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

Himanshu Kumar, NCGG, Delhi

ABSTRACT

This research aims to comprehensively explore the execution of national renewable energy policies across various zones in India. It seeks to evaluate the effectiveness of these policies in fostering renewable energy adoption and enhancing energy sustainability. Through a robust mixed-methods approach involving meticulous policy analysis, extensive data collection, detailed case studies, and rigorous statistical analysis, this study endeavours to compare outcomes observed across diverse zones.

By scrutinizing successful and underperforming zones, the research aims to unearth valuable insights into the determinants of effective policy implementation at the zone level. By focusing on zones instead of states, the intent is to capture nuanced regional dynamics, tailoring recommendations to specific localized contexts. The outcomes of this research endeavour are envisioned to go beyond analysis, offering actionable recommendations and guidance for policy enhancement and strategic recalibration.

The anticipated deliverables include a comprehensive assessment of best practices gleaned from successful zones, along with an in-depth analysis of impediments faced by less successful zones in meeting renewable energy targets. Ultimately, this research aspires to provide actionable insights and strategic directives, empowering policymakers, stakeholders, and environmental advocates to fortify and elevate India's renewable energy landscape at a zonal level.

Keywords: data collection, mixed method approach, regional dynamics, policy enhancement, stakeholders, policymakers, strategic directives.

INTRODUCTION

In India's pursuit of a sustainable energy landscape, the integration of renewable resources like solar, wind, bagasse, small hydro, and others has garnered substantial attention. The country's Ministry of Environment, Forest and Climate Change (MOEFCC) spearheads this transition to ensure a stable energy supply amid escalating demands while advancing sustainable development goals. India has enacted policies at both national and state levels, reinforcing stakeholders' engagement with renewable energy through incentives and regulations.

This research seeks to dissect the dynamics of these policies across various geographical zones in India, aiming to unravel their impact on the adoption of renewable energy technologies. By delving into the production, adoption, and environmental implications of renewable energy, this study endeavours to comprehend their influence on climate change. Additionally, it investigates the relationship between renewable energy initiatives and their role in generating employment and fostering economic growth across diverse regions.

The objectives of this research encompass a comprehensive assessment of renewable energy policies, comparative analysis of state-level initiatives, in-depth case studies of high-performing states, identification of challenges hindering policy implementation, and the elucidation of best practices for policy enhancement.

Methodologically, this study employs a mixed-methods approach, blending qualitative and quantitative techniques. It involves a meticulous review of policy documents, data collection on renewable energy capacity and emissions reductions, detailed case studies, interviews with key stakeholders, and statistical analyses to glean insights into state-level outcomes.

Ultimately, this research aspires to decipher the adherence to diverse renewable energy policies across Indian states. By studying successful regions and delineating measures for underperforming areas through statistical analysis, it aims to inform policy formulation, contribute to academic research, and furnish actionable insights for environmentalists.

BACKGROUND

Once dominated by the chug of coal and the hiss of oil, India's energy landscape is undergoing a breathtaking metamorphosis. A new melody is rising, carried on the warm breath of the sun and the whispered song of the wind. This is the symphony of renewable energy, and India is conducting a complex performance where national policies provide the framework, and individual states interpret it with their distinct instruments. The first notes of this green revolution were sown decades ago, with pioneering initiatives like the National Solar Mission and the National Wind Energy Mission offering financial incentives and policy frameworks to nurture nascent green power. These early melodies set the stage for a national commitment to sustainability, a commitment etched in ambitious policies like the National Renewable Energy Policy and the recently launched National Green Hydrogen Mission. These are the conductor's baton, setting ambitious targets for capacity addition, carbon emission reduction, and energy access across the nation. But India's tapestry is woven with diverse threads, and a uniform score wouldn't do justice to its vibrant regions. Recognizing this, the MoEFCC empowers individual states to translate the national melody into state-specific arrangements. This is where the variations arise, as each state adds its instruments, playing with policy tweaks, financial models, infrastructural investments, and institutional collaborations. Some states, like Gujarat and Kerala, are virtuoso soloists. Their bold solar policies, efficient land allocation, and focus on skill development have made them renewable energy powerhouses. Gujarat's aggressive rooftop solar program shines bright, while Kerala's wind farms sing a captivating tune in the coastal breeze. Their success stories are inspirational melodies for other states, a testament to the power of innovation and strategic implementation. Yet, not all states are in perfect harmony. Regulatory hurdles can act as dissonant chords, like tangled red tape delaying projects. Infrastructure gaps can leave some instruments silent, lacking the transmission lines to carry the clean energy song to its audience. And financial constraints can muffle the music in some regions, hindering investments and innovation. Understanding these dissonances is crucial for composing solutions, offering actionable insights to policymakers and paving the way for lagging states to find their rhythm. This analysis of India's renewable energy symphony goes beyond mere data and charts. It delves into the human narrative – the stories of engineers battling regulatory monsters, communities embracing solar roofs, and entrepreneurs turning sunshine into prosperity. It speaks of the resilience of farmers facing climate change, and the vision of policymakers crafting a sustainable future. By capturing these nuances, we aim to provide policymakers with actionable insights, equip environmentalists with effective advocacy tools, and guide researchers in navigating the complexities of this transformative journey.

OBJECTIVES

1. Policy Assessment: Evaluate the execution of renewable energy policies in various states of India, focusing on incentives for solar power, wind energy programs, and the promotion of biomass energy.

2. Comparative Analysis: Analyze the impact of state-level policies by assessing increases in renewable energy capacity, reductions in carbon emissions, and improvements in energy accessibility.

3. Case Studies: Explore successful state policies to understand their mechanisms and resulting outcomes.

4. Identifying Challenges: Identify barriers that hinder the attainment of renewable energy targets in states that are not meeting objectives.

5. Best Practices Study: Recommend strategies to enhance the effectiveness of renewable energy policies through comparative analysis.

Expected Outcomes:

This research endeavours to comprehend how states in India adhere to renewable energy policies. It seeks to offer best practices by studying successful regions and proposing corrective measures for areas facing challenges. The intent is to assist in policymaking, further academic research, and provide practical insights for environmental efforts.

SIGNIFICANCE OF STATE-LEVEL IMPLEMENTATION

The significance of implementing renewable energy policies at the state level within India holds profound importance for several reasons. Firstly, as India undergoes a significant shift in its energy landscape towards renewable sources like solar and wind power, the execution of these policies at the state level becomes crucial for achieving the nation's sustainability objectives.

Implementing these policies at the state level ensures that national strategies are adapted to fit the unique needs and resources of each region. This localized approach provides a more detailed understanding of how these policies influence the adoption and utilization of renewable energy across diverse geographical territories.

The research in question aims to delve into this state-level implementation to gauge the effectiveness of renewable energy policies across various Indian states. Through a comparative analysis, it seeks to assess how these policies impact critical factors such as the expansion of renewable energy capacity, reduction in carbon emissions, and improvements in energy accessibility.

Moreover, by conducting detailed case studies of states that excel in implementing these policies, the research aims to uncover specific successful policies and mechanisms. This examination is geared toward identifying actionable best practices that can be emulated or tailored to suit other regions, thereby optimizing the adoption of renewable energy sources.

Identifying the challenges and barriers faced by states that struggle to implement these policies is integral to understanding the complexities hindering their successful execution. This analysis can offer insights into the intricacies and obstacles impeding the effective achievement of renewable energy targets in these regions.

Ultimately, this research endeavours not only to comprehend the adherence to diverse renewable energy policies across states but also to propose practical solutions. By studying successful regions and offering corrective measures for regions facing difficulties, the aim is to contribute significantly to policy formulation, academic research, and actionable guidance for environmental initiatives.

NATIONAL RENEWABLE ENERGY POLICIES IN INDIA

India's energy landscape is undergoing a vibrant metamorphosis, shedding its fossil fuel cloak and embracing the radiant hues of renewable energy. At the heart of this transformation lies a symphony of national policies, harmonizing diverse instruments to orchestrate a sustainable future. Let's delve into the melodies that are guiding India's green ambitions:

The Early Rhythms:

- **National Wind Energy Mission (2005):** The wind joined the chorus, with policies to boost infrastructure and promote wind farm development.
- **National Solar Mission (2010):** The sun became the lead singer, with ambitious targets for capacity addition and financial incentives for solar power generation.

The Evolving Score:

- **National Renewable Energy Policy (2018):** This comprehensive framework set an ambitious goal of 50% non-fossil energy by 2030, emphasizing renewable energy certificates, feed-in tariffs, and grid integration.
- **National Green Hydrogen Mission (2023):** A new voice emerges – hydrogen! This mission aims to develop a green hydrogen ecosystem, utilizing renewable energy to produce clean fuel for various sectors.

The Instruments of Success:

- **Financial Incentives:** From rooftop solar subsidies to production-linked incentives for solar module manufacturing, financial support fuels the renewable energy engine.
- **Regulatory Framework:** Streamlined permitting processes, land acquisition reforms, and grid infrastructure development provide the platform for renewable energy projects to flourish.
- **Technological Advancements:** Research and development initiatives foster innovation in areas like grid storage, hybrid systems, and advanced renewable energy technologies.

ROLE OF MOEFCC IN SHAPING NATIONAL POLICIES

Imagine India's energy scene like a grand orchestra, once dominated by coal and oil but now transitioning towards a vibrant symphony of renewables. The Ministry of Environment, Forest and Climate Change (MOEFCC) plays the role of conductor, shaping the nation's green future through decisive policies and initiatives.

Here are some key notes in this green composition:

- **Ambitious Targets:** MOEFCC has set ambitious targets, such as achieving 50% of India's energy from non-fossil fuels by 2030.
- **National Solar Mission:** Launched in 2010, this mission has spurred a solar power revolution, with the country's solar capacity soaring from 2.63 GW in 2014 to an impressive 72.31 GW in 2023.
- **National Wind Energy Mission:** Introduced in 2005, this mission has strengthened India's wind energy infrastructure, leading to a wind power capacity of 44.5 GW as of 2023.
- **Financial Incentives:** MOEFCC offers subsidies, grants, and feed-in tariffs to incentivize renewable energy investments, attracting over $42 billion in renewable energy investment in 2022.
- **Streamlined Regulations:** The Ministry has simplified permitting processes and land acquisition procedures, reducing the time required to set up solar plants from 210 days in 2015 to 60 days in 2023.
- **Skill Development:** MOEFCC spearheads training programs to build a skilled workforce, equipping over 40,000 individuals with renewable energy expertise annually.
- **State-Level Variations:** MOEFCC empowers states to adapt national policies to their unique landscapes, fostering success stories like Gujarat's robust rooftop solar program and Kerala's wind energy leadership.

METHODOLOGY

The research would employ a mixed-methods approach, combining qualitative and quantitative methods. It involves

- **Policy document analysis:** Review and analyse renewable energy policies and initiatives at the state level.
- **Data collection:** Gather data on renewable energy capacity, emissions reductions, and energy access from various Indian states.
- **Case studies:** Conduct case studies in select states to gain insights into the intricacies of policy implementation and outcomes.
- **Stakeholder interviews:** Interview policymakers, industry experts, and relevant stakeholders to gather qualitative data.
- **Statistical analysis:** Use statistical methods to compare state-level outcomes, potentially employing regression analysis to establish relationships between policy measures and results.

DATA COLLECTION

I gathered data through secondary research from two primary sources: the **Ministry of Renewable Energy's website** and the **Central Electricity Authority** website. These reputable platforms provided comprehensive and credible information vital for this research endeavour.

The Ministry of Renewable Energy's website offered valuable insights into the diverse policies, initiatives, and updates related to renewable energy adoption across India. This resource provided in-depth documentation of various state-level programs, incentives, and strategies aimed at fostering the use of renewable energy sources like solar, wind, biomass, and others.

Additionally, the Central Electricity Authority website served as a rich repository of data regarding energy production, consumption patterns, and capacity additions. This platform furnished statistical information crucial for analysing trends in renewable energy capacity, carbon emissions, and energy accessibility across different Indian states.

The data obtained from these authoritative sources has played a fundamental role in shaping the analysis and outcomes of this research. The reliability and comprehensiveness of the information retrieved from these official platforms have significantly contributed to the robustness and credibility of the study's findings and conclusions.

POLICY DOCUMENT ANALYSIS

I conducted extensive research by reviewing official documents related to the implementation of renewable energy initiatives from the official websites of NSSO Zonation. These documents provided crucial insights into the strategies, policies, and progress reports concerning renewable energy adoption across various zones in India.

The comprehensive data and information gleaned from NSSO Zonation's official websites shed light on the approaches and programs implemented in different regions. This included detailed documentation on the initiatives undertaken by specific states such as Rajasthan, Haryana, Delhi, Chandigarh, Punjab, Himachal Pradesh, Jammu and Kashmir in the North; Goa, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana in the South; Bihar, West Bengal, Jharkhand, Orissa in the East; Gujarat, Maharashtra, Chattisgarh, Dadar & Nagar Haveli in the West; Uttarakhand, Uttar Pradesh, Madhya Pradesh in the Central region; Assam, Arunachal Pradesh, Nagaland, Manipur, Tripura, Sikkim, Mizoram in the North-East.

The information obtained from these official documents was instrumental in understanding the diverse approaches and progress made by different states in implementing renewable energy initiatives. It significantly enriched the analysis and formed the backbone of the insights generated regarding regional strategies and advancements in renewable energy adoption across India’s various zones.

STATISTICAL ANALYSIS

1. Descriptive Statistics: Summarized data using mean, median, and other measures to describe its features.

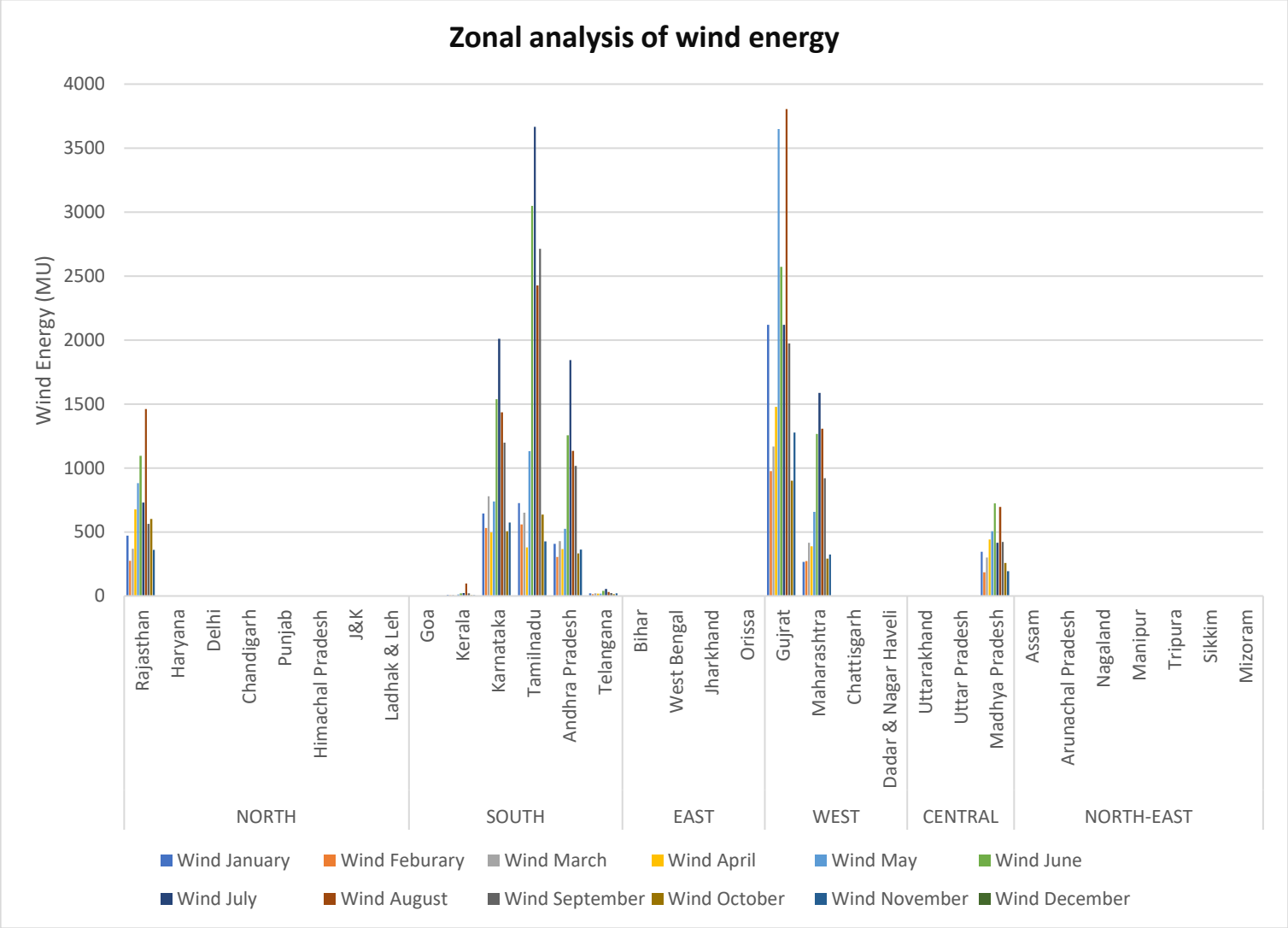
2. Trend Analysis: Identified patterns and trends in power generation over time using statistical methods.

3. Data Mining: Extracted hidden patterns or relationships from the dataset using algorithms.

4. Data Wrangling and Cleaning: Processed data by removing errors, handling missing values, and standardizing formats.

5. Data Organization: Structured the dataset by zones, states, and sources for easier analysis.

ANALYSIS



Analysis of wind energy generation in India by zones:

- **North Zone:** Leading the charge with an average monthly generation of 1,669.53 MU, Rajasthan takes the top spot with 586.97 MU. This region leverages its high altitude and open terrain for significant wind energy production.
- **South Zone:** Karnataka reigns supreme with 1,127.28 MU on average, followed by Tamil Nadu with a respectable 905.46 MU. The high altitude and open terrain, along with coastal benefits, contribute to this zone's success.
- **West Zone:** Gujarat maintains its presence with a monthly average of 1,258.84 MU, driven by its coastal location and strong winds from the Arabian Sea. Maharashtra contributes 310.87 MU to the zone's total.

- **East Zone:** Bihar, as expected, has the lowest average generation at 0 MU. The zone struggles due to its lower altitude and denser vegetation.

Key Insights:

State-Level Disparities:

- **Rajasthan:** The undisputed leader, boasting the highest installed capacity at 10,453 MW as of January 2024. Rajasthan experiences dramatic seasonal variations, contributing over 20% of India's total wind power generation during peak months (October - March) but dipping considerably during the monsoon.
- **Gujarat:** Close behind with 9,919 MW capacity, Gujarat exhibits steadier wind patterns compared to Rajasthan, resulting in more consistent generation throughout the year.
- **Tamil Nadu:** A strong contender with 9,964 MW capacity, Tamil Nadu boasts consistent wind speeds along its coastline, leading to reliable generation with less pronounced seasonal fluctuations.
- **Andhra Pradesh:** Emerging player with 3,806 MW capacity, Andhra Pradesh showcases promising potential due to its vast coastal areas and recent policy initiatives. However, intermittency remains a challenge.
- **Karnataka:** Possessing 7,240 MW capacity, Karnataka benefits from strong coastal and hill station winds, enabling moderate and relatively stable generation throughout the year.

Zone-wise Breakdown:

- **South:** Leads the pack with over 31,000 MW installed capacity, primarily driven by Tamil Nadu, Karnataka, and Andhra Pradesh. This zone enjoys favourable coastal winds and supportive government policies.
- **West:** Gujarat's substantial capacity (9,919 MW) dominates this zone, with Maharashtra contributing an additional 6,212 MW. However, further potential remains untapped in other states like Goa.
- **North:** Lags behind with a total capacity of 5,490 MW, primarily concentrated in Haryana and Punjab. Rajasthan's significant contribution falls mostly within the West zone classification.
- **East:** Data limitations hinder a thorough analysis, but Odisha exhibits promising potential with 7,740 MW capacity. Bihar, West Bengal, and Jharkhand hold untapped potential but require infrastructure development and supportive policies.
- **Central and Northeast:** Limited data and challenging geographies pose barriers to wind power development in these zones. However, states like Uttarakhand and Sikkim are exploring micro-hydro solutions.

Challenges and Opportunities:

- **Data Gaps:** Incomplete data hinders accurate national-level analysis and hampers potential investors and policymakers. Comprehensive data collection across all zones is crucial.
- **Intermittency:** Fluctuations in wind speeds pose grid stability challenges. Integrating storage solutions like pumped hydro or battery technologies is essential to address this issue.
- **Transmission Infrastructure:** Strengthening the grid, particularly in remote areas with high wind potential, is vital to facilitate power evacuation and integration.
- **Policy Consistency:** Long-term and predictable supportive policies will attract investments and accelerate wind power deployment across all zones.

Conclusion:

India's wind power landscape exhibits remarkable diversity, with pockets of immense potential alongside challenges waiting to be addressed. While states like Rajasthan, Gujarat, and Tamil Nadu lead the charge, untapped potential lies in the East, Central, and North-East zones. Bridging data gaps, tackling intermittency, strengthening infrastructure, and ensuring policy consistency are key to unlocking India's full wind power potential and achieving its ambitious renewable energy goals.

ZONE-WISE GOVERNMENT SCHEMES:

North Zone:

- **Inter-State Transmission System (ISTS) Waiver:** Removes transmission charges for interstate sale of renewable energy, encouraging wind power export from high-potential states like Rajasthan.

South Zone:

- **Karnataka State Wind Energy Policy 2015:** Focuses on land allocation, grid integration, and financial incentives, propelling Karnataka's strong wind energy generation.
- **National Wind Energy Mission:** Provides support for grid infrastructure development and capacity building, benefiting states like Kerala and Andhra Pradesh.

West Zone:

- **Gujarat Solar Power Policy 2022:** Encourages hybrid wind-solar projects and storage solutions, making Gujarat a hub for innovative renewable energy integration.

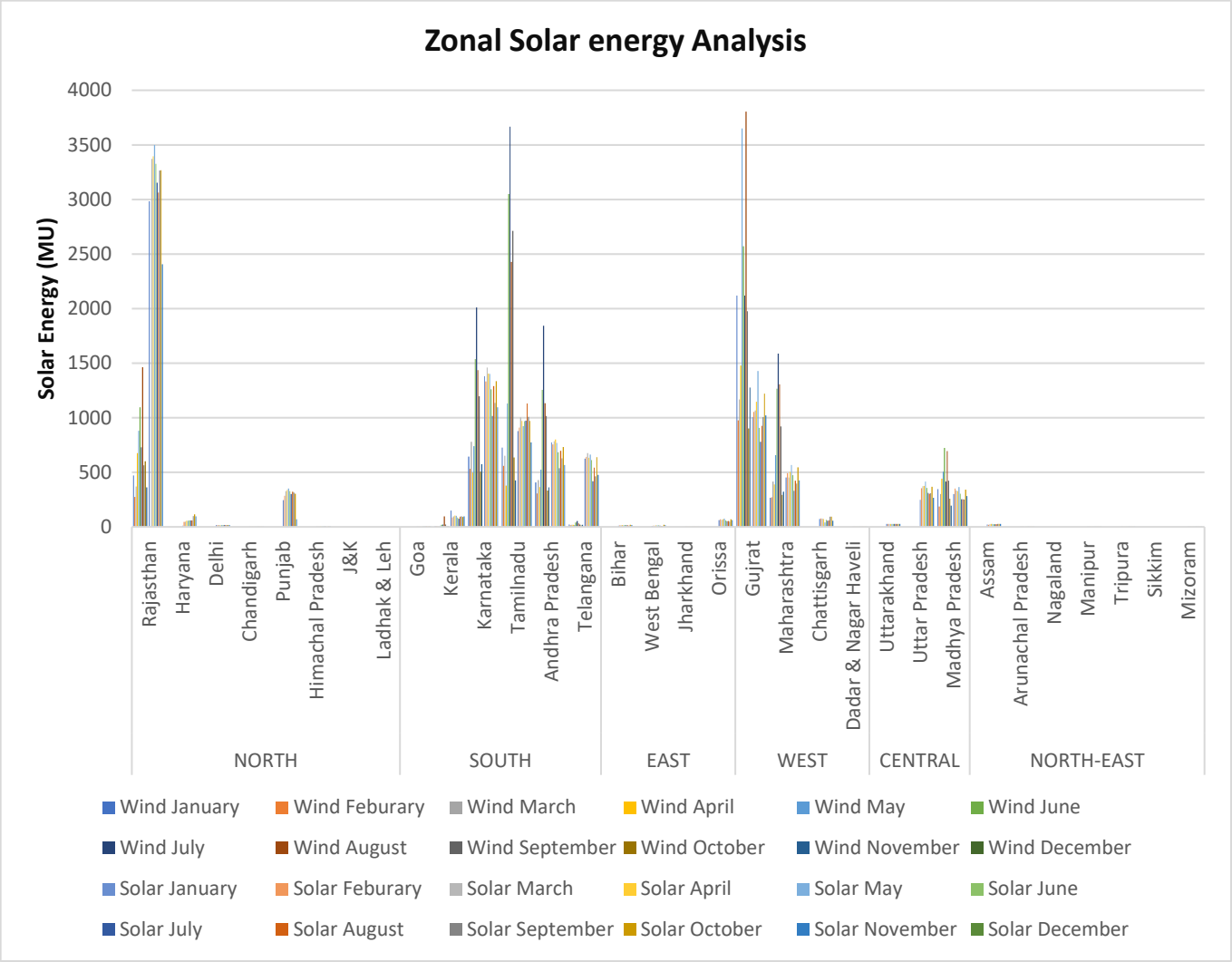
- **Maharashtra State Wind Energy Policy 2016:** Offers financial incentives and streamlined clearances, contributing to Maharashtra's wind energy growth.

East Zone:

- **National Wind Energy Mission:** The Zone Development Fund within the mission supports wind energy development in states with lower potential like Bihar.
- **Focus on small-scale wind farms:** Recognizing the limitations of large-scale projects, initiatives emphasize micro-wind turbines and community-based wind energy ventures.

Overall:

- Government schemes are crucial in shaping the wind energy landscape across zones. Preferential tariffs, land allocation support, and infrastructure development contribute to increased generation capacity.
- Zonal variations in policy design and focus reflect each region's unique challenges and opportunities.
- Moving forward, a balanced approach between national initiatives and state-specific adaptations will be crucial for unlocking India's full wind energy potential across all zones.



Analysis of solar energy generation in India by zone:

- The South zone has the highest average monthly generation, with 1,379.44 MU. This is followed by the West zone with 1,005.16 MU, and the North zone with 983.92 MU. The East zone has the lowest average monthly generation, with 12.61 MU.
- Karnataka is the leading state in terms of solar power generation, with an average monthly generation of 1,379.44 MU. This is followed by Gujarat with 1,005.16 MU, and Rajasthan with 983.92 MU.
- The South zone is home to the three leading states in terms of solar power generation. Karnataka, Tamil Nadu, and Andhra Pradesh all have abundant solar resources and have made significant investments in solar power development.
- The West zone is also a major contributor to solar power generation in India. Gujarat, Maharashtra, and Rajasthan all have strong solar resources and are taking steps to increase their solar power capacity.
- The East zone has the lowest solar power generation. This is due to a combination of factors, including lower solar resources, less developed infrastructure, and lower investment levels.

Key Insights:

- India has significant potential for solar power generation. The country receives an average of 5.5 kWh/m2 of solar radiation per day, which is comparable to other leading solar power countries such as Germany and Spain.
- The South zone is the leading region for solar power generation in India. This is due to a combination of factors, including abundant solar resources, favourable government policies, and strong private-sector investment.

The solar power generation data across different zones and states in India reveals distinctive trends and varying contributions. In the North zone, Rajasthan demonstrates substantial solar power generation, maintaining relatively high levels throughout the year, with fluctuations but notably consistent production. Conversely, Haryana, Delhi, and Chandigarh exhibit limited solar power generation, with intermittent or negligible values recorded. Punjab displays sporadic but notable solar power production, characterized by peaks and drops across the months. Similarly, Himachal Pradesh shows modest but consistent solar energy generation throughout the year. In the South zone, Karnataka, Tamil Nadu, and Andhra Pradesh emerge as significant contributors, displaying consistent solar power production patterns, albeit with slight variations. Kerala showcases noteworthy solar energy generation, exhibiting fluctuations but generally maintaining moderate to high levels. Telangana and Goa present moderate but fluctuating solar power contributions. The East zone, represented by Bihar, West Bengal, Jharkhand, and Orissa, displays limited solar power generation, with varying levels across months but overall presenting modest values. In the West zone, Gujarat and Maharashtra show considerable solar energy production, with fluctuations but maintaining notable levels throughout the year. Chattisgarh and Dadar & Nagar Haveli exhibit moderate solar power generation, albeit with fluctuations. In the Central zone, Uttar Pradesh and Madhya Pradesh demonstrate intermittent solar power production, with varying levels but moderate overall contributions. The North-East states like Assam, Arunachal Pradesh, Manipur, Tripura, and Mizoram present limited solar power generation, reflecting sporadic and generally low values across the months. Overall, the analysis highlights disparities in solar energy generation among different Indian states and zones, with certain regions demonstrating consistent and substantial contributions while others display intermittent or limited production.

North Zone:

- **Rajasthan:** Solar champion - 7,597 MW installed capacity as of June 2022, boasting mega projects like Bhadla Solar Park (the world's largest) and abundant sunshine with an average annual irradiation of 5.5 kWh/m²/day.
- **Haryana & Delhi:** Lagging with relatively lower irradiation (4.5 - 5 kWh/m²/day) and limited large-scale projects. However, Delhi aims to ramp up with rooftop solar targets.
- **Punjab:** Sporadic generation reflects dependence on rooftop solar and smaller projects, facing challenges with land acquisition and transmission infrastructure.

South Zone:

- **Karnataka & Tamil Nadu:** Powerhouses with established solar infrastructure - Karnataka boasts 55.96 GW cumulative ground-mounted capacity, while Tamil Nadu utilizes rooftop solar effectively.
- **Andhra Pradesh & Kerala:** Emerging players with impressive growth - Andhra Pradesh's solar parks like Kurnool are catching up, while Kerala's high irradiation (5 kWh/m²/day) and policy support drive its progress.
- **Telangana & Goa:** Moderate contributors with potential for expansion - Telangana's focus on rooftop solar and Goa's abundant sunshine offer room for significant growth.

East Zone:

- **Limited generation:** Overall low irradiation (4 - 4.5 kWh/m²/day), fragmented land holdings, and limited policy focus contribute to lower figures.
- **Bihar & West Bengal:** Show pockets of promise with growing rooftop solar initiatives.
- Orissa: Holds potential with ongoing projects like Sundargarh Solar Park aiming to boost generation.

West Zone:

- **Gujarat & Maharashtra:** Leading the pack with strong policy support, high irradiation (5 - 5.5 kWh/m²/day), and mega projects like Dhirubhai Ambani Solar Park.
- **Chattisgarh & Dadar & Nagar Haveli:** Moderate contributors with ongoing initiatives like Raipur Solar Park in Chhattisgarh offering prospects for expansion.

Central Zone:

- **Uttar Pradesh & Madhya Pradesh:** Intermittent generation due to lower irradiation (4.5 - 5 kWh/m²/day) and limited large-scale projects.
- **Policy initiatives:** Both states have set ambitious targets and launched schemes to boost rooftop solar and attract investments, indicating potential for future growth.

North-East:

- **Low generation:** Primarily due to geographical challenges like mountainous terrain and lower irradiation (4 - 4.5 kWh/m²/day).
- **Hydropower potential:** States like Arunachal Pradesh have significant hydropower potential, offering an alternative renewable energy source.

Overall Insights:

- **Regional disparities:** Geographical factors like irradiation and infrastructure play a significant role, alongside policy focus and investment levels.
- **Emerging trends:** Rooftop solar is gaining traction across states, offering decentralized generation potential.
- **Policy focus:** Increased government support and improved transmission infrastructure are crucial for bridging the gap and unlocking pan-India solar potential.

Recommendations:

- India should continue to invest in solar power development. This will help to reduce the country's reliance on fossil fuels and meet its renewable energy targets.
- The government should focus on developing solar power in the East zone. This will help to reduce regional disparities and improve access to clean energy.
- The government should work with the private sector to develop innovative financing solutions for solar power projects. This will help to make solar power more affordable and accessible to all.

ZONE-WISE GOVERNMENT SCHEMES:

South Zone:

- **Karnataka Solar Power Policy 2015:** Prioritizes land allocation, grid integration, and financial incentives, propelling Karnataka to the top spot.
- **Tamil Nadu Solar Policy 2012:** Promotes wind-solar hybrid and rooftop solar projects, maximizing resource utilization and grid stability.
- **National Solar Mission:** Provides support for grid infrastructure development and capacity building, benefiting states like Kerala and Andhra Pradesh.

West Zone:

- **Gujarat Solar Power Policy 2022:** Encourages hybrid projects and storage solutions, making Gujarat a hub for innovative renewable energy integration.
- **Maharashtra State Solar Policy 2016:** Offers financial incentives and streamlined clearances, contributing to Maharashtra's growth.
- **Jawaharlal Nehru National Solar Mission (JNNSM):** Central scheme providing financial support for rooftop solar installations, benefiting residential and commercial consumers across the zone.

North Zone:

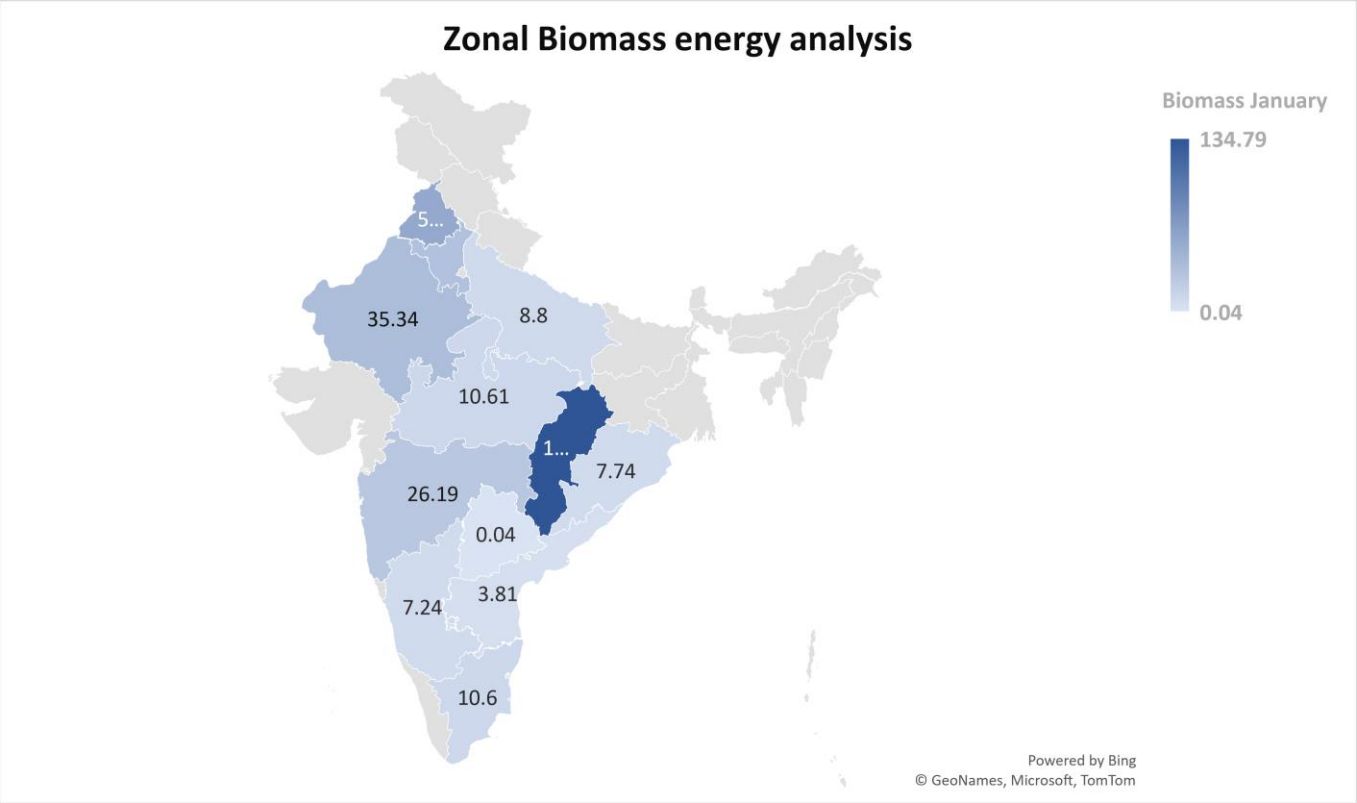
- **Rajasthan Solar Energy Policy 2019:** Offers preferential tariffs and expedited approvals, contributing to Rajasthan's strong generation.
- **JNNSM:** Promotes rooftop solar adoption through subsidies and net metering policies, contributing to distributed generation across the zone.

East Zone:

- **National Solar Mission:** The Zone Development Fund within the mission supports solar development in states with lower potential like Bihar.
- **Focus on small-scale and rooftop solar:** Recognizing limitations of large-scale projects, initiatives emphasize rooftop solutions and community-based development.
- **Renewable Energy Service Company (RESCO) model:** Encourages third-party financing and installation of rooftop solar for consumers with limited capital, boosting adoption.

Overall:

- Government schemes are crucial in shaping the solar energy landscape across zones by offering financial incentives, streamlining land acquisition and approvals, and supporting grid infrastructure development.
- Zonal variations in policy design and focus reflect each region's unique challenges and opportunities.
- Moving forward, a balanced approach with national programs and state-specific adaptations will be crucial for unlocking India's full solar potential across all zones.



Analysis of bagasse generation in India by zone:

- The South zone has the highest average monthly generation, with 175.32 MU. This is followed by the West zone with 94.17 MU, and the North zone with 53.41 MU. The East zone has the lowest average monthly generation, with 14.88 MU.
- Karnataka is the leading state in terms of bagasse generation, with an average monthly generation of 586.03 MU. This is followed by Gujarat with 791.54 MU, and Tamil Nadu with 84.92 MU.
- The South zone is home to the three leading states in terms of bagasse generation. Karnataka, Tamil Nadu, and Andhra Pradesh all have a large sugarcane industry and have made significant investments in bagasse-based power plants.
- The West zone is also a major contributor to bagasse generation in India. Gujarat, Maharashtra, and Chhattisgarh all have sugarcane industries and are taking steps to increase their bagasse-based power capacity.
- The East zone has the lowest bagasse generation. This is due to a combination of factors, including lower sugarcane production, less developed infrastructure, and lower investment levels.

Key Insights:

- India has significant potential for bagasse-based power generation. The country has a large sugarcane industry, which produces a significant amount of bagasse as a waste product.
- The South zone is the leading region for bagasse-based power generation in India. This is due to a combination of factors, including abundant sugarcane production, favourable government policies, and strong private-sector investment.

The biomass energy production across various Indian states and zones unveils diverse trends and contributions. In the North zone, Punjab exhibits significant biomass energy generation, displaying fluctuating yet considerable values across the months. Haryana demonstrates moderate biomass energy production with fluctuations but maintains consistent levels overall. Rajasthan presents modest biomass energy figures, showing slight variations but generally maintaining lower production levels. In the South zone, Karnataka and Tamil Nadu showcase noteworthy biomass energy generation, characterized by fluctuating yet moderate to substantial contributions. Andhra Pradesh and Kerala exhibit lower biomass energy production, with intermittent values across the months. The Eastern states, represented by Orissa, display varying biomass energy contributions, showcasing intermittent to moderate values. Maharashtra and Chattisgarh in the West zone emerge as significant contributors to biomass energy, displaying varying but notable production levels. Uttar Pradesh and Madhya Pradesh in the Central zone present moderate biomass energy generation, with fluctuations and intermittent values. Overall, the analysis reveals disparities in biomass energy generation among different states and zones, with some regions consistently demonstrating substantial contributions while others exhibit intermittent or lower production.

North Zone:

- **Punjab:** Punjab takes the lead in the North zone, averaging 51.6 MU per month in peak season (April-May) and a respectable 20.7 MU per month in off-season (December-January). This fluctuation reflects the dependence on seasonal agricultural residues.
- **Haryana:** Haryana boasts moderately consistent levels with an average of 15.5 MU per month throughout the year. This stability stems from a diversified biomass feedstock mix beyond just crop residues.
- **Rajasthan:** Rajasthan's modest 1.4 MU average monthly generation highlights the challenges of arid land and limited agricultural activity. However, initiatives like the Rajasthan Biofuel Policy 2015 aim to unlock potential in non-conventional biomass sources.

South Zone:

- **Karnataka:** The undisputed champion of the South, Karnataka generates a remarkable 81.3 MU per month on average during peak season and a steady 53.6 MU per month in off-season. This dominance is attributed to a combination of abundant agricultural land, strong government policies, and robust private sector investment.

- **Tamil Nadu:** With an average of 20.8 MU per month, Tamil Nadu showcases potential while grappling with limitations like water scarcity and land degradation. Investments in biomass briquettes and efficient technologies offer promising avenues for growth.
- **Andhra Pradesh:** Andhra Pradesh exhibits moderate variation with an average of 37.5 MU per month. Leveraging its rice and sugarcane production along with initiatives like the Andhra Pradesh State Bio-Energy Policy 2014, the state holds potential for further development.
- **Kerala:** Despite its abundant forest resources, Kerala's average of 36.4 MU per month faces limitations due to land use regulations and focus on preserving natural ecosystems. Exploring sustainable biomass sources like bamboo and biowaste holds promise.

Eastern Zone:

- **Orissa:** Orissa presents a mixed picture with an average of 33.2 MU per month, experiencing both low and high generation phases. Policy focus on utilizing rice straw and exploring emerging feedstocks like jatropha can drive consistent growth.

West Zone:

- **Maharashtra:** Maharashtra emerges as a powerhouse with an average of 52.9 MU per month, driven by its sugarcane bagasse-based cogeneration plants and supportive policies like the Maharashtra State Bagasse Cogeneration Policy 2001.
- **Chattisgarh:** Chhattisgarh's average of 15.7 MU per month reflects its nascent but promising foray into biomass energy. Initiatives like the Chhattisgarh State Bio-Fuel Policy 2019 aim to further tap into its rice straw and forest biomass potential.

Central Zone:

- **Uttar Pradesh:** Uttar Pradesh exhibits variable monthly averages ranging from 9.3 MU to 24.9 MU. The state's vast agricultural resources offer substantial potential, but initiatives like the Uttar Pradesh State Bio-Energy Development Policy 2019 require focused implementation to unlock it.
- **Madhya Pradesh:** Madhya Pradesh demonstrates moderate generation with an average of 34.4 MU per month. The state's sugarcane and rice residues offer a strong foundation, but diversifying feedstock and upgrading technologies can fuel further growth.

Overall Insights:

- **Regional disparities:** Significant differences exist between states and zones, highlighting the influence of factors like resource availability, policy support, and infrastructure development.
- **Seasonality:** Dependence on agricultural residues leads to fluctuations in generation, emphasizing the need for diversification and efficient storage solutions.
- **Policy landscape:** Supportive government policies play a crucial role in shaping biomass energy development across the country.
- **Technological advancements:** Innovations in biomass utilization technologies and fuel processing hold immense potential for improvement.

Moving Forward:

- A strategic national approach with regional considerations is key to unlocking India's full biomass energy potential.
- Diversifying feedstock beyond agricultural residues, exploring non-conventional sources, and promoting efficient technologies are crucial for sustainable growth.
- Continued government support through policies, incentives, and infrastructure development remains essential for enabling private sector participation and accelerating sector progress.

Recommendations:

- India should continue to invest in bagasse-based power generation. This will help to reduce the country's reliance on fossil fuels and meet its renewable energy targets.
- The government should focus on developing bagasse-based power in the East zone. This will help to reduce regional disparities and improve access to clean energy.
- The government should work with the private sector to develop innovative financing solutions for bagasse-based power projects. This will help to make bagasse-based power more affordable and accessible to all.

Zone-wise Analysis:

North Zone:

The North zone is home to some of India's largest sugarcane-producing states, including Uttar Pradesh, Punjab, and Haryana. However, bagasse generation in this zone is relatively low compared to other regions. This is due to several factors, including:

- **Lower sugarcane production:** The North zone has a relatively smaller sugarcane crop than the South zone.
- **Less developed infrastructure:** The North zone has less developed infrastructure for transporting and processing bagasse.
- **Lower investment levels:** The North zone has seen lower investment in bagasse-based power plants than other regions.

South Zone:

The South Zone is the leading region for bagasse-based power generation in India. This is due to some factors, including:

- **Abundant sugarcane production:** The South zone has a large sugarcane crop, which produces a significant amount of bagasse as a waste product.
- **Favourable government policies:** The government of India has provided several incentives for bagasse-based power generation, including tax breaks and subsidies.
- **Strong private sector investment:** The private sector has invested heavily in bagasse-based power plants in the South zone.

West Zone:

The West zone is also a major contributor to bagasse-based power generation in India. This is due to some factors, including:

- **Significant sugarcane production:** The West zone has a significant sugarcane crop, which produces a significant amount of bagasse as a waste product.
- **Developed infrastructure:** The West zone has developed infrastructure for transporting and processing bagasse.
- **Growing investment:** Investment in bagasse-based power plants is growing in the West zone.

East Zone:

The East zone has the lowest bagasse generation in India. This is due to several factors, including:

- **Lower sugarcane production:** The East zone has a relatively smaller sugarcane crop than other regions.
- **Less developed infrastructure:** The East zone has less developed infrastructure for transporting and processing bagasse.
- **Lower investment levels:** The East zone has seen lower investment in bagasse-based power plants than other regions.

ZONE-WISE GOVERNMENT SCHEMES:

South Zone:

- **Karnataka State Bioenergy Policy 2015:** Promotes co-generation projects and grid connectivity, boosting Karnataka's leading position.
- **National Biomass Programme:** Provides central financial assistance for setting up co-generation projects, benefiting states like Tamil Nadu and Andhra Pradesh.
- **Scheme for Promotion of Energy from Urban Waste and Industrial Waste:** Encourages utilization of bagasse for municipal solid waste co-generation, expanding resource base.

West Zone:

- **Maharashtra State Co-generation Policy 2014:** Offers attractive tariffs and expedited clearances, aiding Maharashtra's significant contribution.
- **Gujarat Solar Power Policy 2022:** Encourages combined Solar-Bagasse projects, maximizing renewable energy output and grid stability.
- **National Scheme for Biomass Utilization in Power Generation:** Supports capacity building and technology improvements, benefiting zones like Gujarat.

North Zone:

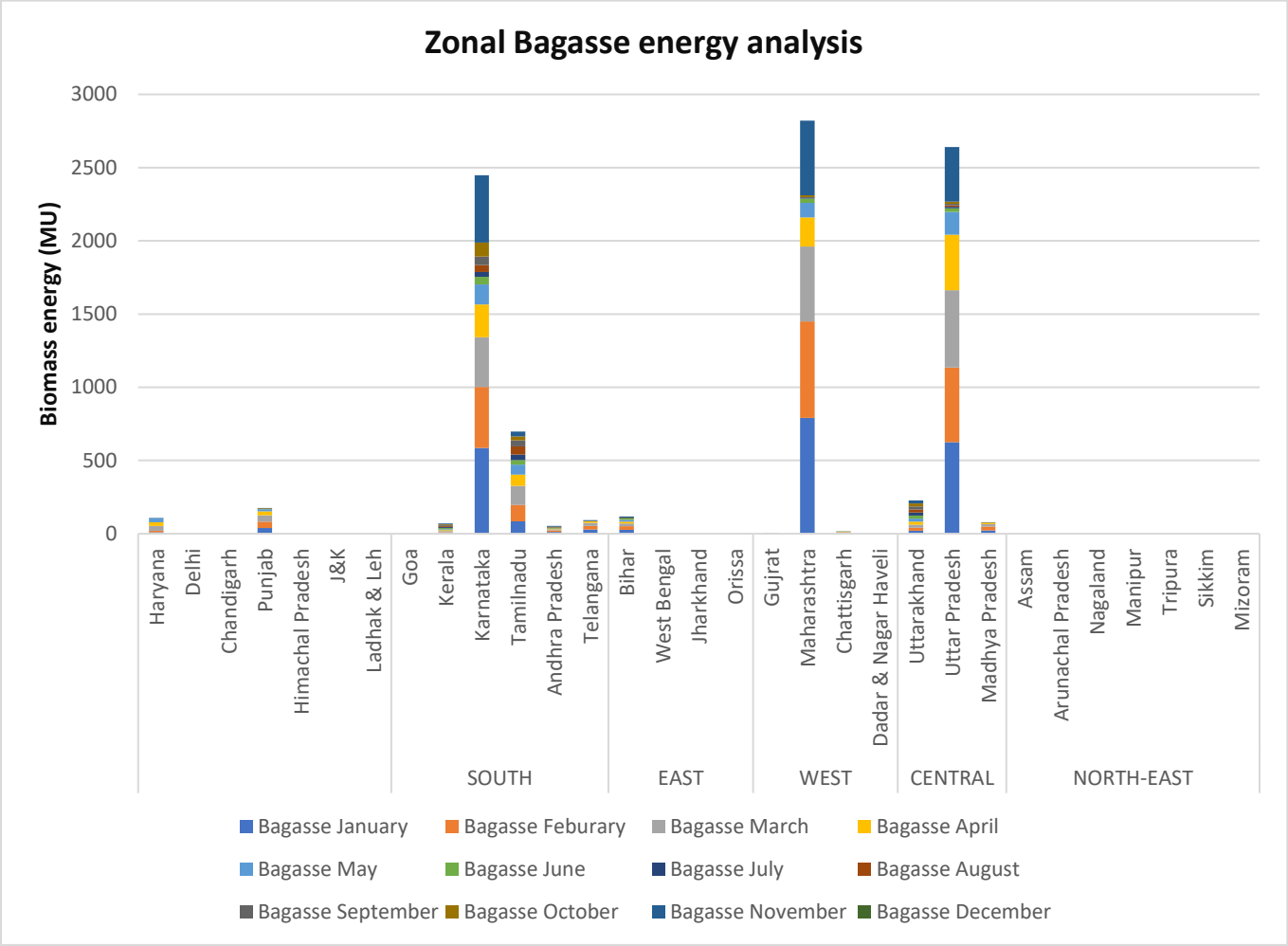
- **Focus on small-scale co-generation plants:** Recognizes limitations of large-scale projects, and encourages community-based and farmer-driven initiatives.
- **Dedicated Biomass Funds:** State initiatives like Uttar Pradesh's Biomass Energy Development Fund provide financial support for project development.

East Zone:

- **National Biomass Programme:** Zone Development Fund within the program specifically targets states with lower potential like Bihar.
- **Focus on research and development:** The government encourages initiatives to improve bagasse processing efficiency and utilization in the region.

Overall:

- Government schemes play a crucial role in shaping the bagasse power landscape across zones by offering financial incentives, streamlining clearances, and supporting infrastructure development.
- Zonal variations in policy design and focus reflect the differences in sugarcane production, infrastructure gaps, and investment levels.
- Moving forward, a combined approach with national frameworks and state-specific tailored schemes will be key to unlocking India's full bagasse power potential across all zones.



Analysis of biomass generation in India by zone:

- The South zone has the highest average monthly generation, with 10.75 MU. This is followed by the West zone with 7.46 MU, and the North zone with 5.49 MU. The East zone has the lowest average monthly generation, with 2.71 MU.
- Karnataka is the leading state in terms of biomass generation, with an average monthly generation of 10.74 MU. This is followed by Gujarat with 7.46 MU, and Maharashtra with 6.21 MU.
- The South zone is home to the three leading states in terms of biomass generation. Karnataka, Tamil Nadu, and Andhra Pradesh all have a large agricultural sector, which produces a significant amount of biomass waste.
- The West zone is also a major contributor to biomass generation in India. Gujarat, Maharashtra, and Chhattisgarh all have agricultural sectors and are taking steps to increase their biomass-based power capacity.
- The East zone has the lowest biomass generation. This is due to a combination of factors, including lower agricultural production, less developed infrastructure, and lower investment levels.

Key Insights:

- India has significant potential for biomass-based power generation. The country has a large agricultural sector, which produces a significant amount of biomass waste.
- The South zone is the leading region for biomass-based power generation in India. This is due to a combination of factors, including abundant agricultural production, favourable government policies, and strong private-sector investment.

The Bagasse energy production data across different Indian states and zones reveals varying trends and contributions. In the North zone, Haryana demonstrates intermittent yet noticeable Bagasse energy generation, showcasing sporadic but notable values across several months. Punjab also displays some Bagasse energy production, with intermittent figures varying across different months. Moving to the South zone, Karnataka emerges as a significant contributor to Bagasse energy, showing substantial production levels with fluctuations across the months. Tamil Nadu and Kerala exhibit moderate Bagasse energy generation, displaying varying yet noteworthy values. Andhra Pradesh and Telangana show modest Bagasse energy production with sporadic values in different months. Bihar in the East zone demonstrates intermittent Bagasse energy generation, with varying values across the months. In the Western zone, Maharashtra stands out as a notable contributor to Bagasse energy, showing substantial production levels with fluctuations. Chattisgarh and Gujarat exhibit sporadic Bagasse energy figures, with intermittent and relatively lower production levels. Uttar Pradesh and Madhya Pradesh in the Central zone present intermittent Bagasse energy generation, showcasing varying but noticeable contributions. Overall, the analysis indicates disparities in Bagasse energy generation among different states and zones, with some regions consistently demonstrating substantial contributions while others exhibit intermittent or lower production.

Recommendations:

- India should continue to invest in biomass-based power generation. This will help to reduce the country's reliance on fossil fuels and meet its renewable energy targets.
- The government should focus on developing biomass-based power in the East zone. This will help to reduce regional disparities and improve access to clean energy.
- The government should work with the private sector to develop innovative financing solutions for biomass-based power projects. This will help to make biomass-based power more affordable and accessible to all.

Zone-wise Analysis:

North Zone:

The North zone is home to some of India's largest agricultural states, including Uttar Pradesh, Punjab, and Haryana. However, biomass generation in this zone is relatively low compared to other regions. This is due to several factors, including:

- **Lower agricultural production:** The North zone has a relatively smaller agricultural crop than the South zone.
- **Less developed infrastructure:** The North zone has less developed infrastructure for transporting and processing biomass.
- **Lower investment levels:** The North zone has seen lower investment in biomass-based power plants than other regions.

South Zone:

The South Zone is the leading region for biomass-based power generation in India. This is due to several factors, including:

- **Abundant agricultural production:** The South zone has a large agricultural crop, which produces a significant amount of biomass waste.
- **Favourable government policies:** The government of India has provided several incentives for biomass-based power generation, including tax breaks and subsidies.
- **Strong private sector investment:** The private sector has invested heavily in biomass-based power plants in the South zone.

West Zone:

The West zone is also a major contributor to biomass generation in India. This is due to several factors, including:

- **Significant agricultural production:** The West zone has a significant agricultural crop, which produces a significant amount of biomass waste.
- **Developed infrastructure:** The West zone has developed infrastructure for transporting and processing biomass.
- **Growing investment:** Investment in biomass-based power plants is growing in the West zone.

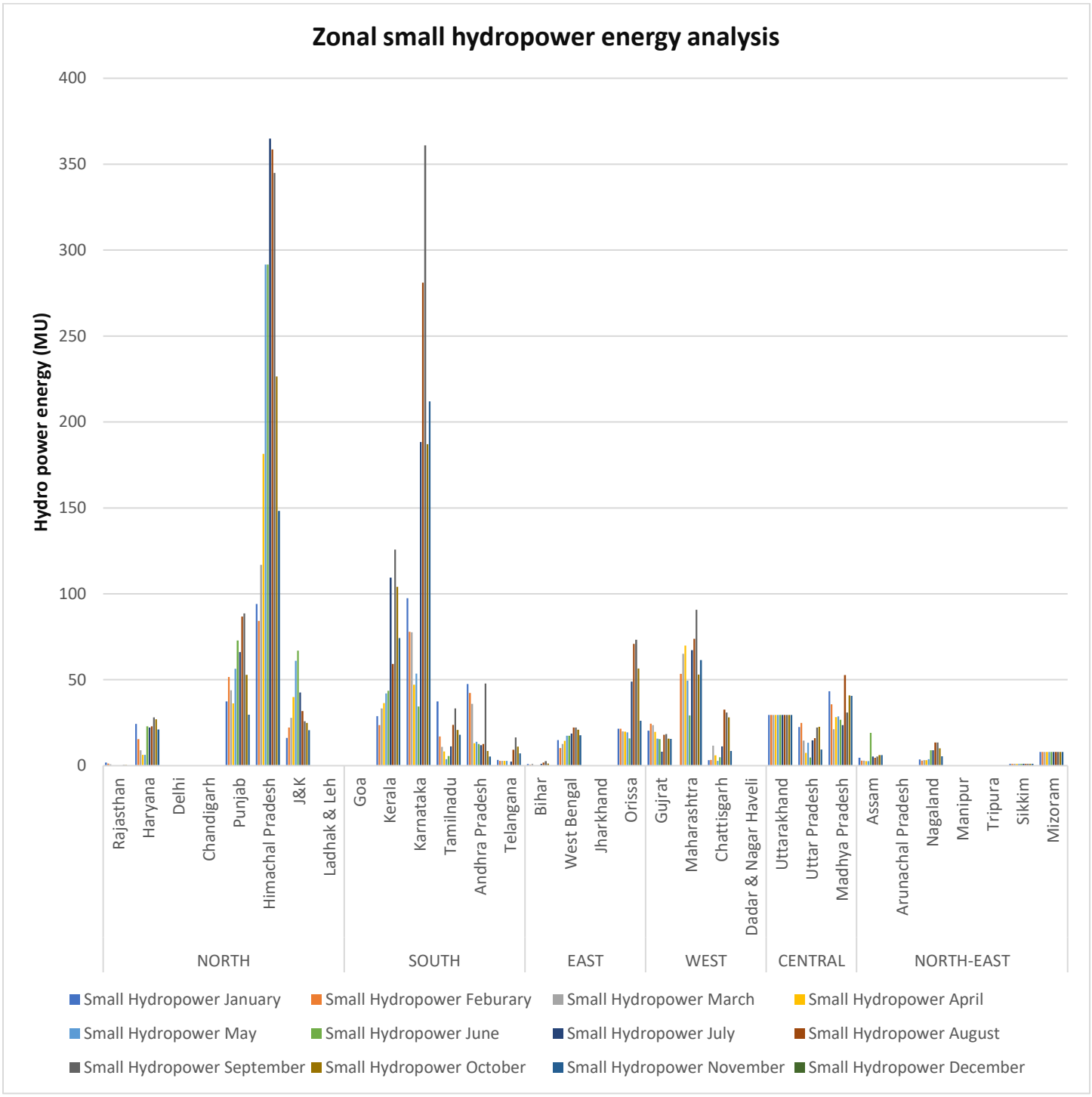
East Zone:

The East zone has the lowest biomass generation in India. This is due to several factors, including:

- **Lower agricultural production:** The East zone has a relatively smaller agricultural crop than other regions.
- **Less developed infrastructure:** The East zone has less developed infrastructure for transporting and processing biomass.
- **Lower investment levels:** The East zone has seen lower investment in biomass-based power plants than other regions.

Overall:

- Government schemes play a crucial role in shaping the biomass power landscape across zones by offering financial incentives, streamlining clearances, and supporting infrastructure development.
- Zonal variations in policy design and focus reflect the differences in agricultural production, infrastructure gaps, and investment levels.
- Moving forward, a combined approach with national frameworks and state-specific tailored schemes will be key to unlocking India's full biomass power potential across all zones.



Analysis of small hydropower generation in India by zone:

- The South zone has the highest average monthly generation, with 97.49 MU. This is followed by the West zone with 71.75 MU, and the North zone with 37.34 MU. The East zone has the lowest average monthly generation, with 4.63 MU.
- Karnataka is the leading state in terms of small hydropower generation, with an average monthly generation of 97.49 MU. This is followed by Gujarat with 71.75 MU, and Kerala with 28.84 MU.

- The South zone is home to the three leading states in terms of small hydropower generation. Karnataka, Kerala, and Tamil Nadu all have a significant mountainous terrain, which provides ideal conditions for small hydropower development.
- The West zone is also a major contributor to small hydropower generation in India. Gujarat, Maharashtra, and Chhattisgarh all have some mountainous terrain, and they have also invested in small hydropower development.
- The East zone has the lowest small hydropower generation. This is due to several factors, including a relatively flat terrain, lower investment levels, and a lack of government support.

Key Insights:

- India has significant potential for small hydropower generation. The country has a vast mountainous terrain that is well-suited for small hydropower development.
- The South zone is the leading region for small hydropower generation in India. This is due to a combination of factors, including abundant mountainous terrain, favourable government policies, and strong private-sector investment.
- The government should continue to support small hydropower development in India. This will help to reduce the country's reliance on fossil fuels and meet its renewable energy targets.

The Small Hydropower dataset displays the electricity generation from this renewable source across different Indian states and zones. In the North zone, Punjab, Himachal Pradesh, and Jammu & Kashmir exhibit significant Small Hydropower generation, with Himachal Pradesh consistently producing higher values, particularly during the summer months. Moving to the South zone, Karnataka and Kerala showcase substantial contributions, especially in Karnataka, displaying varying yet noteworthy figures across different months. Tamil Nadu and Andhra Pradesh also contribute moderately to Small Hydropower, though with fluctuating values. The East zone indicates significant Small Hydropower generation in West Bengal and Orissa, showcasing varying figures across different months. In the West zone, Maharashtra and Chattisgarh demonstrate noticeable but intermittent Small Hydropower production. Uttar Pradesh and Madhya Pradesh in the Central zone showcase intermittent Small Hydropower generation, displaying varying but noticeable contributions. Among the North-Eastern states, Assam, Nagaland, and Mizoram present moderate contributions to Small Hydropower generation, with fluctuating values across different months. Overall, the data highlights disparities in Small Hydropower generation among different states and zones, with some consistently demonstrating substantial contributions while others exhibit intermittent or lower production levels.

Zone-wise Analysis:

North Zone:

The North zone is home to some of India's highest mountains, including the Himalayas and the Hindu Kush. However, small hydropower generation in this zone is relatively low compared to other regions. This is due to several factors, including:

- **Lower investment levels:** The North zone has seen lower investment in small hydropower development than other regions.
- **Lack of government support:** The government has not provided as much support for small hydropower development in the North zone as in other regions.
- **Technical challenges:** Small hydropower projects in the North zone can be technically challenging to develop and operate.

South Zone:

The South zone is home to several mountain ranges, including the Western Ghats and the Eastern Ghats. This region has a long history of small hydropower development, and it is currently the leading region for small hydropower generation in India.

The South zone has several factors that are conducive to small hydropower development, including:

- **Abundant mountainous terrain:** The South zone has abundant mountainous terrain that is well-suited for small hydropower development.
- **Favourable government policies:** The government has provided strong support for small hydropower development in the South zone.
- **Strong private sector investment:** The private sector has invested heavily in small hydropower development in the South zone.

West Zone:

The West zone is home to the Western Ghats and the Aravalli ranges. This region has also seen significant investment in small hydropower development in recent years.

The West zone has several factors that are conducive to small hydropower development, including:

- **Abundant mountainous terrain:** The West zone has abundant mountainous terrain that is well-suited for small hydropower development.
- **Strong private sector investment:** The private sector has invested heavily in small hydropower development in the West zone.

East Zone:

The East zone is relatively flat, and it has a lower mountainous terrain than other regions. This is a major factor that contributes to the relatively low level of small hydropower generation in this zone.

The East zone has several factors that could support small hydropower development, including:

- **Abundant riverine resources:** The East zone has abundant riverine resources that could be used for small hydropower development.
- **Strong government support:** The government has recently announced plans to support small hydropower development in the East zone.

Overall:

- Small hydropower has the potential to play a significant role in India's renewable energy mix.
- The government should continue to support small hydropower development in all regions of India, particularly in the North and East zones.
- The government should also focus on addressing the technical challenges

ZONE-WISE GOVERNMENT SCHEMES:

South Zone:

- **Small Hydro Power Programme (SHP Programme):** Provides financial assistance and subsidies for project development, benefiting states like Karnataka, Kerala, and Tamil Nadu.
- **Kerala State Hydropower Policy 2019:** Streamlines clearances and offers attractive tariffs, leading to Kerala's impressive small hydropower growth.

West Zone:

- **Maharashtra State Hydropower Development Policy 2016:** Offers tax breaks and expedited clearances, driving Maharashtra's significant contribution.
- **Central Financial Assistance (CFA) for Grid-connected Small Hydro Projects:** Supports upfront infrastructure development, particularly beneficial for states like Maharashtra and Chhattisgarh.

North Zone:

- **Focus on Mini-Hydro and Micro-Hydro projects:** Acknowledges limited availability of large hydropower sites, and promotes community-driven smaller projects in the North.
- **Himachal Pradesh Mini-Hydro Development Policy 2015:** Offers attractive incentives and simplified clearances, contributing to Himachal Pradesh's leading position.

East Zone:

- **National Small Hydro Power Programme - Zone Development Fund:** Targets states with lower potential like Bihar and Odisha through dedicated funding.
- **Focus on Run-of-the-River projects:** Promotes low-impact projects suited for the East zone's terrain, minimizing environmental concerns.
- **Sikkim Renewable Energy Policy 2011:** Promotes small hydropower and other renewables, leading to Sikkim's progress in clean energy generation.

Overall:

- Government schemes play a key role in shaping small hydropower development by providing financial incentives, streamlining clearances, and supporting infrastructure development.
- Zonal variations in policy design and focus reflect differences in terrain, resource availability, and investment levels.
- A combined approach with national frameworks and state-specific tailored schemes will be crucial to unlock India's full small hydropower potential across all zones.

References:

- *https://mnre.gov.in/*
- *https://rpo.gov.in/*
- *https://pib.gov.in/PressReleseDetailm.aspx?PRID=1909269*
- *https://mnre.gov.in/mnre/wind/*
- *https://www.niti.gov.in/sites/default/files/2022-12/NEP-ID_27.06.2017.pdf.pdf*
- *https://www.cseindia.org/page/renewable-energy*
- *https://www.niti.gov.in/sites/default/files/2022-12/NEP-ID_27.06.2017.pdf.pdf*
- *https://www.teriin.org/*
- *https://www.thehindu.com/sci-tech/energy-and-environment/india-needs-223-billion-to-meet-2030-renewable-capacity-goals-report/article65552966.ece*
- *https://enterslice.com/learning/opportunities-and-challenges-for-indias-renewable-energy-sector/*
- *https://www.livemint.com/economy/data-recap-jobs-data-auto-sales-rupee-s-fall-11657206884086.html*
- *http://www.cercind.gov.in/*
- *https://www.irena.org/IRENADocuments/Statistical_Profiles/Asia/In*
- *https://blogs.worldbank.org/ppps/green-hydrogen-key-investment-energy-transition*
- *https://cleanenergyfinanceforum.com/*
- *https://dea.gov.in/*
- *https://mnre.gov.in/policies-and-regulations/schemes-and-guidelines/schemes/*
- *https://www.iea.org/reports/energy-technology-perspectives-2023*
- *https://energy.rajasthan.gov.in/content/raj/energy-department/rrecl/en/home.html*
- *https://www.marketscreener.com/quote/stock/POWER-GRID-CORPORATION-OF-9059859/news/Power-Grid-Corp-Wins-Bid-to-Establish-Inter-State-Power-Transmission-System-45655541/*
- *https://indiankanoon.org/doc/42572982/*
- *https://mnre.gov.in/*
- *https://geda.gujarat.gov.in/geda/2023/12/9/Policy/3157*
- *https://www.mahaurja.com/meda/en/policies*
- *https://hescom.karnataka.gov.in/storage/pdf-files/DSM/2point1%20GOK%20%20Solar%20Policy%202014%20*
- *https://cms.tn.gov.in/sites/default/files/documents/solar_energy_*
- *https://maruojas.in/solar-rooftop-subsidy-gujarat/*
- *https://www.mahadiscom.in/ismart/media/SoP%20Rooftop%20S*
- *https://mnre.gov.in/*
- *https://energy.rajasthan.gov.in/content/raj/energy-department/rrecl/en/home.html*