE CITIES AND COMMUNITIES"

Figure 2-3 11th Goal Sustainable Cities and Communities

SDG Goal 11 is "Sustainable Cities and Communities." It focuses on making cities and human settlements inclusive, safe, resilient, and sustainable. The goal recognizes that urbanization is a global trend, and that well-planned cities and communities can provide opportunities for economic growth, social development, and environmental sustainability.

The specific targets under SDG Goal 11 include:

- **Safe and inclusive urbanization:** Ensuring access for all to adequate, safe, and affordable housing and basic services, such as water, sanitation, and transportation. It also aims to upgrade slums and provide suitable living conditions for marginalized groups.
- **Sustainable transport and infrastructure:** Developing sustainable and efficient transportation systems, including affordable and accessible public transport, walking, and cycling infrastructure. It also promotes the sustainable management and upgrade of urban infrastructure.
- **Inclusive and sustainable urbanization:** Providing access to safe, inclusive, and accessible green and public spaces. It focuses on enhancing urban planning and management, reducing the environmental impact of cities, and promoting sustainable and resilient urban development.
- **Resilience to disasters:** Strengthening the capacity for disaster risk reduction and management in cities, including early warning systems, risk assessment, and resilient infrastructure. This target aims to reduce the vulnerability of cities to natural and human-made disasters.

- **Participatory and sustainable urban planning:** Enhancing participatory and inclusive decision-making processes at all levels of urban planning and development. It emphasizes the integration of cultural heritage and sustainable practices into urban development.

- **Integrated policies and sustainable resource management**: Promoting integrated policies, efficient resource utilization, and waste management practices in cities. It seeks to improve air quality, reduce the adverse environmental impact of cities, and provide access to sustainable and renewable energy sources.

2.3.2. Targets and Indicators of SDG Goal 11

Targets	Indicators
11.1: By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	**11.1.1:** Proportion of urban population living in slums, informal settlements or inadequate housing
11.2: Provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.	**11.2.1:** Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities.
11.3: By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.	**11.3.1**: Ratio of land consumption rate to population growth rate. **11.3.2:** Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically.
11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage.	**11.4.1:** Total per capita expenditure on the preservation, protection and conservation of all cultural and natural heritage, by source of funding (public, private), type of heritage (cultural, natural) and level of government (national, regional, and local/municipal)
11.5: By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.	**11.5.1:** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population. **11.5.2:** Direct economic loss attributed to disasters in relation to global domestic product (GDP). **11.5.3**: (a) Damage to critical infrastructure and (b) number of disruptions to basic services, attributed to disasters.
11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.	**11.6.1:** Proportion of municipal solid waste collected and managed in controlled facilities out of total municipal waste generated, by cities. **11.6.2:** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted).
11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	**11.7.1:** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities. **11.7.2:** Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months.
11.a: Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning.	**11.a.1:** Number of countries that have national urban policies or regional development plans that (a) respond to population dynamics; (b) ensure balanced territorial development; and (c) increase local fiscal space.
11.b: By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.	**11.b.1:** Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030. **11.b.2:** Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies.
11.c: Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials..	Source: Goal 11: Sustainable cities and communities - The Global Goals

Table 1 Targets and Indicators of SDG Goal 11

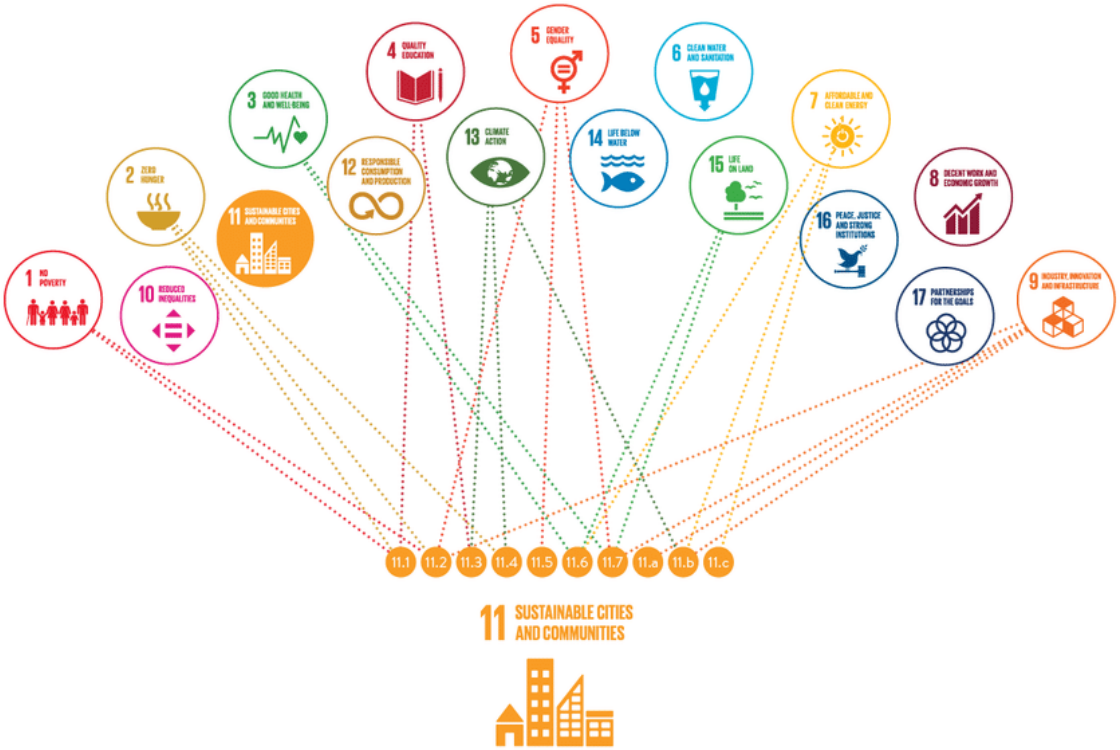


Figure 2-4 SDGs Goal 11 Targets

2.3.3. SDG Goal 11 Principles in Peri-Urban Areas

Inclusive Access to Basic Services:

Assessing efforts to provide equitable access to water, sanitation, healthcare, and education in peri-urban areas.

Challenges: Limited infrastructure, population growth, and spatial fragmentation.

Opportunities: Innovative solutions like decentralized systems and mobile services.

Sustainable Urban Planning:

Evaluating the integration of SDG 11 principles in peri-urban planning.

Challenges: Conflicting interests, fragmented governance, and lack of planning frameworks.

Opportunities: Well-planned neighbourhood's, efficient transportation, and green spaces.

Affordable Housing and Slum Upgrading:

Examining progress in providing affordable housing and upgrading slums.

Challenges: Limited resources, housing policies, and inadequate infrastructure.

Opportunities: Affordable housing schemes, rehabilitation programs, and innovative financing models.

Resilient Infrastructure:

Assessing efforts to develop climate-resilient infrastructure in peri-urban areas.

Challenges: Funding, maintenance, and awareness of resilience measures.

Opportunities: Climate-resilient infrastructure, renewable energy, and nature-based solutions.

Environmental Sustainability:

Evaluating initiatives for environmental protection and sustainable waste management.

Challenges: Urbanization, natural resource depletion, pollution, and waste management.

Opportunities: Sustainable waste practices, conservation, renewable energy, and eco-friendly infrastructure.

CHAPTER 3. CASE STUDIES

3.1. Masdar City in the United Arab Emirates (U.A.E)

Masdar City is a sustainable urban development project located in the United Arab Emirates (UAE). It is situated near Abu Dhabi, the capital city of the UAE. Masdar City was conceived as a model for a sustainable city of the future, incorporating innovative technologies and renewable energy sources.

3.1.1. Vision Of the City

Masdar City was launched in 2006 by the Abu Dhabi government's renewable energy company, Masdar, with the vision of creating a carbon-neutral and zero-waste city. The main purpose of the project was to showcase sustainable urban development and serve as a center for clean technology and renewable energy research and innovation. It aims to be a model for sustainable urban development, incorporating multiple Sustainable Development Goals (SDGs), including SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), and SDG 13 (Climate Action).

Figure 3-1 Masdar City The First Sustainable City

3.1.2. Design and Architecture

The city was designed by the British architectural firm Foster + Partners. The design incorporates traditional Arabic architecture principles with modern technologies. The layout of the city is pedestrian-friendly, with narrow streets that help reduce heat and promote natural cooling.

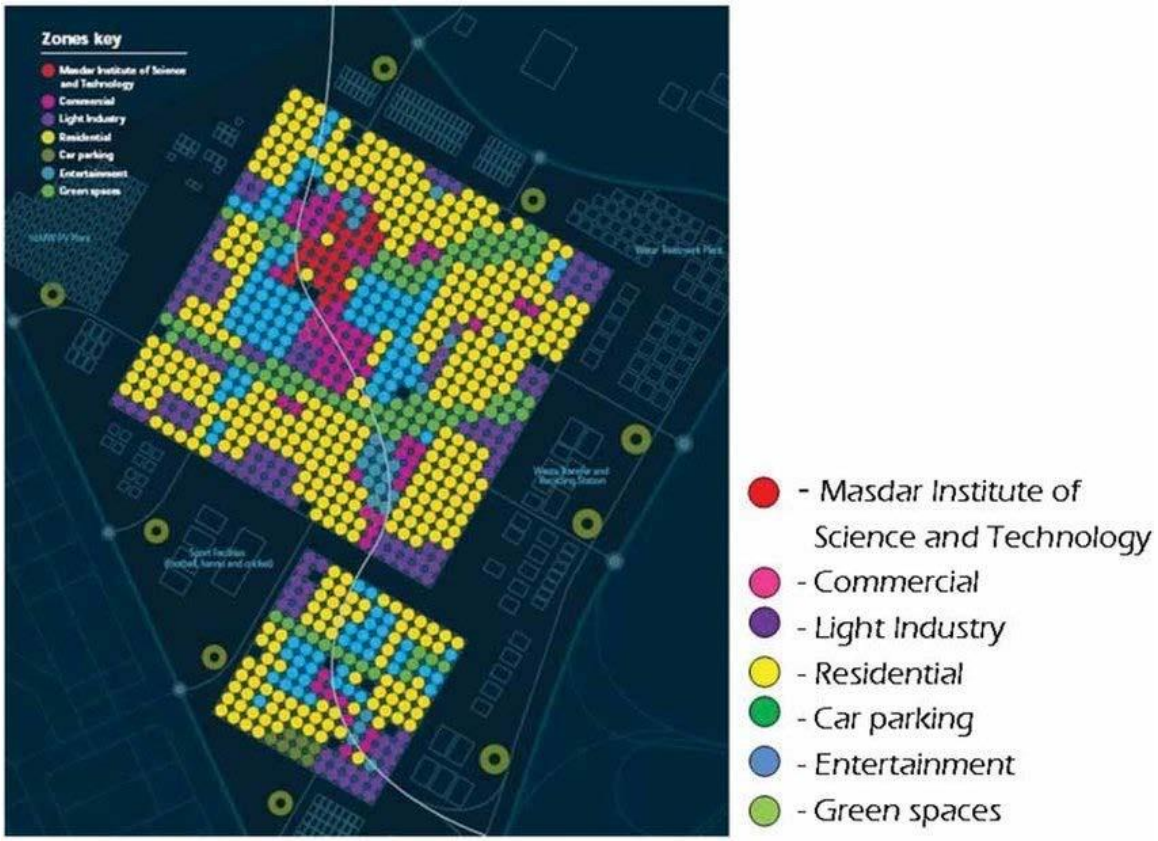


Figure 3-2 Key Zones of Masdar City

3.1.3. Renewable Energy

One of the core features of Masdar City is its emphasis on renewable energy sources. The city aims to generate clean energy and reduce its carbon footprint. It utilizes a variety of renewable energy technologies such as solar power, wind power, and geothermal energy. The city's solar power plant, located outside its boundaries, supplies a significant portion of its energy needs.

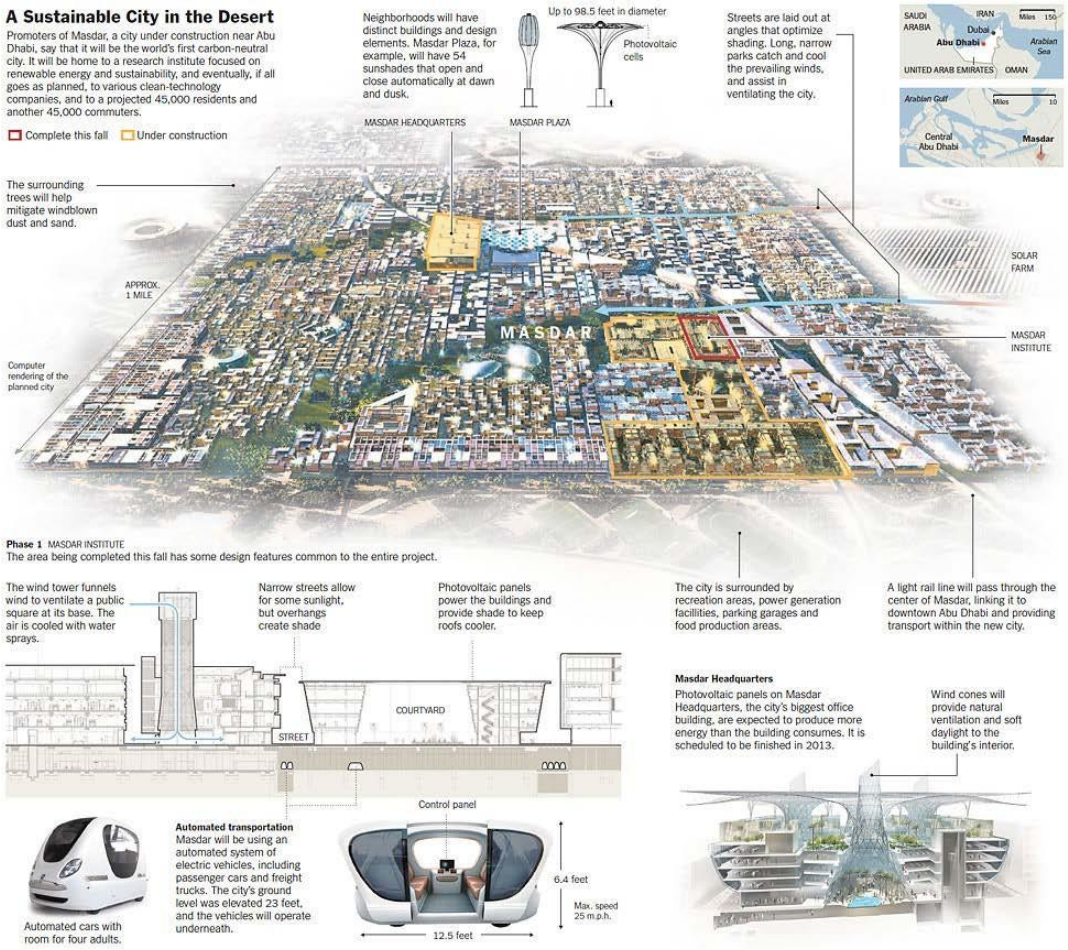


Figure 3-3 Use of Renewable Energy Within a city

3.1.4. Transportation

To promote sustainable transportation, Masdar City discourages the use of private vehicles within its boundaries. Instead, the city encourages walking, cycling, and the use of electric vehicles (EVs) for transportation. The city features a Personal Rapid Transit (PRT) system, which is a network of automated electric vehicles that transport passengers within the city.

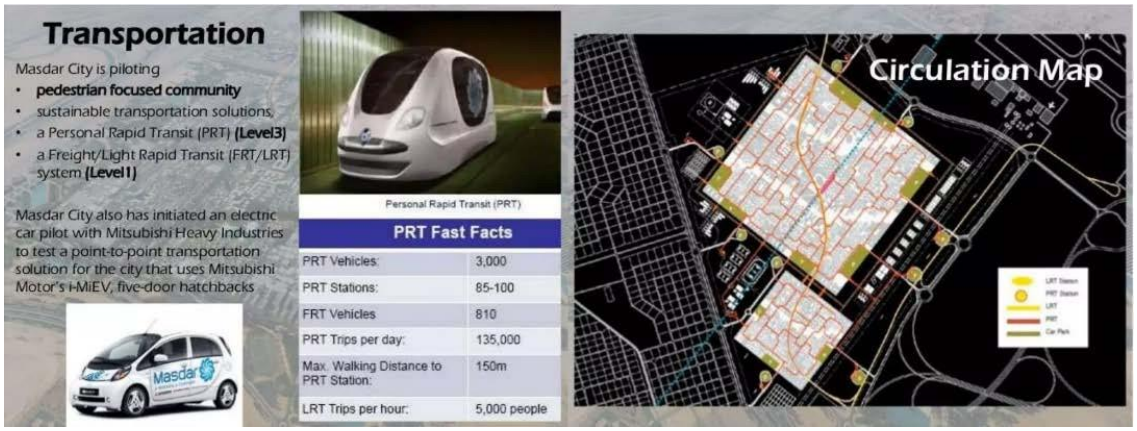


Figure 3-4 Transportation Circulation Map

3.1.5. Sustainable Practices

Masdar City incorporates numerous sustainable practices. Buildings in the city are designed to be energy-efficient, using technologies such as solar panels and natural ventilation systems. The city aims to achieve zero waste through recycling and waste management programs. Water conservation is also a priority, with the city implementing efficient irrigation systems and wastewater treatment technologies.

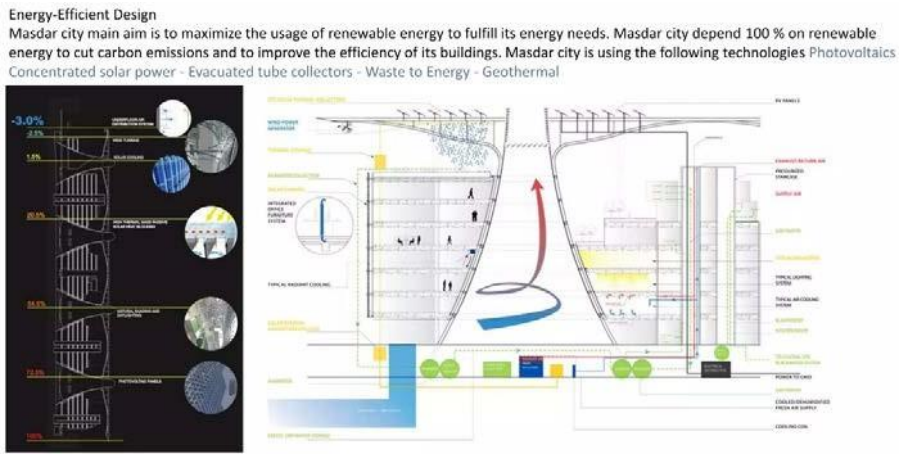
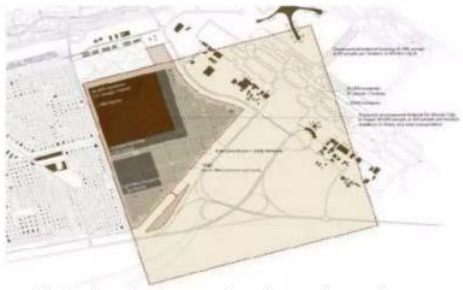


Figure 3-5 Use of Sustainable Technique for buildings

In order to enhance air movement in linear parks and courtyards the city oriented in the direction of prevailing wind 38 degrees counter-clock wise of the north direction, North side for soft sunshine (Masdar Institute, 2010).



Masdar city orientation towards southeast-northwest axis
Reference: Wagle,2014

Wind movement at Masdar City Reference: Wagle, 2014, edited by the Researcher

Figure 3-6 Wind Movement map of Masdar City

Research and Development:

Masdar City serves as a hub for research and development in clean technology and renewable energy. It houses the Masdar Institute of Science and Technology, a research university focused on sustainable technologies. The city attracts international companies, startups, and research institutions working in the field of renewable energy.

Residential and Commercial Areas:

The city includes residential areas, commercial buildings, and public spaces. The residential area provides housing for individuals and families, incorporating sustainable design principles. The commercial area accommodates offices, retail outlets, and other businesses focused on sustainability and clean technologies.

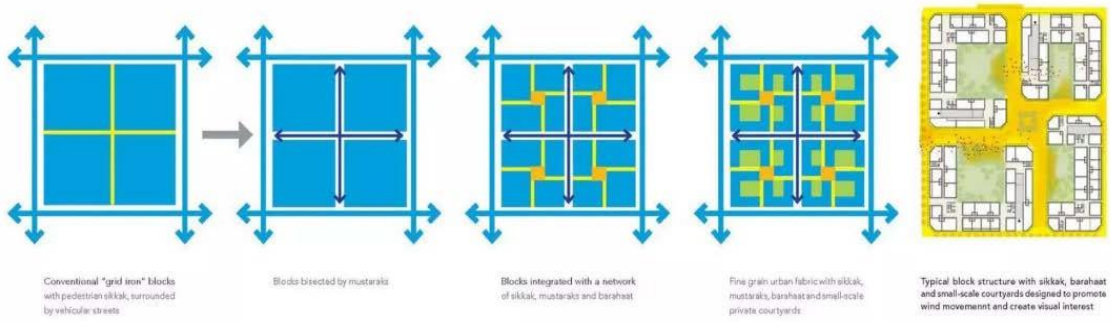


Figure 3-7 Use of Winds to design communities

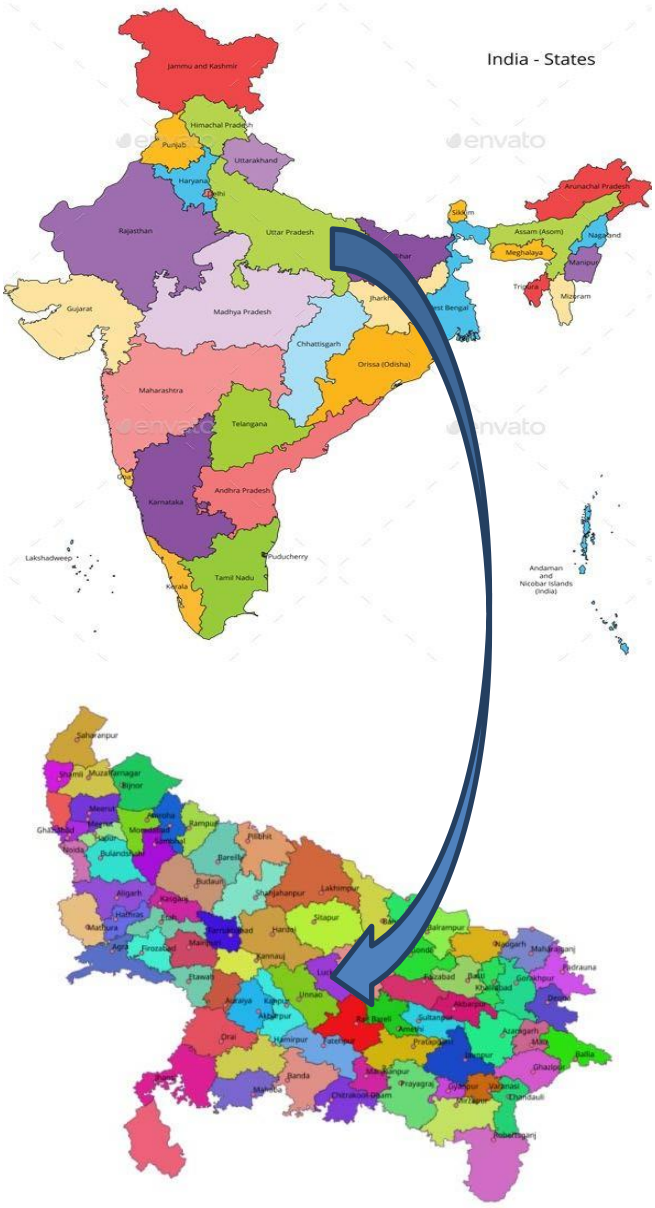
Cultural and Educational Facilities:

Masdar City is home to cultural and educational institutions that promote sustainability and renewable energy. It features the Siemens Middle East headquarters, a sustainability center, and various exhibition spaces showcasing renewable energy technologies.

CHAPTER 4. SITE ANALYSIS

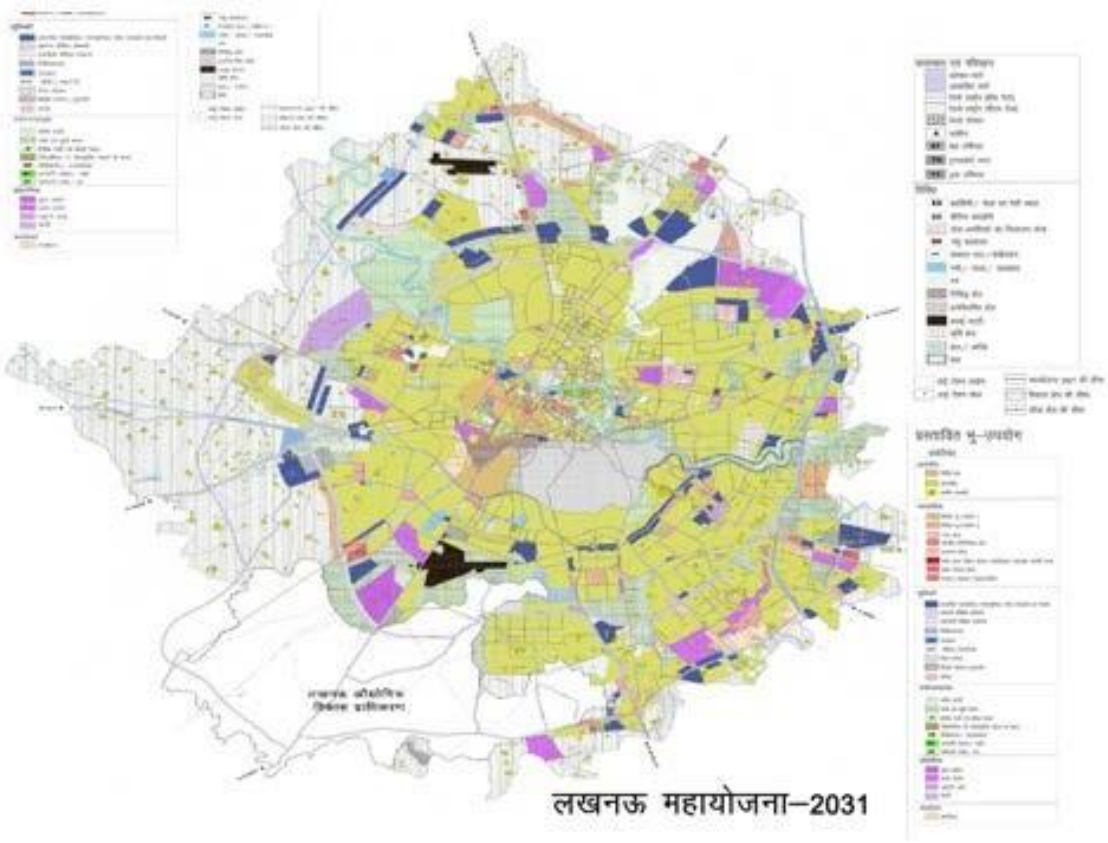
4.1.1. Site Introduction

Lucknow is the capital city of the state of Uttar Pradesh in India. It is the largest and most developed city in North India after Delhi. This metro city is the administrative headquarters of Lucknow District and Lucknow Division. Lucknow has always been known as a multicultural city and flourished as a cultural and artistic capital of North India. The city is spread on both the banks of River Gomti over an area of 350 Sq. Km with a population of over 2.8 million. Lucknow city contributes 6.33% of urban population of the state's urban population.



Source: Veethi.com

Figure 4-1 Site Location



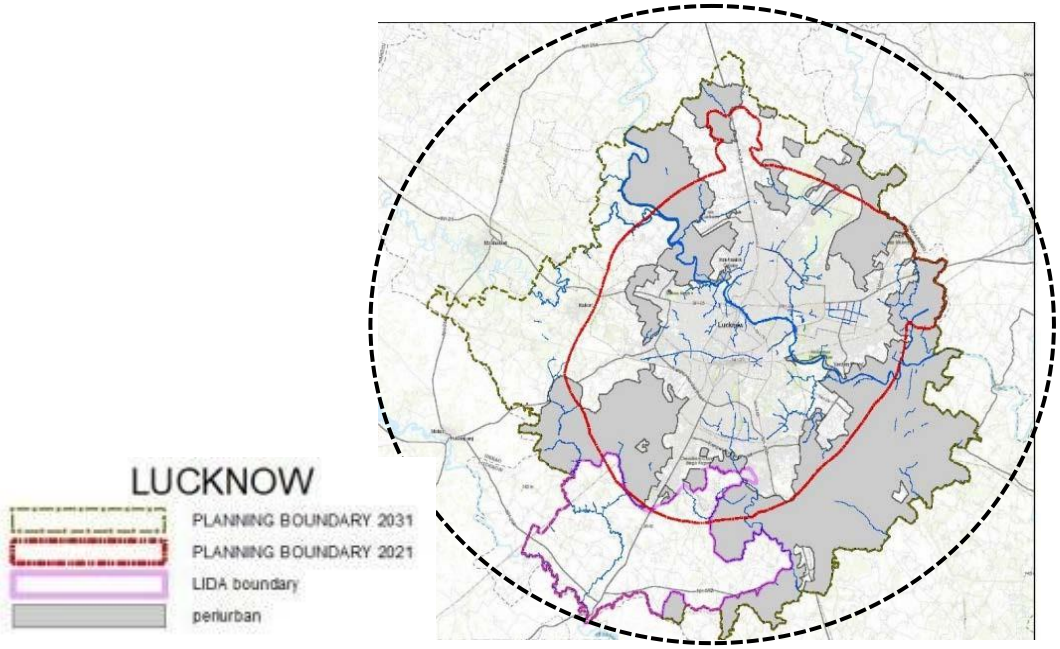


Figure 4-2 Site Location

4.1.2. Area of Growth in the Lucknow city

The city has been sprawling at a very rapid rate engulfing villages of surrounding areas and densification near the riverbeds in the city.

The growth direction shows ribbon development along major NH's and SH's in study areas.

Table 2 Growth Rate 1971-2021

	1971	1981	1991	2001	2011	2021
Area (Sq.km)	110	146	230.26	290.5	359	414.34
Rate of Growth	36.60%	57%	56%	26%	24%	230%

Table 3 Development Percentage in Peri-urban areas

ROAD DIRECTION	PERI-URBAN AREA (in sq. km.)	% of peri-urban development to total	Engulfed Villages due to development	
			Fully	Partly
Sitapur Road	13.3	12.1	6	10
Kursi Road	5.2	5.2	1	2
Faizabad Road	**35.6**	**32.4**	**16**	**10**
Sultanpur Road	**23**	**20.9**	**9**	**1**
Raebareli Road	12	10.9	5	2
Kanpur Road	2.2	2	-	2
Mohan Road	11.3	10.3	1	6
Hardoi Road	7.4	6.7	3	4
Total	110	100	41	37

Inferences

- Due to prominent road connectivity, all the development in peri-urban area is observed along the major roads.
- Mainly City growth sprawling towards, Faizabad and Sultanpur Road.
- Around 110 sq. km of development is beyond the municipal limits in peri-urban regions.
- Increasing the agriculture land-use is changing to non-agriculture land-use.

4.1.3. Development Intensity in Peri-Urban Areas

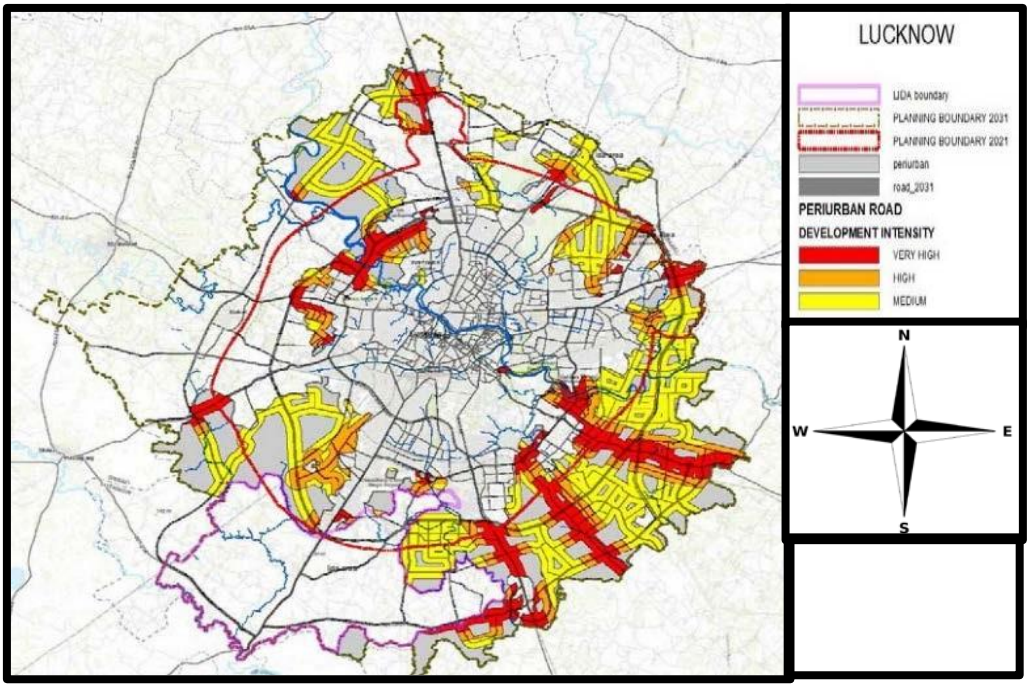


Figure 4-3 Development Intensity Map of Lucknow

Rapid urbanization: Lucknow, being the capital city of Uttar Pradesh, has experienced significant urban growth and population expansion. This rapid urbanization has led to increased development and infrastructure projects in peri-urban areas, resulting in higher intensity along roads.

Industrial and commercial growth: Lucknow has seen substantial industrial and commercial growth in recent years. Peri-urban areas often attract industrial establishments, manufacturing units, and commercial centers due to the availability of land and relatively lower costs compared to urban areas. This can contribute to increased intensity along roads as these areas become hubs of economic activity.

Infrastructure development: The expansion of transportation infrastructure, such as highways, expressways, and ring roads, can increase the intensity along roads in peri-urban areas. These infrastructure projects often result in improved connectivity and accessibility, attracting residential and commercial development along the road corridors.

Real estate and housing demand: The demand for housing in Lucknow has been on the rise due to population growth, migration, and urbanization. Peri-urban areas may offer more affordable housing options compared to the city center, leading to increased residential development along the roads.

Agricultural transitions: Peri-urban areas are typically characterized by the interface between urban and rural activities. In Lucknow's peri-urban areas, agricultural land may be converted for non-agricultural purposes, such as residential or commercial development. This transition can result in the intensification of land use and increased activity along roads.

Planning and governance: The intensity along roads in peri-urban areas of Lucknow can also be influenced by the effectiveness of planning and governance practices. Adequate land-use planning, zoning regulations, and enforcement can help shape the development intensity along the roads.

4.1.4. Urban Growth of Lucknow City

Lucknow, the capital city of Uttar Pradesh, has experienced significant urban sprawl over the years. The city has witnessed rapid population growth and expansion, leading to the development of new residential areas, commercial centers, and infrastructure projects. As per Census 2011, Lucknow city's total population is 28.17 lakh. The population in the last six decades has risen tremendously by almost six times (from 5 lakh to 28 lakh in 2011). The city's decadal population growth rate is 28.87% during 2001-2011, which is less than the country urban population growth rate (31.80%) but is higher than state urban population growth rate (28.75%).

Year	Lucknow UA	
	Population	Growth Rate %
1901	2,56,238	-
1911	2,52,114	-1.61
1921	2,40,566	-4.58
1931	2,74,659	14.17
1941	3,87,177	40.97
1951	4,96,861	28.33
1961	6,55,673	31.96
1971	8,13,982	24.14
1981	10,07,604	23.79
1991	16,69,204	65.66
2001	22,45,509	34.53
2011	28,80,108	28.26

Table 4 Population Growth in Lucknow Agglomeration (1901-2011)

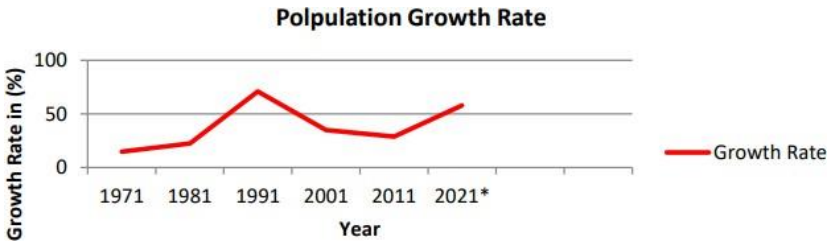


Table 5 Population Growth Rate 1971-2021

4.1.5. Change In Built-Up

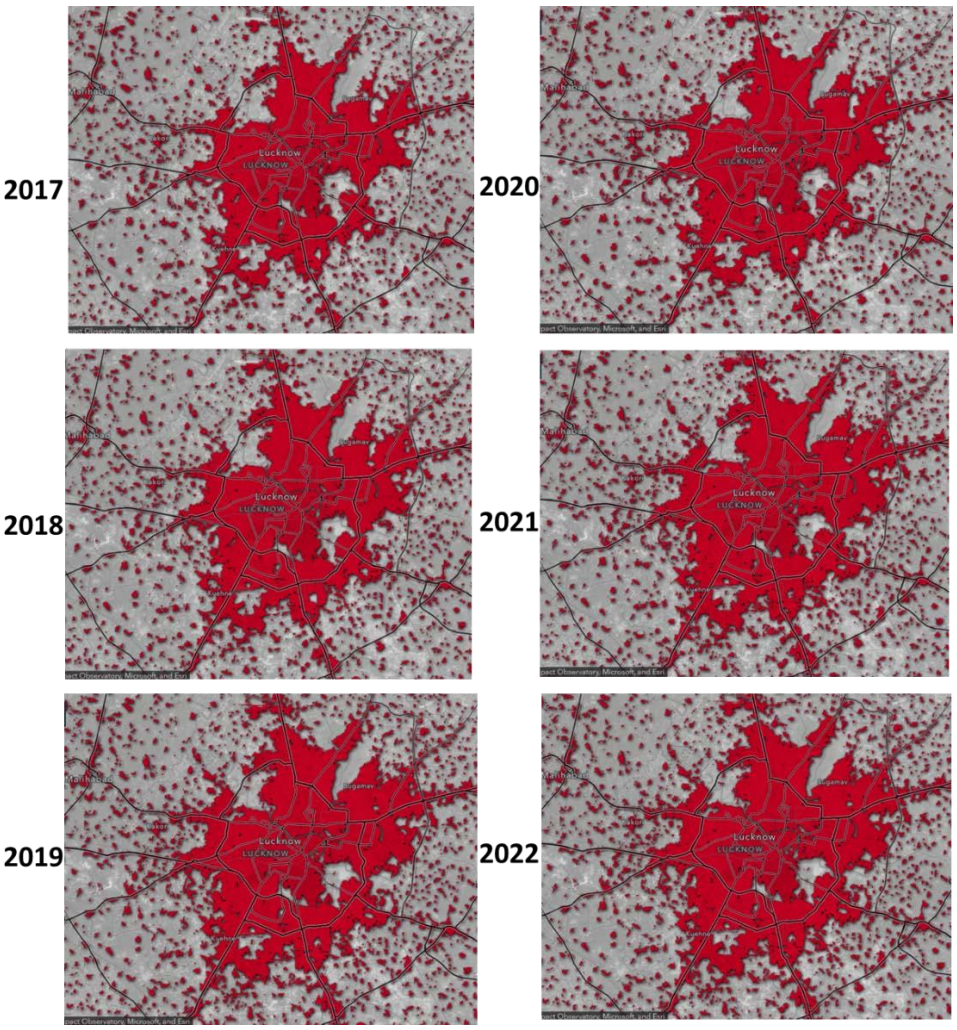


Table 6 Changes in Built-up in Lucknow Region

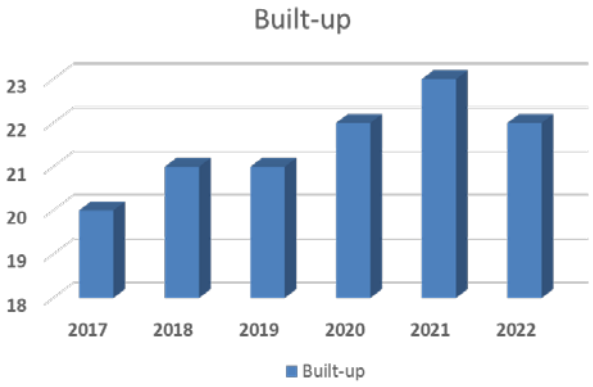


Figure 4-4 Built-up (2017-21)

4.1.6. Land use Land Cover (LULC) Timeline

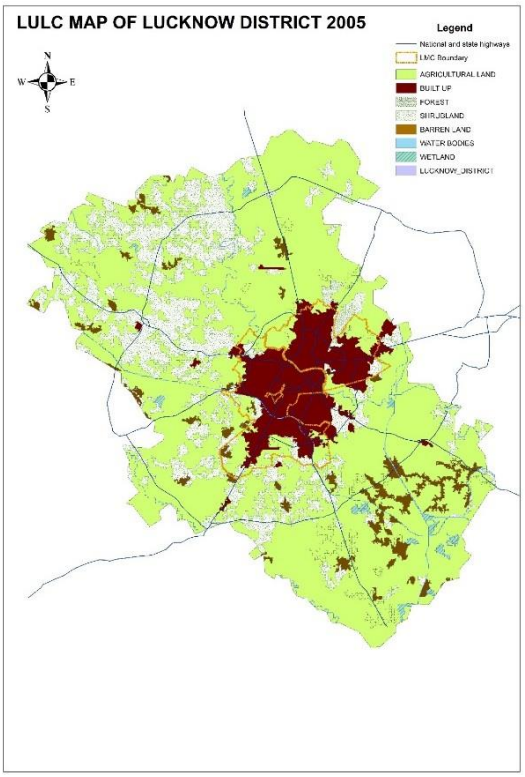


Figure 4-5 LULC Map 2005

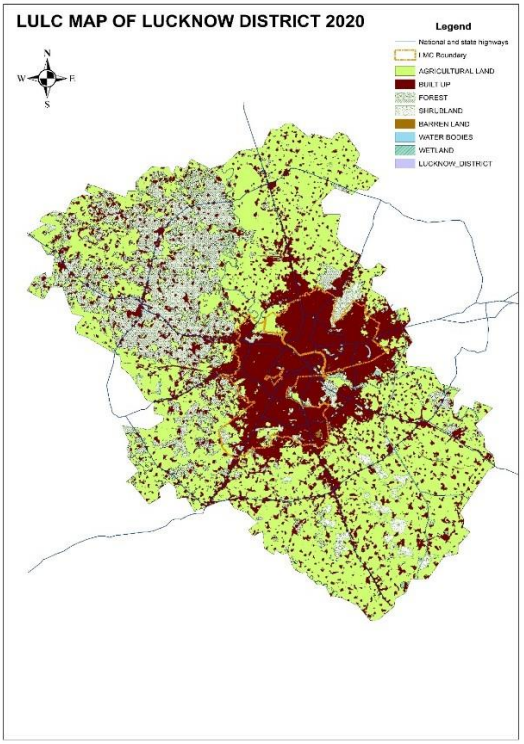


Figure 4-6 LULC Map 2020

- **Analysis of LULC 2005 and 2020**

CATEGORY	Area%	Area%
FOREST	0.69	16.71
AGRICULTURE LAND	62.72	53.75
BUILT UP	9.38	26.51
SHRUBLAND	7.01	2.09
FALLOW LAND	2.33	
WASTE LAND	3.46	0.10
WATER BODIES	0.71	0.82
PLANTATIONS	13.09	
WETLAND	0.60	0.02
TOTAL	100.00	100

Figure 4-7 Analysis of LULC 2005-2020

- **Inferences**

- It is observed that in 2005 there was 9.38 % of total built-up area of Lucknow District, which has significantly increased in 2020 to 26.51%. Because of urbanization and in-migration in Lucknow.
- There is reduction in agriculture land from 62.72 % in 2005 to 53.75% in 2020. Because of urbanization Lucknow Municipal corporation increased the development boundary.
- This rapid urbanization in past two decades is alarming and needs to be carefully catered from proper management of urban and peri-urban areas in Lucknow.
- According to observation we can major contributor of built-up areas is the peri-urban areas around the Lucknow Municipal corporation Region. But this increase in built-up areas has created alarming situation for the local administration for good management of infrastructure and services in the region.

4.1.7. Study Area

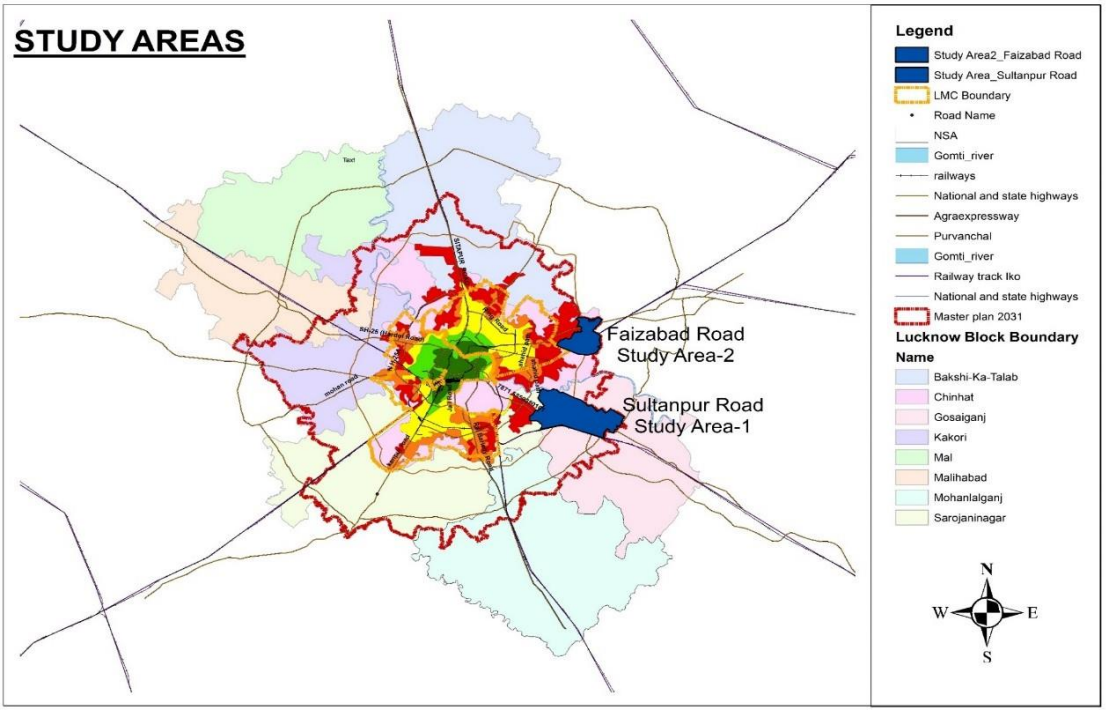


Figure 4-8 Study Areas Map

There are two study areas. Which is beyond the LMC boundary and within a development boundary as per Lucknow master plan 2031.

Study Area-1

- In Gosaiganj NH 31 on Sultanpur road major connectivity is Purvanchal Expressway.

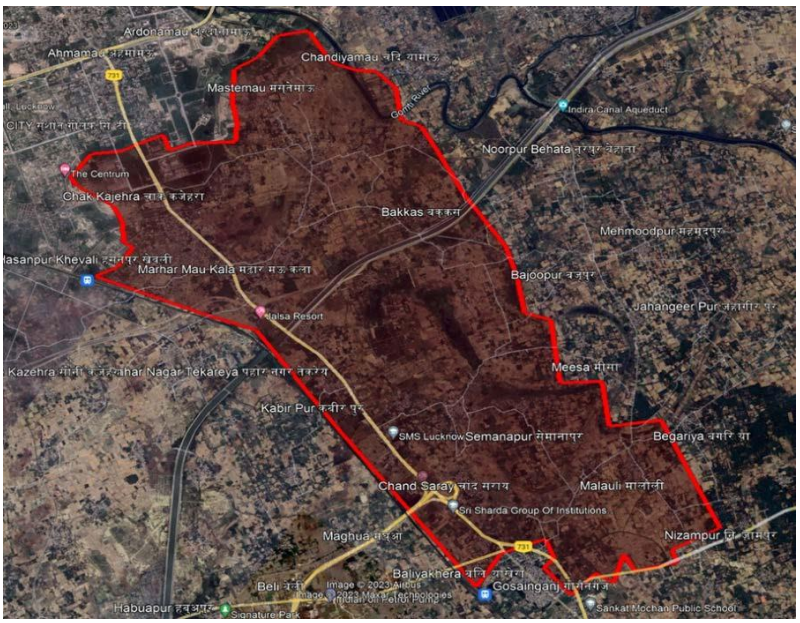


Figure 4-9 Study Area In Gosaiganj

The presence of NH731 and the construction of the Purvanchal expressway have a significant impact on the development of the Gosaiganj area. These transportation corridors have enhanced connectivity, attracted economic activities, promoted industrial and commercial growth, and stimulated real estate development due to which there is unplanned growth which needs to be catered by a sustainable development strategy.

Study Area-2

- Study Area 2 is from Juggar to Anora Kala on NH 27 Faizabad Road.

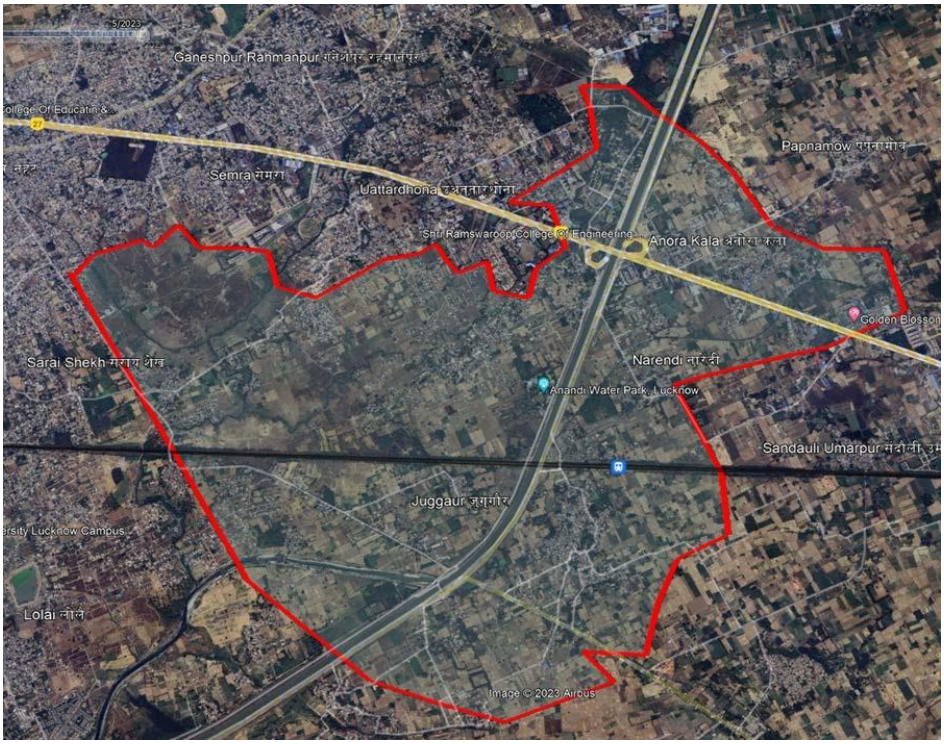


Figure 4-10 Study Area In Chinhat and Juggar

The presence of NH27 and Kishan Path has significantly contributed to the development of the Chinhut Juggar area. These transportation corridors have enhanced connectivity, attracted economic activities, promoted industrial and commercial growth, and stimulated real estate development due to which there is unplanned growth which needs to be catered by a sustainable development strategy.

4.2. Characteristics of Peri-urban in Lucknow

- **Population Growth:** Peri-urban areas in Lucknow have been experiencing significant population growth due to rural-to-urban migration and natural population increase.
- **Urbanization and Expansion:** Lucknow's urban agglomeration has been expanding to accommodate the increasing population, resulting in the emergence of peri-urban zones.
- **Mixed Land Use:** Peri-urban areas in Lucknow exhibit a mix of agricultural, residential, and commercial land uses. While agriculture still plays a significant role in these areas.
- **Infrastructural Development:** Efforts are being made to improve road connectivity, water supply, sanitation, and electricity infrastructure to meet the growing demands of the population.
- **Informal Settlements:** Peri-urban areas often witness the emergence of informal settlements or slums as migrants seek affordable housing options, characterized by inadequate access to basic services and infrastructure.
- **Agricultural Activities:** Agriculture remains an important economic activity in peri-urban areas.
- **Environmental Challenges:** Encroachment of agricultural land, depletion of groundwater resources, and increased pollution are some of the issues that need to be addressed to ensure sustainable development.

4.2.1. Issues faced by peri-urban areas in Lucknow.

Lucknow, the capital city of Uttar Pradesh, India, has experienced rapid urbanization and population growth, resulting in the expansion of peri-urban areas.

Inadequate Infrastructure:

- In peri-urban areas of Lucknow, only 40% of the roads are paved, leading to inadequate road infrastructure (Lucknow Development Authority).
- Approximately 50% of households in peri-urban areas face challenges with water supply and sanitation facilities (source needed).
- Waste management infrastructure in peri-urban areas is insufficient, resulting in improper waste disposal and environmental pollution (source needed).

Pressure on Natural Resources:

- Conversion of Agricultural Land: The expansion of peri-urban areas in Lucknow resulted in a 16% reduction in agricultural land between 2010 and 2015 (Agricultural Census of India).
- Water Scarcity and Loss of Natural Ecosystems: Rapid urbanization in peri-urban areas has led to increased water demand, resulting in groundwater depletion. Additionally, forest cover in peri-urban areas of Lucknow has decreased by approximately 7% over the last decade (Forest Department, Uttar Pradesh).

Informal Settlements:

- Rapid population growth and migration in peri-urban areas of Lucknow have led to the emergence of informal settlements, with around 30% of the peri-urban population residing in such settlements (Housing for All - Lucknow).
- Informal settlements in peri-urban areas face challenges with basic services and amenities, including limited access to clean water, sanitation facilities, and electricity. Many households rely on shared community toilets or practice open defecation (Urban Slums Reports).

Limited Access to Services:

- Limited Healthcare Access: In peri-urban areas of Lucknow, only 50% of households have government health facilities within a 5-kilometer radius, leading to limited access to healthcare services (National Family Health Survey, 2019-20).
- Inadequate Education Facilities: Peri-urban areas suffer from inadequate education facilities, resulting in overcrowded schools and a higher student-to-teacher ratio compared to urban areas. This situation negatively affects the quality of education in these areas (District Information System for Education).

Socio-economic Disparities:

- Socio-economic Disparities: Peri-urban areas in Lucknow show disparities, especially affecting marginalized communities like Scheduled Castes and Scheduled Tribes, who face social exclusion and limited access to resources (Census of India, 2011).
- Income Disparities and Informal Sector: Peri-urban areas experience income disparities, with a significant portion of the population engaged in low-income informal sector occupations, impacting their access to basic amenities and services (Socio-Economic and Caste Census).

CHAPTER 5. CHALLENGES

- Peri-urban areas of Lucknow experiences rapid and unplanned urbanization, leading to inadequate housing and the proliferation of informal settlements. According to the Census of India 2011, about 31.3% of the urban population in Uttar Pradesh (which includes Lucknow) lived in slums.
- Peri-urban areas lack proper transportation infrastructure, limiting access to employment opportunities and essential services. The lack of public transport options in peri-urban areas can result in increased reliance on private vehicles, contributing to congestion and pollution.
- Peri-urban areas are having limited access to social amenities such as schools, healthcare facilities, and recreational spaces. Lucknow had an overall school enrollment rate of 85.7%, but specific data on peri-urban areas may vary.
- Peri-urban areas are experiencing conflicts over land use, including encroachments on public land and disputes between different land-use activities. These conflicts hinder planned development, infrastructure provision, and the implementation of sustainable urbanization strategies.
- Peri-urban areas are experiencing competing land use demands, environmental degradation, and limited adoption of sustainable agricultural practices. Peri-urban areas of Lucknow results in the conversion of agricultural land into residential or commercial areas, posing a threat to sustainable food production systems.
- Peri-urban communities have limited awareness and appreciation for the cultural and natural heritage present in their surroundings leading to a disregard for such heritage preservation and an increased risk of damage or destruction. Peri-urban areas of Lucknow are facing challenges in terms of integrated planning leading to fragmented development, inadequate provision of basic services, and inefficient land use.
- Peri-urban areas are facing challenges in providing access to essential services such as healthcare, education, water supply, sanitation, and electricity. The availability and quality of these services can vary significantly within peri-urban areas, leading to disparities and inequitable access.

- Peri-urban areas may face higher rates of gender-based violence, including domestic violence, sexual harassment, and dowry-related violence.
- Peri-urban areas may have limited representation of women in decision-making roles and have limited economic opportunities and access to resources for women, hindering their economic empowerment and financial independence.
- Peri-urban areas faces challenges in accessing timely emergency services during any kind of disasters.
- Peri-urban areas faces challenges in providing universal access to safe drinking water. Some households rely on unsafe sources and have limited access to piped water supply. Also, suffers from inadequate sanitation facilities.
- Peri-urban areas lacks proper systems for the treatment and management of wastewater. Untreated wastewater disposal contaminates water sources, leading to health hazards and environmental degradation in locality. Peri-urban areas are facing inadequate energy infrastructure, including transmission and distribution networks, to meet the growing demand for electricity. Insufficient infrastructure resulting in power outages, inconsistent supply, and limited capacity to support economic activities and livelihoods.
- Peri-urban areas in Lucknow are facing challenges in adopting renewable energy solutions, due to limited awareness, lack of incentives, and technological barriers hindering the integration of renewable energy sources like solar power into the energy mix of peri-urban areas.
- Peri-urban areas are suffering from fragmented development and a lack of coordination in planning and management leading to inadequate provision of infrastructure, basic services, and housing.
- Peri-urban areas are facing challenges related to environmental sustainability, including land degradation, deforestation, and loss of natural habitats. Balancing urban development with environmental conservation and sustainable land-use practices is essential in peri-urban areas to achieve inclusive and sustainable urbanization.
- Peri-urban areas are facing challenges in implementing inclusive and participatory planning processes that consider the needs and priorities of all residents, including marginalized communities. Ensuring the involvement of local stakeholders and vulnerable groups in decision-making processes can be crucial for effective and sustainable urban development. Lack of coordination

among various stakeholders, including government authorities, urban planning agencies, and community organizations.

- Peri-urban areas faces issues related to resource efficiency and sustainability, which includes challenges in managing water resources, waste management, energy consumption, and transportation systems. Promoting resource-efficient practices and sustainable infrastructure development is important for peri-urban areas to achieve integrated and sustainable policies and plans.

CHAPTER 6. PROPOSALS

Technology and Innovation for Sustainable Development:

- Harness the potential of technology and innovation to address peri-urban challenges, such as smart governance, digital connectivity, e-governance, and data-driven decision-making.
- Promote the use of digital platforms and mobile applications to enhance service delivery, citizen engagement, and access to information in peri-urban areas.
- Encourage the adoption of green technologies, such as renewable energy systems, energy-efficient appliances, and water-saving devices, to promote sustainability and resource efficiency.
- Foster innovation ecosystems and support local start-ups and entrepreneurs working on sustainable solutions for peri-urban development.

Knowledge Sharing and Capacity Building:

- Facilitate knowledge exchange platforms, training programs, and capacity-building initiatives to build the skills and knowledge of local stakeholders in peri-urban areas.
- Strengthen partnerships with academic institutions, research organizations, and think tanks to generate evidence-based solutions and support research on peri-urban development.
- Promote peer-to-peer learning and collaboration among peri-urban communities, sharing best practices and success stories to inspire and replicate positive initiatives.

NATIONAL POLICIES:

- **National Urban Housing and Habitat Policy:** This policy aims to provide affordable housing and basic services to all urban residents, including those in peri-urban areas. It emphasizes the importance of inclusive housing policies, slum redevelopment, and affordable rental housing.
- **National Urban Transport Policy:** This policy focuses on improving urban transportation systems, including public transportation and non-motorized transport.

It emphasizes the need for integrated transport planning, sustainable mobility solutions, and accessibility for all.

- **Swachh Bharat Mission (Urban):** The Swachh Bharat Mission aims to achieve universal sanitation and cleanliness in urban areas. It will support the improvement of sanitation facilities, waste management systems, and cleanliness initiatives in peri-urban areas of Uttar Pradesh.

STATE POLICIES IN UTTAR PRADESH:

- **Uttar Pradesh Affordable Housing and Housing for All Policy:** This policy aims to provide affordable housing options for all segments of society, including those in peri-urban areas. It can support the implementation of affordable housing strategies and slum upgrading initiatives.
- **Uttar Pradesh Urban Development Policy:** This policy focuses on sustainable urban development and can guide the integration of sustainable infrastructure, land use planning, and environmental considerations in peri-urban areas.
- **Uttar Pradesh Solar Energy Policy:** The state's solar energy policy promotes the adoption of renewable energy, including solar power, which can contribute to sustainable resource management and the use of clean energy in peri-urban areas.
- **Uttar Pradesh Solid Waste Management Policy:** This policy emphasizes effective solid waste management practices, including waste reduction, segregation, recycling, and sustainable disposal. It can support the implementation of waste management strategies in peri-urban areas.

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- Gulf News: Gulf News, another prominent UAE newspaper, has published articles on Masdar City that offer in-depth coverage and analysis. You can explore their coverage here: https://gulfnews.com/uae/masdar-city
- Official Website: The official website of Masdar City provides comprehensive information about the project, including its vision, sustainable practices, infrastructure, and ongoing developments. You can access it at: https://www.masdar.ae/en/masdar-city
- Masdar Institute of Science and Technology: The Masdar Institute, located within Masdar City, conducts research in the fields of clean energy, sustainability, and advanced technology. Their website offers insights into their research areas and academic programs: https://www.masdar.ac.ae/