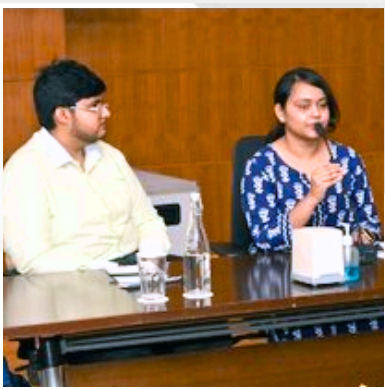
सत्यमेव जयते

Batch - II | 2023

Internship Compendium

National Centre for Good Governance



सत्यमेव जयते
Government of India
NCGG
National Centre for Good Governance
The Torch Bearer of Good Governance

Internship Compendium

2nd batch'23

(10th October, 2023 - 17th January, 2024)

Edition: 2023

Authors:

Ankita Mondal
Gauri Sakaria
Himanshu Kumar
Karthik Govil
Kshitija Kashik
Nilabhra Auddy
Nitesh Tiwari

Mentors:

Prof. Josyula Srinivas, Associate Professor, IIMV
Dr. Kusum Lata, Associate Professor, IIPA
Dr. Shyamli Singh, Assistant Professor, IIPA
Dr. Neha Aneja, Assistant Professor, University of Delhi
Shri Apruv Mishra, Consultant, EAC-PM

Published by:

National Centre for Good Governance (NCGG),
Department of Administrative Reforms & Public Grievances,
Ministry of Personnel, Public Grievances & Pensions,
Government of India

Forward

The National Centre for Good Governance (NCGG) is a leading institution in India, dedicated to enhancing public administration and promoting citizen-centric governance. Through capacity-building initiatives for both national and international civil servants, NCGG plays a crucial role in advancing effective governance practices.

A standout initiative is the NCGG Internship Programme, designed to cultivate the next generation of governance leaders. The program offers students practical experience in addressing real-world public policy challenges, bridging the gap between theory and practice. Interns engage with complex case studies, gaining critical thinking and problem-solving skills while observing the implementation of government schemes in real-time.

The programme attracts highly motivated and intellectually curious interns whose contributions reflect their dedication to public service. Their research, ranging from India's World Happiness Index rankings to AI regulations and climate change, demonstrates their capacity to tackle contemporary governance issues. These empirical research reports not only celebrate the interns' diligence and innovative ideas but also contribute to NCGG's mission of fostering excellence in governance.

Through this initiative, NCGG nurtures a pipeline of future leaders equipped to address evolving governance challenges, reinforcing its role as a vital institution in shaping the future of public administration in India.

V. Srinivas, IAS
Secretary, DARPG & DPPW
and Director General, NCGG

Acknowledgement

I wish to place on record my deepest appreciation for the commitment, professionalism, and passion of each individual involved in the team that has worked day and night since its very inception to make the NCGG Internship Programme an operational success.

I wish to express deep and sincere gratitude to Shri V. Srinivas, IAS, Secretary, DARPG, Govt. of India, and Director General, NCGG, for his visionary leadership and guidance in conceptualizing and implementing the programme. His unwavering support and encouragement have truly empowered the team to strive for excellence.

I am deeply indebted to my colleagues Dr. A.P. Singh, Associate Professor and I/c Admin, Mussoorie Branch, Dr. B.S. Bisht, Associate Professor; Dr. Sanjeev Sharma, Research Associate; Shri Akash Sikdar, Young Professional, Shri Sachin Mahiya, DEO; and all the staff who have been instrumental in making the programme a resounding success.

I would like to take this moment to sincerely thank all mentors who so selflessly contributed time, expertise, and wisdom toward the grooming of these interns; their influence has been forever etched onto their professional journeys.

Lastly, these collaborative efforts by every single person have made the internship programme most enriching, educationally and informationally, for all of us, and I am deeply indebted for their commitment and hard work.

Dr. Gazala Hasan
Course Coordinator & Assistant Professor, NCGG

Abbreviation

WHI	:	World Happiness Index
IoT	:	Internet of Things
MoP	:	Ministry of Power
NGSM	:	National Smart Grid Mission
AVVNL	:	Assam Vidyut Vitran Nigam Limited
HPSEB	:	Himachal Pradesh State Electricity Board
TSECL	:	Tripura State Electricity Corporation Board
TSSPDCL	:	Telangana State Southern Power Distribution Company Limited
UGVCL	:	Uttar Gujarat Vij Company Limited
AI	:	Artificial Intelligence
EU	:	European Union
TRAI	:	Telecom Regulatory Authority of India
NSAI	:	National Strategy for Artificial Intelligence
OECD	:	Organisation for Economic Co-operation and Development
ICI	:	Internet Consumption Index
NDC	:	Nationally Determined Contributions
NTPC	:	National Thermal Power Consumption
AQI	:	Air Quality Index
FSI	:	Forest Survey of India
ISFR	:	India State of Forest Report
PPP	:	Public-Private Partnership
RBAC	:	Role-Based Access Control
COx, NOx, SOx	:	Carbon Oxides, Nitrogen Oxides, Sulfur Oxides
CCS	:	Carbon Capture and Storage

Table of Content

Executive Summary

The NCGG Internship Programme provides a valuable short-term engagement opportunity for students across various disciplines, with a duration ranging from a minimum of 8 weeks to a maximum of 6 months. This initiative serves as a platform for students to collaborate with multiple verticals and units within the National Centre for Good Governance (NCGG). It emphasizes research, critical study, documentation, and the dissemination of best practices aimed at developing a national repository and promoting broader dissemination of information. The program allows young students to learn and contribute meaningfully to public policy.

In its second batch, the programme received over 300 applications nationwide. After a rigorous selection process, seven outstanding interns were chosen based on their academic excellence and dedication to their fields. These interns represent a spectrum of disciplines, bringing a rich diversity of perspectives to the programme. The interns' experience began with an inaugural session featuring distinguished experts such as Dr. Naveen Sirohi from the Indian Institute of Corporate Affairs, Dr. Kusum Lata from the Indian Institute of Public Administration, and Shri Apurv Kumar Mishra from the Economic Advisory Council to the Prime Minister among others. These speakers provided foundational insights into public policy and governance.

During the 3-month programme (10th October 2023 to 17th January 2024), the interns worked under the guidance of mentors, namely Dr. Kusum Lata, Dr. Shyamli Singh from Indian Institute of Public Administration, Prof. Josyula Srinivas from IIM Visakhapatnam, and Dr. Neha Aneja from Delhi University, who helped refine their research efforts. Each intern focused on a specific topic aligned with their academic strengths, producing research papers on themes like digital fluency, climate change, green credit systems, among others. These research topics showcase innovative perspectives on citizen-centric governance.

The interns' work has been compiled into a comprehensive compendium, capturing their findings and proposed solutions to governance challenges. This compendium serves as a knowledge repository to benefit policymakers, researchers, and the public, furthering NCGG's mission of promoting inclusive, effective governance across India.

Detailed research papers of the Interns

Paper - I	'Unlocking Happiness: Analyzing World Happiness Index Rankings and Proposing Strategies for India' by Ankita Mondal	**Click to view**
Paper - II	'Study of Energy Management System and IoT integration in Smart Grid (In context to India)' by Gauri Sakaria	**Click to view**
Paper - III	'Comparative Study: Assessing State-level Implementation of National-Level Renewable Energy Policies in India' by Himanshu Kumar	**Click to view**
Paper - IV	'Implementation of Green Credit System' by Karthik Govil	**Click to view**
Paper - V	'Navigating the Future: India's Strategic Approach to Artificial Intelligence Regulations' by Kshitija Kashik	**Click to view**
Paper - VI	'Digital Fluency Quotient: Assessing Consumption Maturity of Internet users in Rural and Suburban India' by Nilabhra Auddy	**Click to view**
Paper - VII	'Climate Change & Global Warming' by Nitesh Tiwari	**Click to view**

Paper - I

Ankita Mondal

“Unlocking Happiness: Analyzing World Happiness Index Rankings and Proposing Strategies for India”

This research analyzes India's low ranking in the World Happiness Index 2023, critiques WHI’s methodology, and proposes culturally tailored strategies to enhance happiness, focusing on governance, social welfare, and mental health.

"Unlocking Happiness: Analyzing World Happiness Index Rankings and Proposing Strategies for India"

Scope of Study

The research focuses on analyzing India's position in the World Happiness Report 2023, where India is ranked 126th out of 137 countries. The study identifies key factors contributing to India's low ranking and explores the methodologies adopted by higher-ranking nations. Additionally, it critiques the World Happiness Index (WHI) and proposes alternative strategies suitable for India to improve its standing in future reports. The scope is broad, touching on social, economic, cultural, and governance issues that influence happiness across nations.

Problem Statement

India's position in the World Happiness Index 2023 highlights a critical issue: despite significant strides in economic growth and development, the happiness and well-being of its citizens remain relatively low. The problem stems from multiple factors such as inequality, unemployment, gender discrimination, and insufficient social support. Additionally, the methodology of the WHI is questioned for its ability to adequately represent happiness in diverse cultural contexts like India. Thus, the core issue is twofold: understanding why India ranks low and how the WHI methodology may not fully capture the happiness of a diverse and complex nation.

Objectives

- Examine the standings of various nations in the WHI and assess India's position.
- Identify factors contributing to India's low rank, such as inequality, social support, and perceptions of corruption.
- Analyze the strategies adopted by top-ranking countries that promote happiness and well-being.
- Critique the UN Happiness Index by identifying its limitations and potential biases in the Indian context.
- Propose strategies for India to improve its ranking by adopting feasible elements of successful models used by other countries.

Methodology

The research employed secondary data sources including reports, articles, and academic journals to gather relevant information on the WHI and happiness determinants. The primary methodology involved a critical review of the WHI, analyzing its six key parameters: GDP per capita, healthy life expectancy, social support, freedom to make life choices, generosity, and perceptions of corruption. A comparative analysis was also conducted between India and higher-ranking countries to explore the applicability of their strategies in the Indian context.

Key Findings

- India's low ranking is attributed to several socio-economic factors, including inequality, unemployment, gender discrimination, and corruption. For example, a large portion of India's population works in the informal sector, where job insecurity is high, contributing to widespread dissatisfaction.
- Environmental and societal issues such as air pollution, rising healthcare costs, and women's safety further lower happiness levels in India.
- The WHI methodology is critiqued for its cultural bias and small sample sizes. The WHI's metrics, such as social support and generosity, may not accurately reflect the complex social fabric of India, where happiness is often linked to family, community, and religious practices rather than individualism.
- High-ranking nations like Finland, Denmark, and Norway have implemented successful strategies that promote well-being through strong social welfare systems, universal healthcare, and transparent governance. These countries also emphasize work-life balance, which contributes significantly to happiness.
- India's unique challenges make it difficult to adopt these models directly. While the Nordic countries benefit from smaller populations and homogeneous societies, India's vast and diverse population creates obstacles to implementing similar policies effectively.

"Unlocking Happiness: Analyzing World Happiness Index Rankings and Proposing Strategies for India"

Recommendations

- Tailored Happiness Index: Develop a new happiness index that incorporates India's cultural and societal values, such as the role of family and festivals in promoting happiness. This index should also take into account regional diversity within India, ensuring that rural areas are not overlooked in the analysis.
- Focus on Mental Health: Addressing mental health issues is crucial for improving happiness in India. The government should prioritize mental health services and social support systems to alleviate the growing burden of mental illness and suicide rates, especially among the youth.
- Improve Governance and Transparency: India should strengthen governance structures to reduce corruption and enhance public trust in institutions. Transparent electoral processes and clear funding mechanisms will lead to stronger democratic governance, contributing to citizens' overall sense of well-being.
- Social Welfare and Healthcare: Expand social welfare programs to cover a larger portion of the population, especially in rural areas. Improving the quality of public healthcare services can also enhance life expectancy and reduce financial stress related to medical expenses.
- Vocational Education and Job Creation: The government should focus on vocational education to equip the workforce with practical skills that lead to sustainable employment. Reducing unemployment through job creation programs will help alleviate the frustration and unrest seen among young people in India.
- Environmental Sustainability: Implement stringent policies to tackle environmental degradation, including air and water pollution, which directly affect the health and well-being of citizens.

Conclusion

The study concludes that while India's current ranking in the World Happiness Index is low, there is significant scope for improvement through targeted policy interventions. High-ranking nations offer valuable lessons in governance, social welfare, and healthcare, but their models cannot be directly transplanted into India's unique socio-economic environment. Instead, India should focus on developing its own happiness index that reflects the country's cultural and regional diversity.

The WHI's methodological limitations, such as cultural bias and inadequate sample sizes, further suggest that the index may not fully capture the happiness of India's population. Therefore, India should advocate for a more comprehensive approach to measuring happiness, one that considers the unique values and aspirations of its people. Addressing mental health, inequality, and environmental sustainability will be critical steps in making India a happier nation in the future.

Paper - II

Gauri Sakaria

“Study of Energy Management System and IoT integration in Smart Grid (In context to India)”

This research explores the potential of IoT integration in India’s smart grids, addressing challenges in cybersecurity, scalability, and interoperability, while recommending policy frameworks to enhance energy efficiency, grid reliability, and sustainability.

"Study of Energy Management System and IoT integration in Smart Grid (In context to India)"

Scope of Study

The research conducted by Gauri Sakaria investigates the potential of integrating the Internet of Things (IoT) in smart grids, particularly in the context of India's energy management systems. It addresses key components such as data collection, real-time monitoring, and the application of IoT technologies to enhance energy efficiency, grid reliability, and sustainability. The scope of the study is broad and involves an in-depth exploration of the challenges posed by IoT integration, such as security concerns, scalability, and interoperability. It further discusses the current landscape of smart grid projects in India and outlines future considerations for a successful transition to an IoT-enabled energy management infrastructure.

Problem Statement

India faces several challenges in managing its growing energy demands due to rapid urbanization, population growth, and increased industrialization. Traditional energy grids are becoming insufficient to handle the evolving complexity and load, often resulting in power outages, inefficiencies, and transmission losses. Furthermore, the integration of renewable energy sources into the grid adds another layer of complexity. The integration of IoT in smart grids offers a potential solution to these challenges, but there are significant obstacles, including security risks, privacy concerns, and the lack of a unified infrastructure that can seamlessly incorporate IoT devices into the national grid.

Objectives

The primary objectives of this research are as follows:

- Investigate the benefits of IoT integration in smart grids for energy management systems.
- Explore the challenges associated with IoT integration, including security, scalability, interoperability, and data privacy.
- Propose solutions to address these challenges and ensure a smooth transition to IoT-based smart grids.
- Evaluate the current smart grid landscape in India, including the National Smart Grid Mission and completed pilot projects.
- Provide recommendations for future policy and regulatory frameworks to support IoT integration in smart grids.

Methodology

The methodology involves a detailed literature review and analysis of existing smart grid systems, both globally and in India. The study draws from secondary data sources, including reports from the Ministry of Power (MoP) and case studies from the National Smart Grid Mission (NSGM). The research explores various aspects of IoT integration, such as smart meters, sensors, grid monitoring, demand response, and cybersecurity concerns. Data from established smart grid projects in India is used to analyze the practical challenges faced during IoT implementation and the effectiveness of proposed solutions. This data-driven approach allows for a comprehensive understanding of both the technical and regulatory hurdles in transitioning to IoT-enabled smart grids.

Key Findings

The study presents several key findings that highlight the advantages and challenges of IoT integration in smart grids.

a. Benefits of IoT Integration:

- Smart Meters and Sensors: IoT-enabled devices such as smart meters allow for real-time monitoring and two-way communication between consumers and utilities. This helps optimize load management and demand response, enhancing the efficiency and reliability of the grid.
- Predictive Maintenance: IoT sensors placed at critical points in the grid infrastructure enable predictive maintenance, reducing equipment downtime and improving overall grid stability.
- Distributed Energy Resources (DER) Integration: IoT facilitates the integration of renewable energy sources such as solar and wind farms into the grid. This contributes to grid stability and resilience.

"Study of Energy Management System and IoT integration in Smart Grid (In context to India)"

- Data Analytics: IoT generates vast amounts of data that can be used for predictive analytics, identifying potential issues before they escalate and allowing for informed decision-making.
- Enhanced Communication: Reliable communication networks are essential for transmitting data between IoT devices and smart grid systems. Advanced metering infrastructure (AMI) and wireless technologies are critical to efficient IoT integration.

b. Challenges:

- Cybersecurity Risks: As the grid becomes more connected, it also becomes more vulnerable to cyberattacks. Ensuring robust cybersecurity measures for IoT devices and the data they generate is essential.
- Interoperability and Scalability: The smart grid ecosystem involves various devices and technologies, making scalability and interoperability significant challenges. It is crucial to ensure that these systems can expand and accommodate new technologies in the future.
- Privacy Concerns: IoT devices collect large amounts of data, including personal information about consumers' energy usage patterns. Protecting this data from unauthorized access and ensuring privacy compliance are key concerns.
- Regulatory Gaps: The integration of IoT in smart grids requires a supportive regulatory environment that encourages innovation while safeguarding data privacy and security. However, India's regulatory framework is still evolving in this regard.

c. India's Smart Grid Landscape:

India has made considerable progress in deploying smart grids under the National Smart Grid Mission (NSGM), launched in 2015. The following regions have implemented successful pilot projects:

- Ajmer APDC
- Assam AVVNL
- Mysore HPSEB
- Puducherry TSECL
- Tripura TSSPDCL
- Gujarat UGVCL

These projects showcase India's efforts to modernize its grid infrastructure, though significant work remains to ensure nationwide scalability and the integration of IoT technologies across all grids.

Recommendations

The study offers several recommendations for improving India's transition to IoT-based smart grids.

- Enhance Cybersecurity Measures: Strong cybersecurity protocols are essential to protect smart grids from potential cyberattacks. The government should establish mandatory cybersecurity standards for IoT devices and smart grid infrastructure.
- Develop Interoperability Standards: Interoperability between various devices and systems is critical for a seamless smart grid. Developing and enforcing national standards for device compatibility will ensure that future technologies can be easily integrated into the existing grid infrastructure.
- Improve Data Privacy Regulations: The government should establish clear guidelines on data privacy and ensure that IoT devices comply with these regulations to protect consumers' personal information. Role-based access control (RBAC) can help restrict unauthorized access to sensitive information.
- Expand Smart Grid Projects Nationwide: While several pilot projects have been successful, scaling these initiatives to cover the entire country is essential. The NSGM should focus on implementing IoT-enabled smart grids in rural and underserved areas to promote equitable access to energy resources.
- Invest in Education and Skill Development: As smart grid technology becomes more widespread, the need for a skilled workforce capable of managing IoT devices and infrastructure will increase. Investments in education and training programs focused on smart grid technologies and IoT integration should be prioritized.

"Study of Energy Management System and IoT integration in Smart Grid (In context to India)"

- Foster Public-Private Partnerships: Collaboration between the public and private sectors can accelerate the deployment of IoT-enabled smart grids. Encouraging private sector participation through incentives and policy support can help bridge the funding and resource gaps in smart grid projects.

Conclusion

The integration of IoT in smart grids represents a transformative opportunity for India to modernize its energy management systems, enhance grid reliability, and meet the growing energy demands of its population. However, several challenges remain, including cybersecurity risks, privacy concerns, and the need for interoperability. By addressing these issues through targeted policy interventions, robust regulatory frameworks, and public-private collaboration, India can accelerate its transition to a more efficient and resilient energy grid. The successful deployment of IoT-based smart grids will not only improve energy efficiency but also contribute to environmental sustainability and economic growth.

The study underscores the importance of aligning IoT integration efforts with India's national energy policies and regulatory environment, ensuring that the country remains on track to meet its long-term energy goals while safeguarding the security and privacy of its citizens

Paper - III

Himanshu Kumar

“Comparative Study: Assessing State-level Implementation of National-Level Renewable Energy Policies in India”

This research assesses the effectiveness of national renewable energy policies at the state level in India, highlighting disparities in policy execution, particularly in solar, wind, and biomass energy adoption. Through comparative analysis, the study identifies key success factors and challenges, offering recommendations to enhance renewable energy adoption across India’s diverse regions.

"Comparative Study: Assessing State-level Implementation of National-Level Renewable Energy Policies in India"

Scope of Study

The research aims to evaluate the implementation of national renewable energy policies across India, focusing on state-level performance in adopting renewable technologies such as solar, wind, and biomass. The study seeks to compare the outcomes of policy execution in different zones of the country, with a special focus on uncovering factors that contribute to the success or failure of these initiatives in fostering renewable energy adoption. By assessing regional variations, the study provides insights into how national policies can be tailored to local needs, ensuring sustainability and effective energy management.

Problem Statement

Despite the presence of robust national renewable energy policies in India, their state-level implementation shows significant disparities in success. While certain states, such as Gujarat and Tamil Nadu, have excelled in renewable energy adoption, others lag behind due to various barriers like regulatory hurdles, infrastructure limitations, and financial constraints. This uneven performance hinders India's progress toward its renewable energy goals and its commitments to reducing carbon emissions. The research investigates these discrepancies to identify the challenges and provide actionable insights for improving policy execution across all states.

Objectives

The key objectives of the study are as follows:

- Assess the execution of renewable energy policies in Indian states, with a focus on solar, wind, and biomass technologies.
- Conduct a comparative analysis of state-level renewable energy adoption and its impact on energy capacity, carbon emission reductions, and energy access.
- Analyze case studies of high-performing states to understand the mechanisms that contribute to successful policy implementation.
- Identify challenges and obstacles in states that are underperforming in renewable energy adoption.
- Recommend best practices for enhancing the effectiveness of renewable energy policies and overcoming implementation barriers.

Methodology

This study employs a mixed-methods approach, combining both qualitative and quantitative research techniques. The methodology includes:

- Policy Document Analysis: A thorough review of state and national renewable energy policies to assess their design, incentives, and effectiveness.
- Data Collection: Data on renewable energy capacity, carbon emissions, and energy access were gathered from reliable government and organizational sources, such as the Ministry of Renewable Energy (MNRE) and the Central Electricity Authority (CEA).
- Case Studies: In-depth case studies of states like Gujarat, Rajasthan, Tamil Nadu, and others that have successfully implemented renewable energy initiatives.
- Stakeholder Interviews: Qualitative data from interviews with key stakeholders, including policymakers, industry experts, and environmental advocates.
- Statistical Analysis: The use of statistical tools to compare state-level outcomes and analyze the relationships between policy measures and renewable energy results.

Key Findings

a. State-Level Disparities in Renewable Energy Adoption:

- Gujarat has emerged as a renewable energy leader, particularly in solar energy, with an installed capacity of over 10,000 MW, thanks to government support and financial incentives such as preferential tariffs.
- Tamil Nadu has demonstrated consistent growth in wind energy, leveraging its coastal geography and policy initiatives that prioritize grid integration and land allocation for wind farms.

"Comparative Study: Assessing State-level Implementation of National-Level Renewable Energy Policies in India"

- States like Bihar and Jharkhand have struggled to adopt renewable energy due to lower investment levels, infrastructure gaps, and regulatory challenges. Their solar and wind energy capacities remain significantly below national averages.

b. Impact on Energy Capacity and Emission Reductions:

- States with strong policy frameworks, such as Rajasthan and Karnataka, have not only increased their renewable energy capacities but have also contributed significantly to national targets for carbon emission reductions.
- States with less favorable policy environments, such as in the North-East region, exhibit slow progress in both energy capacity and emissions reductions due to geographical and infrastructural constraints.

c. Challenges Hindering Renewable Energy Adoption:

- Regulatory Barriers: Lengthy approval processes and red tape, particularly in land acquisition and grid integration, have delayed project implementation in many states.
- Financial Constraints: Limited access to financing options for renewable energy projects, especially in rural areas, has curtailed the growth of small and large-scale projects.
- Inadequate Infrastructure: States with underdeveloped transmission networks face significant difficulties in evacuating generated renewable power to the grid, limiting the potential of renewable energy sources such as wind and solar.

Recommendations

The research proposes several strategies to improve the execution of renewable energy policies across all Indian states:

a. Strengthen Regulatory Frameworks:
Streamline land acquisition and grid integration processes to ensure timely approval and execution of renewable energy projects. This includes simplifying bureaucratic procedures and ensuring transparent, predictable regulatory frameworks.

b. Promote Regional Adaptation of Policies:

Given the significant regional disparities in renewable energy potential and infrastructure, policies should be customized to fit the unique needs of each state. For instance, coastal states like Tamil Nadu and Gujarat should focus on wind energy, while land-abundant states like Rajasthan should prioritize solar energy development.

c. Enhance Financial Support for Renewable Energy Projects:

Introduce innovative financing mechanisms such as green bonds, public-private partnerships (PPP), and subsidies that target small-scale renewable energy producers, especially in states with limited resources. Special financial packages should be offered to incentivize investments in underperforming states.

d. Focus on Capacity Building:

Invest in skill development and training programs to build a skilled workforce capable of supporting the growing renewable energy sector. Collaboration between state governments and private institutions can ensure that technical expertise is available to manage renewable energy technologies effectively.

e. Address Infrastructure Deficiencies:

Governments should prioritize strengthening transmission infrastructure, particularly in states with high renewable energy potential but limited evacuation capacity. Building high-capacity transmission lines can facilitate better integration of renewable energy into the national grid.

f. Encourage Public and Private Sector Collaboration:

Encourage public-private partnerships (PPPs) by offering long-term policy stability and creating a conducive investment climate. States like Maharashtra and Karnataka have successfully attracted private investments through favorable policies that combine government support with private sector initiative.

"Comparative Study: Assessing State-level Implementation of National-Level Renewable Energy Policies in India"

Conclusion

This research underscores the critical importance of robust policy frameworks and state-level adaptation in achieving India's renewable energy targets. While national policies such as the National Solar Mission and National Wind Energy Mission have laid the foundation for renewable energy growth, their execution at the state level remains uneven.

States such as Gujarat and Tamil Nadu have emerged as front-runners in renewable energy adoption, driven by favorable policies, financial incentives, and strong infrastructure. However, states like Bihar, Jharkhand, and others in the North-East face significant challenges that have limited their progress. To bridge this gap, the government must focus on tailoring renewable energy policies to regional contexts, improving infrastructure, and providing financial support to struggling states.

The research provides policymakers with actionable recommendations aimed at overcoming the challenges hindering renewable energy adoption across India. By promoting regional adaptations, enhancing financial support, and improving infrastructure, India can accelerate its transition to a sustainable and clean energy future.

Paper - IV

Karthik Govil

“Implementation of Green Credit System”

This research investigates the Green Credit System's practical application in Delhi's NCR, focusing on carbon offsetting through increased forest cover. The study assesses how forest expansion impacts carbon sequestration and air quality improvement while proposing a point-based system to allocate and trade green credits as market-driven commodities.

"Implementation of Green Credit System"

Scope of Study

The study focuses on the Green Credit System recently introduced by the Indian government to encourage market-based mechanisms for climate change mitigation. The research aims to explore the application of this system, particularly in carbon offsetting within the Delhi National Capital Region (NCR). The Green Credit System, which aligns with India's LiFE Program, Net Zero by 2070, and the 30 by 30 target, introduces a novel approach to incentivizing green-positive actions by attaching market values to environmental contributions. The research specifically examines how forest cover in Delhi can reduce carbon emissions and improve the Air Quality Index (AQI) while developing a system to allocate green credits based on these environmental improvements.

Problem Statement

As the government shifts towards a market-driven approach for environmental conservation, the Green Credit System seeks to quantify and monetize green activities, such as tree plantation and carbon offsetting, allowing entities to trade credits like stocks. However, it remains unclear how this system will function in practice, particularly in cities like Delhi where pollution levels remain high. How much carbon can forest cover in Delhi offset? Can a practical system be developed to quantify this impact and generate tradeable green credits? This research addresses these questions by exploring how the Green Credit System can work, using carbon offsetting through increased forest cover in Delhi as a specific case study.

Objectives

The main objectives of this research are:

- To explore the potential of the Green Credit System in practice, using the specific example of forest expansion and carbon offsetting in Delhi.
- To quantify the impact of forest cover on carbon emission reductions and AQI improvements in Delhi.
- To develop a point-based system that assigns green credits based on environmental improvements (such as carbon sequestration) to be traded within the Green Credit System.
- To analyze the economic mechanisms behind the Green Credit System, including demand-supply dynamics, and propose a structure for carbon credits trading.
- To provide recommendations for improving the Green Credit System, including identifying the most suitable tree species for Delhi's climate and forest types to maximize carbon offsetting.

Methodology

This research follows a structured methodology, combining data analysis, literature review, and expert interviews:

- Literature Review: The study begins with a review of existing research on forest types, carbon sequestration, and the impact of trees on carbon offsetting and AQI. The researcher identifies specific tree species suitable for Delhi's tropical thorn forests that offer the most significant carbon offset potential.
- Data Collection: The primary data is drawn from sources such as Global Forest Watch, the Forest Survey of India (FSI), and ISFR reports. These sources provide insights into the historical increase in forest cover in Delhi and the associated changes in carbon sequestration and air quality.
- Carbon Offset Calculations: The study calculates the carbon offset potential of forested areas in Delhi, using data on forest types, tree species, and the area of afforestation over the past 10 years. The researcher identifies how much carbon is sequestered per square meter of forest, translating this into carbon credit points that could be used in a green credit trading system.
- Economic Analysis: Drawing parallels to stock markets, Mr. Govil explores how the Green Credit System can operate, incorporating market dynamics such as fluctuating credit prices based on demand, similar to stock indices like the NIFTY50.

"Implementation of Green Credit System"

The study also considers economic factors like demand for pollution reduction and the cost-effectiveness of green-positive actions.

- Expert Interviews: The researcher consults with environmental and forestry experts to verify the carbon sequestration potential of specific tree species and explore the feasibility of implementing a green credit trading system.

Key Findings

a. Forest Cover in Delhi and Carbon Sequestration:

Delhi has shown a significant increase in forest cover in the last two decades, with its total forest area rising from 151 km² in 2001 to 342 km² by 2021. While this is a promising trend, the study reveals that not all trees contribute equally to carbon offsetting. Tropical thorn forests dominate the Delhi region, and trees like Acacia and Prosopis are among the most effective at carbon sequestration. Delhi's forest cover is primarily medium-dense, which has seen the most growth over the years.

b. Carbon Offset Potential:

Using data from Global Forest Watch, the study estimates that Delhi's increased forest cover has the potential to offset 182,000 kg of carbon annually. This translates to 146 kg of carbon offset per square kilometer of forest. The research establishes that 1 m² of forest offsets approximately 0.146 grams of carbon, which can be converted into 1 Carbon Credit Point within the Green Credit System.

c. Tree Species and Carbon Sequestration Efficiency:

The study identifies that some trees, such as Tamarind and Acacia, are better suited for carbon sequestration in Delhi's climate due to their deep roots, long lifespan, and high biomass. However, invasive species like Eucalyptus, which have shallow roots and low biomass, score poorly in terms of carbon sequestration. A tree ranking system is proposed, allowing trees to be graded based on their environmental value, with indigenous, high-biomass species scoring higher than short-lived, invasive species.

d. Green Credit System as a Market Mechanism:

The study draws parallels between the Green Credit System and traditional stock markets. Carbon credits could be traded similarly to shares, with prices fluctuating based on demand for pollution reduction. As companies face greater pressure to reduce emissions, the demand for green credits (representing carbon sequestration or pollution reduction) will rise, driving up their value. The concept of sector-specific credits for different pollutants (e.g., COx, NOx, SOx) is also introduced.

Recommendations

The study offers several actionable recommendations to improve the implementation of the Green Credit System:

a. Tree Selection for Carbon Offset:

- The government should prioritize native tree species like Acacia, Tamarind, and Boswellia in afforestation projects, as these species offer higher carbon sequestration potential and are well-suited to Delhi's climate.
- Invasive species, such as Eucalyptus, should be discouraged, as they contribute less to carbon sequestration and can degrade the local ecosystem.

b. Market Mechanisms for Green Credits:

- The government should introduce a dynamic pricing model for green credits, where the price of each credit fluctuates based on demand for carbon reduction, similar to stock markets. This would create an incentive for companies to purchase credits when pollution levels are high, driving investment in green projects.
- Sector-specific credits should be developed for different pollutants. For instance, companies could purchase specific credits for reducing CO2, NOx, or SOx, depending on their emission profiles. This would make the Green Credit System more targeted and efficient.

"Implementation of Green Credit System"

c. Monitoring and Enforcement:

- The government should establish a Green Credit Steering Committee to oversee the implementation of the system. This committee would monitor the environmental impact of afforestation projects, ensure transparency in credit allocation, and regularly update the carbon sequestration values based on new data.
- The study recommends setting up third-party verification mechanisms to prevent fraudulent claims of carbon offsetting and ensure that companies purchasing credits are genuinely contributing to environmental improvements.

d. Public and Private Sector Collaboration:

The study encourages public-private partnerships (PPPs) in implementing green projects. Private companies should be incentivized to invest in afforestation, pollution reduction technologies, and sustainable practices through tax benefits and access to green credits.

Conclusion

This research offers a well-rounded analysis of how the Green Credit System can be implemented in India, with a focus on carbon offsetting through forest cover in Delhi. The study not only quantifies the carbon sequestration potential of Delhi's forests but also develops a practical system for assigning and trading green credits. By treating carbon credits as tradeable commodities, the Green Credit System has the potential to incentivize environmentally positive actions while driving market-based solutions for pollution reduction.

The research highlights the importance of tree selection, with native species like Acacia and Tamarind showing the highest potential for carbon sequestration in Delhi's climate. The study also introduces the concept of sector-specific green credits for different pollutants, making the system more tailored and efficient. Moving forward, the success of the Green Credit System will depend on robust monitoring mechanisms, dynamic pricing, and public-private collaboration to ensure transparency and effectiveness.

By aligning with India's national goals of Net Zero by 2070 and the LiFE Program, this research provides a blueprint for scaling the Green Credit System across the country, making it a key tool in combating climate change.

Paper - V

Kshitija Kashik

“Navigating the Future: India’s Strategic Approach to Artificial Intelligence Regulations”

This research provides a comprehensive analysis of AI regulatory frameworks globally and adapts these insights to the Indian context. It evaluates risks like data privacy, biases, job impacts, and security concerns, proposing a balanced, human-centric regulatory framework tailored for India. The research emphasizes sector-specific guidelines, a robust data protection framework, and the importance of international collaboration, aiming to foster responsible AI innovation that aligns with India’s socio-economic landscape.

"Navigating the Future: India's Strategic Approach to Artificial Intelligence Regulations"

Scope of Study

The research paper titled "Navigating the Future: India's Strategic Approach to Artificial Intelligence Regulation" focuses on AI regulation both globally and within India. It explores how AI is revolutionizing various sectors and the potential risks associated with its widespread adoption. The study's scope is both international and national, providing a comparative analysis of global AI regulatory frameworks and tailoring these insights to the Indian context.

Problem Statement

The rise of AI has posed numerous ethical, legal, and socio-economic challenges. These include biases in algorithms, data privacy concerns, and the socioeconomic impact on jobs and livelihoods due to automation. Despite AI's potential to drive innovation and economic growth, the absence of comprehensive regulatory frameworks could lead to unethical uses, societal inequities, and unintended consequences. Therefore, the problem this research seeks to address is how India can create a tailored AI regulatory framework that ensures innovation while mitigating risks.

Objectives

The main objectives of this study include:

- Identifying Risks: Assessing potential risks associated with AI development and deployment such as data bias, privacy concerns, job losses, and security threats.
- Exploring Global Regulatory Frameworks: Reviewing AI regulatory strategies adopted by other countries, such as the EU, US, China, and others, to identify best practices.
- Developing an AI Regulatory Framework for India: Proposing a framework that is contextually appropriate for India's unique socio-economic, technological, and demographic realities.
- Promoting Ethical AI: Ensuring that the proposed regulatory framework integrates principles of transparency, accountability, and fairness.

Methodology

- The research employs a doctrinal methodology, with comparative, exploratory, and analytical approaches. It draws heavily on secondary sources, including government documents, international reports, and academic papers. Additionally, empirical methods such as interviews, questionnaires, and observations were used to assess public and expert opinions on AI risks and regulations.

Key Findings

a. International Strategies

- European Union (EU): The EU emphasizes a human-centric approach with a focus on ethical AI, ensuring transparency, fairness, and accountability. The "Proposal for a Regulation on a European Approach for Artificial Intelligence" outlines strict guidelines for high-risk AI systems.
- China: China's approach combines national standards for AI, stringent data privacy regulations, and ethical AI development. It prioritizes sector-specific AI regulations, particularly in education, finance, and healthcare. A coordinated government oversight model and a strong emphasis on cybersecurity further define China's AI regulation strategy.
- United States: The US National AI Strategy focuses on promoting innovation while addressing risks such as data privacy, algorithmic biases, and the potential for misuse in critical sectors like law enforcement.
- OECD Principles: The OECD advocates for inclusive growth, transparency, and accountability in AI development. It stresses the need for robust, transparent, and secure AI systems that are compliant with human rights standards.

b. India's Approach

- India's National Strategy for Artificial Intelligence (NSAI), spearheaded by NITI Aayog, emphasizes the mantra "AI for All."

"Navigating the Future: India's Strategic Approach to Artificial Intelligence Regulations"

It focuses on creating responsible AI, addressing privacy concerns, minimizing algorithmic biases, and ensuring transparency through Explainable AI (XAI).

- The Telecom Regulatory Authority of India (TRAI) has also issued a consultation paper on leveraging AI in the telecom sector, addressing risks such as biased algorithms, data security, and privacy violations.
- India's unique demographics, such as its large youthful population, require an AI framework that promotes innovation while ensuring data protection and ethical deployment.

c. Risks Identified

The study identifies several risks associated with AI, including:

- Data Bias: AI systems often rely on historical data that may contain biases, leading to discriminatory outcomes in areas such as hiring, lending, and law enforcement.
- Data Privacy: The mass collection and analysis of personal data present significant privacy concerns, especially in sectors such as finance and healthcare.
- Job Losses: Automation and AI-driven processes threaten to replace human workers, exacerbating unemployment and inequality.
- Security Risks: Autonomous systems, if left unchecked, could present security vulnerabilities, particularly in critical infrastructure.

Recommendations

The research proposes the following recommendations to guide India in developing its AI regulatory framework:

- Balanced Regulation: A balance between innovation and risk mitigation is crucial. Over-regulation could stifle innovation, while under-regulation could lead to significant ethical and societal risks.
- Human-Centric AI: AI governance in India should prioritize human welfare, ensuring that AI technologies are developed with fairness, accountability, and transparency.
- Data Protection Framework: India needs a robust data protection law that aligns with international standards, ensuring that AI technologies safeguard personal data.
- Sector-Specific Guidelines: The regulatory framework should be sector-specific, with different regulations for healthcare, finance, education, and other critical sectors. This approach would allow for more targeted and effective oversight.
- Promote Public Awareness: There should be public campaigns to raise awareness about the risks and benefits of AI, helping citizens make informed decisions.
- Continuous Review of Regulations: AI technology evolves rapidly, so regulations must be continuously reviewed and updated to remain relevant and effective.
- International Collaboration: India should collaborate with global institutions like the OECD, GPAI, and others to ensure that its AI regulations are aligned with international standards, promoting cross-border collaboration and innovation.

Conclusion

Artificial intelligence presents enormous opportunities for India, from improving healthcare outcomes to transforming industries. However, these opportunities come with significant risks, including privacy concerns, algorithmic biases, and socio-economic challenges. A well-balanced regulatory framework, which considers the specific needs and challenges of India, is essential. The proposed framework should be agile, human-centric, and promote transparency and accountability while fostering innovation.

In conclusion, this research highlights the critical need for India to develop a comprehensive AI regulatory framework. Such a framework will not only ensure responsible AI development but also position India as a leader in the global AI ecosystem.

Paper - VI

Nilabhra Auddy

“Digital Fluency Quotient: Assessing Consumption Maturity of Internet users in Rural and Suburban India”

This Research examines internet usage maturity across Itachuna, Echhey Gaon, Katwa, and Ghatshila. Through the Internet Consumption Index (ICI), the research quantifies digital fluency in these regions, revealing a significant gap in advanced service adoption beyond basic communication. Key recommendations include boosting digital literacy, infrastructure, and e-governance at the grassroots level, and supporting rural entrepreneurship through digital platforms. This study emphasizes that enhancing internet maturity in rural India is crucial for fostering economic growth and sustainable development.

"Digital Fluency Quotient: Assessing Consumption Maturity of Internet users in Rural and Suburban India"

Scope of Study

The study assesses the level of internet consumption maturity in rural and suburban India, focusing on four distinct locations: Itachuna, Echhey Gaon, Katwa, and Ghatshila. The research aims to determine how internet consumption impacts socio-economic development in these areas and provides insights into their potential for growth. The study develops an Internet Consumption Index (ICI) to measure the maturity level of internet use in these regions and highlights its significance for entrepreneurship, digital inclusion, and overall development.

Problem Statement

India is undergoing rapid digital transformation, yet a significant gap persists between urban centers and rural/suburban areas regarding internet accessibility and maturity. Despite improved infrastructure, many rural and suburban areas still face challenges in leveraging the internet to its full potential, limiting their opportunities for development, education, and entrepreneurship. The problem this study addresses is the low level of internet consumption maturity in rural and suburban India, particularly how this lack of maturity hampers digital inclusivity, economic growth, and the ability to utilize digital services effectively.

Objectives

The primary objectives of this study are as follows:

- To evaluate internet consumption maturity: By assessing the extent to which rural and suburban populations use the internet across various sectors such as communication, finance, e-governance, and education.
- To create an Internet Consumption Index (ICI): The ICI measures the degree of internet usage maturity in the study areas, providing a metric for policymakers and stakeholders to target digital inclusion efforts.
- To identify barriers to internet adoption and usage: Understanding the factors that inhibit internet consumption, including infrastructural, socio-economic, and cultural barriers.
- To propose recommendations for improving internet maturity: Offering strategic recommendations for enhancing digital inclusion, infrastructure, and internet literacy in rural and suburban India.

Methodology

The study employs a quantitative research methodology, using a survey-based approach to collect primary data from residents in the four selected areas: Itachuna, Echhey Gaon, Katwa, and Ghatshila. Each area was chosen for its unique demographic and socio-economic characteristics. The study's primary tool is the Internet Consumption Index (ICI), which is based on nine parameters:

- Communication and Connectivity (e.g., WhatsApp, Facebook)
- Banking and Finance (e.g., Paytm, Gpay)
- Entertainment (e.g., YouTube, OTT platforms)
- Skill Courses or Tutoring (e.g., Byju's, Udemy)
- Online Shopping (e.g., Flipkart, Zomato)
- e-Governance (e.g., Aadhaar services, PAN Card applications)
- Jobs and Related Services (e.g., LinkedIn, Naukri.com)
- Navigation (e.g., Google Maps)
- Reservation and Bookings (e.g., IRCTC, Oyo)

A Yes-No questionnaire was used to gauge the usage of each parameter, with a sample size of 100 respondents per area. The maturity of internet usage was scored on a scale of 0 to 9, based on the number of services used by respondents. Areas were selected to represent both rural and peri-urban regions, offering a comparative analysis.

Key Findings

a. Itachuna

Itachuna, a village in West Bengal, scored an average of 2.1 on the ICI, indicating low internet usage maturity. Although literacy rates are high, the population predominantly uses basic services like communication and social media but lags in utilizing advanced internet services. The study found that despite the infrastructure being in place, many people are not adopting the full range of internet services, which limits their economic and social advancement.

"Digital Fluency Quotient: Assessing Consumption Maturity of Internet users in Rural and Suburban India"

b. Echhey Gaon

Located in a relatively isolated hilly region near Kalimpong, Echhey Gaon scored the lowest, with an ICI score of 1.12. Most residents use the internet only for basic communication, and the village's limited infrastructure and connectivity severely hinder its potential to benefit from digital inclusion. Internet maturity is particularly low, and awareness of the internet's broader applications, such as online business and e-governance, is minimal.

c. Katwa

Katwa, a peri-urban town, has an ICI score of 1.17. While Katwa is more developed than other rural areas, it still shows low internet maturity. Over 50% of respondents only use between one and three internet services, indicating underutilization of digital tools. Despite its service-oriented economy and proximity to urban centers, the town's digital adoption is minimal, restricting its growth potential.

d. Ghatshila

Ghatshila, a mining town in Jharkhand, scored 1.77 on the ICI, showing a low level of internet consumption maturity. Despite having good infrastructure and connectivity to major towns, the internet is primarily used for communication, with limited engagement in advanced services like e-governance and online learning. This low level of internet engagement suggests that the region is underutilizing its digital potential.

Recommendations

The study offers several recommendations for improving internet maturity in rural and suburban India:

a. Improving Digital Literacy

One of the key barriers to higher internet consumption maturity is a lack of digital literacy. The government, local NGOs, and private organizations should collaborate to provide digital literacy training in rural and suburban areas. This training should focus not only on basic internet usage but also on advanced services like e-governance, online education, and financial management.

b. Enhancing Infrastructure

Though basic internet connectivity exists, the quality and speed of internet services in rural areas are often subpar. Investments should be made in broadband infrastructure to ensure that rural areas receive high-speed internet, which is essential for accessing a wide range of online services. The government's BharatNet Project should be expanded and accelerated to cover more villages and ensure last-mile connectivity.

c. Awareness Campaigns

Awareness campaigns should be launched to demonstrate the economic and social benefits of internet use. These campaigns should particularly target rural populations to encourage the use of internet services in education, healthcare, and financial inclusion. Local governments could use community centers or schools to host digital literacy workshops and awareness programs.

d. E-Governance Initiatives

Introducing more e-governance services at the Panchayat level can help familiarize rural populations with the benefits of internet usage. Services like Aadhaar updates, land record management, and online healthcare consultations can significantly improve the perception and utility of the internet in these areas.

e. Support for Entrepreneurs

Entrepreneurship is a vital factor for rural development, and the internet plays a key role in fostering small businesses. The government should provide financial incentives and grants to encourage entrepreneurs in rural areas to use digital platforms to expand their businesses. Training programs focusing on digital marketing, online sales, and e-commerce can further boost internet usage maturity in these regions.

f. Collaborating with Telecom Providers

Partnerships with telecom providers can help lower the cost of internet access in rural areas, making it more affordable for households. Reduced data plans or subsidies for low-income families can promote wider adoption of internet services.

"Digital Fluency Quotient: Assessing Consumption Maturity of Internet users in Rural and Suburban India"

Conclusion

The study reveals a significant gap in internet consumption maturity in rural and suburban India. While infrastructure is improving, many areas remain underdeveloped in terms of digital literacy and engagement with online services. The Internet Consumption Index (ICI) highlights the low levels of maturity, with most rural populations using only basic services like communication and social media. To bridge this gap and harness the internet's full potential, a concerted effort is required from both government and private stakeholders to improve infrastructure, promote digital literacy, and raise awareness of the economic and social benefits of internet usage.

In conclusion, digital inclusion is a critical component of rural development in India. By improving internet consumption maturity through targeted interventions, rural and suburban regions can unlock new economic opportunities, enhance education and healthcare access, and empower local populations. The recommendations outlined in this study serve as a roadmap for achieving greater digital fluency and leveraging the internet as a tool for sustainable development.

Paper - VII

Nitesh Tiwari

“Climate Change & Global Warming”

This research explores India's challenges in reducing greenhouse gas emissions while sustaining economic growth. Key findings highlight India's dependency on coal, limited renewable energy adoption in rail networks, and the emissions profile of NTPC Dadri's coal-based power plant. The study recommends electrifying rail networks with renewables, converting coal plants to solar/hydro, implementing carbon taxation, and investing in carbon capture. These strategies aim to help India transition to a low-carbon economy and meet its climate goals.

"Climate Change & Global Warming"

Scope of Study

The research focuses on climate change mitigation through renewable energy in India, contextualized within the framework of the Paris Agreement. The study examines the impact of global climate initiatives on India, particularly in sectors like energy and transportation. It also evaluates India's efforts to meet its Nationally Determined Contributions (NDCs) by transitioning from fossil fuels to renewable energy sources. The study investigates the challenges India faces in achieving its climate goals and explores innovative solutions, including the electrification of rail networks and the promotion of renewable energy.

Problem Statement

The Paris Agreement aims to limit global warming to well below 2°C, with an aspirational target of 1.5°C. However, achieving this goal requires significant reductions in greenhouse gas (GHG) emissions. India, as one of the world's largest emitters, faces the challenge of balancing its economic growth with its commitment to reduce emissions. While India has made progress in renewable energy adoption, its dependence on fossil fuels, particularly coal, for electricity generation remains a major hurdle. The problem lies in how India can accelerate its energy transition and reduce GHG emissions while meeting the growing energy demands of its population and industrial sectors.

Objectives

The main objectives of this study are:

- To analyze India's commitment to the Paris Agreement: Understanding the role of India's Nationally Determined Contributions (NDCs) in meeting the global climate goals.
- To evaluate the effectiveness of current renewable energy initiatives: Exploring the expansion of renewable energy, including solar and wind, and the electrification of transportation systems.
- To assess the impact of fossil fuel-based power generation on the environment: Identifying the emissions profile of coal-based power plants and their contribution to climate change.
- To propose solutions for reducing GHG emissions: Offering recommendations for transitioning to renewable energy, electrifying rail networks, and increasing carbon taxation.

Methodology

The research adopts a qualitative and quantitative approach, using data collected from various sources, including government reports, academic literature, and a one-day industrial visit to the NTPC Dadri power plant. The methodology includes:

- Literature Review: Analyzing previous studies on the Paris Agreement, climate change, and renewable energy initiatives.
- Site Visit: A visit to the NTPC Dadri power plant provided insights into how thermal power plants operate, their emissions profile, and potential areas for transitioning to renewable energy.
- Data Collection: Primary data were collected during the site visit, with a focus on understanding the processes of coal combustion, electricity generation, and emissions control.

Analysis of Renewable Energy Potential: The research also evaluated the feasibility of using solar power and hydropower at NTPC Dadri, assessing the site's potential for converting to renewable energy sources.

Key Findings

a. Impact of the Paris Agreement on India

The Paris Agreement has driven India to make ambitious climate commitments. India has pledged to reduce the emissions intensity of its GDP by 33-35% by 2030 compared to 2005 levels. It has also set a target to achieve 175 GW of renewable energy capacity by 2022, focusing on solar and wind power. However, the reliance on coal for power generation continues to be a significant challenge.

b. Electrification of Rail Networks

India's railway network is one of the largest in the world, and electrifying the rail system is a key strategy for reducing GHG emissions. As of 2023, approximately 90% of India's broad-gauge network has been electrified, but the power used for railway electrification is still generated from fossil fuels.

"Climate Change & Global Warming"

This limits the environmental benefits of electrification unless renewable energy is used for power generation.

c. NTPC Dadri Power Plant and Thermal Power Generation

The NTPC Dadri plant, a coal-based thermal power station, is a major source of electricity for the National Capital Region. However, it contributes significantly to GHG emissions. The plant's infrastructure is aging, with some units over 25 years old. The combustion of coal produces large quantities of CO2, SO2, NOx, and particulate matter, contributing to air pollution and global warming. The research found that desulfurization technologies and carbon capture systems are being explored but are not yet fully implemented.

d. Renewable Energy Potential

The research identified significant potential for solar energy at NTPC Dadri. The plant already has a rooftop solar system that generates 5 MW of electricity, but this is insufficient to meet the plant's full demand. The proximity of the Ganga River also presents opportunities for hydropower generation, but no current infrastructure exists to harness this resource. The research suggests that converting the NTPC Dadri plant to renewable energy could reduce emissions by 80-90%.

e. Challenges in Transitioning to Renewable Energy

The major challenges in transitioning from thermal to renewable energy include the high cost of converting existing infrastructure, the need for new technologies like energy storage systems, and the intermittent nature of renewable energy sources. While solar and hydropower offer great potential, the lack of efficient storage systems means that fossil fuels are still required for backup power generation.

Recommendations

Based on the research findings, several recommendations are proposed to accelerate India's transition to renewable energy and meet its climate goals:

a. Electrification of Rail Networks with Renewable Energy

While India has made significant progress in electrifying its railway network, the electricity used still comes from coal-based thermal plants. It is essential to power the railway system with renewable energy, such as solar and wind. The government should invest in renewable energy projects specifically aimed at supporting the railway network.

b. Conversion of Coal-Based Power Plants to Renewable Energy

Thermal power plants like NTPC Dadri should be transitioned to renewable energy sources. Solar power offers the most viable option due to the abundance of sunlight in India. Installing larger solar farms and integrating energy storage systems would ensure a reliable supply of electricity. Hydropower from the nearby Ganga River should also be explored.

c. Carbon Taxation and Policy Incentives

The government should increase the carbon tax to discourage the use of fossil fuels and promote the adoption of clean energy technologies. Financial incentives for renewable energy projects, such as tax breaks and subsidies, should be expanded to attract private investment in the sector.

d. Adoption of Carbon Capture and Storage (CCS)

- To reduce emissions from existing coal-based power plants, CCS technologies should be implemented. This would involve capturing CO2 emissions before they are released into the atmosphere and storing them underground. While this technology is still in the early stages of development in India, it holds promise for reducing the country's overall carbon footprint.

e. Public Awareness and Education

- Public awareness campaigns should be launched to educate citizens about the benefits of renewable energy and the importance of reducing GHG emissions. Schools, colleges, and communities should be involved in these efforts to create a culture of sustainability and environmental stewardship.

"Climate Change & Global Warming"

f. Strengthening Renewable Energy Infrastructure

The government should invest in building a robust renewable energy infrastructure, including smart grids and energy storage systems. This would help integrate renewable energy into the national grid and ensure a stable supply of electricity even when renewable sources are intermittent.

Conclusion

India is at a critical juncture in its fight against climate change. While the country has made notable progress in renewable energy adoption and electrification, its continued reliance on coal-based power generation poses a significant challenge. The research conducted by Mr. Nitesh Tiwari highlights the need for a more aggressive shift towards renewable energy to meet India's commitments under the Paris Agreement. The electrification of rail networks and the conversion of coal-based power plants to solar and hydropower are key steps in reducing GHG emissions. However, these efforts must be supported by strong government policies, increased investment in renewable technologies, and public awareness initiatives.

By implementing the recommendations outlined in this report, India can accelerate its transition to a low-carbon economy, reduce its environmental impact, and play a leading role in global climate action. The journey towards sustainability is challenging, but with coordinated efforts and innovative solutions, India can achieve its climate goals and contribute to a healthier planet for future generations.

India is a land of potentials and now, it is also a land of enabling policy environment. It is a nation of 1.25 billion people blessed with the extraordinary resources in the form of 800 million youth. At a time when the global economy remains weak the world speaks in one voice that India is the new bright spot of hope for our region and the world.

- Shri Narendra Modi
Hon'ble Prime Minister

सत्यमेव जयते
Government of India
NCGG
National Centre for Good Governance
The Torch Bearer of Good Governance

National Centre for Good Governance
Department of Administrative Reforms & Public Grievances
Ministry of Personnel, Public Grievances & Pensions
Government of India

9th Floor, NDCC – II Building, Jai Singh Road, New Delhi – 110 001