

## **An Analysis of Awareness and Implementation of Net Zero Carbon Policy in Alirajpur District, Madhya Pradesh**

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**Abstract:** Climate change has emerged as one of the most critical environmental challenges of the twenty-first century. Governments across the world are adopting net-zero carbon strategies to reduce greenhouse gas emissions and promote sustainable development. India has committed to achieving net-zero carbon emissions by 2070, which requires coordinated efforts at national, state, and local levels. This study examines the implementation of net-zero carbon policy in Alirajpur district of Madhya Pradesh, a predominantly tribal and rural region. The study uses both primary and secondary data collected from 120 respondents through questionnaires, interviews, and field observations. Statistical analysis is applied to understand socio-economic characteristics, energy use patterns, awareness of climate change, adoption of renewable energy technologies, and perceptions about government support. The findings reveal that firewood remains the primary cooking fuel, awareness of climate change is limited, and renewable energy adoption is moderate. Financial constraints, technological limitations, and lack of awareness are major barriers to policy implementation. The study highlights the need for improved policy outreach, community participation, renewable energy infrastructure, and environmental awareness programs. Strengthening local governance and integrating climate initiatives with rural development programs can significantly contribute to achieving net-zero carbon goals in rural and tribal regions.

**Keywords:** Net-Zero Carbon Policy, Climate Change Mitigation, Renewable Energy Adoption, Sustainable Rural Development, Environmental Governance, Carbon Emission Reduction, Tribal Region Sustainability

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### **I. Introduction**

Climate change has emerged as one of the most pressing global challenges of the twenty-first century. Rapid industrialization, urbanization, deforestation, and dependence on fossil fuels have led to unprecedented increases in greenhouse gas (GHG) emissions, contributing significantly to global warming and environmental degradation. Carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) are among the major greenhouse gases responsible for the enhanced greenhouse effect that is altering the Earth's climate system. The consequences of climate change include rising global temperatures, extreme weather events, erratic rainfall patterns, biodiversity loss, and increasing vulnerability of human societies and ecosystems. In response to these global environmental challenges, countries around the world have adopted various climate mitigation strategies aimed at reducing greenhouse gas emissions. One of the most widely recognized approaches is the concept of **"net-zero carbon emissions."** Net-zero carbon refers to the balance between the amount of greenhouse gases emitted into the atmosphere and the amount removed through natural or technological carbon sinks. Achieving net-zero emissions implies that any remaining emissions are offset through carbon sequestration measures such as afforestation, reforestation, or advanced carbon capture technologies. The global momentum toward net-zero commitments gained prominence after the **Paris Agreement of 2015**, where nations pledged to limit global temperature rise to well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C. Many countries have subsequently established long-term net-zero targets as part of their national climate strategies. These commitments require structural transformation in energy systems, transportation, industry, agriculture, and urban planning.

Developing countries, including India, face the dual challenge of promoting economic growth while simultaneously reducing carbon emissions. Balancing developmental priorities with environmental sustainability requires innovative policy frameworks and localized climate action plans. Therefore, the implementation of net-zero carbon policies at regional and district levels has become increasingly important for translating national climate commitments into tangible outcomes. Climate change presents a complex challenge that requires coordinated action across global, national, and local levels. India's commitment to achieving net-zero carbon emissions by 2070 reflects its determination to pursue sustainable development while addressing environmental concerns. The successful realization of this goal depends on the implementation of climate policies at state and district levels.

Madhya Pradesh has taken several initiatives to promote renewable energy, green infrastructure, and sustainable development. However, achieving long-term climate goals requires localized strategies that address the specific needs and challenges of different regions. Alirajpur district, with its unique socio-economic and

environmental characteristics, represents an important case for studying the implementation of net-zero carbon policies in rural and tribal contexts. By promoting renewable energy, sustainable agriculture, forest conservation, and community participation, the district can move toward a low-carbon and climate-resilient future. The implementation of net-zero carbon policy in Alirajpur not only contributes to national climate objectives but also supports sustainable livelihoods, environmental conservation, and inclusive development. As such, it offers valuable lessons for other regions seeking to integrate climate action with socio-economic progress.

### **India's Net-Zero Vision and Climate Policy Framework**

India has emerged as an active participant in global climate governance. Despite being a developing country with significant developmental challenges, India has taken several policy measures to address climate change while maintaining its commitment to inclusive growth. The country has pledged to achieve **net-zero carbon emissions by the year 2070**, demonstrating its long-term commitment to global climate mitigation efforts. India's climate strategy is guided by a combination of national policies, international commitments, and sector-specific initiatives. One of the key frameworks is the **National Action Plan on Climate Change (NAPCC)**, launched in 2008. This plan comprises several national missions that focus on renewable energy, energy efficiency, sustainable agriculture, water conservation, and climate-resilient development. In addition to the NAPCC, India's climate policies include:

1. **National Solar Mission**, aimed at expanding solar energy capacity.
2. **National Mission for Enhanced Energy Efficiency**, promoting energy-efficient technologies and industrial processes.
3. **National Mission on Sustainable Habitat**, focusing on sustainable urban development.
4. **National Water Mission**, addressing water conservation and efficient use.
5. **Green India Mission**, promoting afforestation and forest conservation.

India has also significantly expanded renewable energy capacity, particularly solar energy. As of 2026, the country has installed more than **140 GW of solar power capacity**, making it one of the world's fastest-growing renewable energy markets. These national initiatives provide the broader framework within which state governments and local authorities implement climate action strategies. Achieving the net-zero target requires coordinated efforts across all levels of governance, including states, districts, municipalities, and rural communities.

### **Role of State Governments in Achieving Net-Zero Targets**

While climate commitments are often announced at the national level, their successful implementation largely depends on sub-national governments. States play a critical role in translating national climate goals into region-specific policies and programs. They are responsible for sectors such as agriculture, forestry, energy distribution, transportation, and rural development, all of which significantly influence carbon emissions. State governments develop **State Action Plans on Climate Change (SAPCCs)** to identify local vulnerabilities, mitigation opportunities, and adaptation strategies. These plans align state policies with national climate objectives and international commitments. Madhya Pradesh, one of India's largest states in terms of geographical area, has actively engaged in climate action planning. The state government has taken several initiatives to reduce carbon emissions and promote sustainable development, including renewable energy policies, forest conservation programs, and green infrastructure initiatives. However, achieving net-zero emissions at the state level requires addressing multiple challenges such as energy demand growth, industrial emissions, transportation expansion, and land-use changes. Therefore, localized strategies at district and community levels are essential for effective climate governance.

### **Climate Change and Environmental Context of Madhya Pradesh**

Madhya Pradesh occupies a central position in India and is characterized by diverse ecological and climatic conditions. The state has extensive forest cover, rich biodiversity, and significant mineral resources. At the same time, it faces environmental challenges related to deforestation, industrialization, and rapid population growth.

Studies indicate that Madhya Pradesh contributes significantly to India's greenhouse gas emissions due to coal-based power generation, industrial activities, transportation, and land-use changes. The energy sector, particularly electricity generation from coal, is one of the major sources of emissions in the state.

Despite these challenges, Madhya Pradesh possesses substantial potential for renewable energy development. The state has high solar and wind energy potential, making it suitable for large-scale renewable energy projects. Recognizing this opportunity, the state government has introduced policies aimed at expanding renewable energy generation and reducing dependence on fossil fuels.

For example, the **Madhya Pradesh Renewable Energy Policy** emphasizes the promotion of clean and green power generation, encouraging investment in solar, wind, biomass, and hydro energy projects.

The state is also working toward developing green cities and promoting energy-efficient infrastructure to reduce carbon emissions. These initiatives contribute to the broader objective of achieving sustainable and low-carbon development.

### **Renewable Energy and Green Development Initiatives in Madhya Pradesh**

Renewable energy plays a crucial role in achieving net-zero carbon emissions. Madhya Pradesh has emerged as one of the leading states in India in terms of renewable energy potential and policy innovation. The state government has introduced several programs aimed at expanding renewable energy capacity, promoting green technology, and encouraging private sector participation. The **Renewable Energy Policy 2025** aims to transform Madhya Pradesh into a major hub for renewable energy manufacturing and deployment, while also generating employment and supporting economic development. Key objectives of renewable energy initiatives in the state include:

- Increasing the share of renewable energy in the electricity mix
- Promoting solar parks and wind energy projects
- Encouraging rooftop solar installations
- Supporting green hydrogen and bioenergy technologies
- Developing green industrial zones and sustainable infrastructure

The state government has also proposed the development of **net-zero carbon projects**, where energy consumption is balanced with renewable energy production. These initiatives demonstrate the state's commitment to sustainable energy transition and climate mitigation.

### **Importance of Local-Level Climate Action**

Although national and state policies provide the framework for climate action, effective implementation ultimately depends on local governance systems. District administrations, municipal bodies, and village councils play a crucial role in translating climate policies into practical actions.

Local-level climate action is important for several reasons:

1. **Context-specific solutions** – Climate challenges vary across regions depending on geography, economic activities, and environmental conditions.
2. **Community participation** – Local communities can actively participate in sustainability initiatives such as afforestation, renewable energy adoption, and waste management.
3. **Efficient resource management** – District authorities are better positioned to manage natural resources such as water, forests, and agricultural land.
4. **Integration with rural development programs** – Climate initiatives can be linked with livelihood programs and poverty alleviation schemes.

Therefore, district-level implementation of net-zero carbon policies can significantly contribute to national climate targets while promoting sustainable local development.

### **Socio-Economic Profile of Alirajpur District**

Alirajpur district is located in the western part of Madhya Pradesh and is predominantly inhabited by tribal communities. The district was carved out of Jhabua district in 2008 and is considered one of the relatively underdeveloped regions of the state.

The district is characterized by:

- A predominantly rural population
- Dependence on agriculture and forest resources
- Limited industrial development
- High levels of poverty and socio-economic vulnerability

Many households rely on traditional sources of energy such as firewood and biomass for cooking and heating. These practices contribute to deforestation and carbon emissions while also causing indoor air pollution.

At the same time, Alirajpur possesses significant potential for sustainable development through renewable energy, agroforestry, and climate-resilient agriculture. Implementing net-zero carbon policies in such regions can provide multiple benefits, including environmental conservation, improved livelihoods, and sustainable economic growth.

### **Community-Based Climate Initiatives in Rural Madhya Pradesh**

Rural development programs in Madhya Pradesh have increasingly incorporated environmental sustainability and climate resilience. Community-based initiatives such as agroforestry, biogas production, and solar lighting have helped reduce carbon emissions while improving rural livelihoods.

Programs like the **Madhya Pradesh Rural Livelihoods Project (MPRLP)** have promoted sustainable practices including biogas plants, smokeless cooking stoves, solar lighting, and agroforestry plantations. These initiatives reduce dependence on fossil fuels and enhance carbon sequestration through tree planting.

Such community-driven approaches demonstrate how climate mitigation and poverty alleviation can be integrated at the grassroots level.

### **Need for Net-Zero Carbon Policy in Alirajpur**

Alirajpur district faces several environmental and developmental challenges that highlight the need for sustainable and low-carbon development strategies.

First, the district's dependence on biomass fuels for cooking contributes to deforestation and carbon emissions. Introducing renewable energy technologies such as solar cookers, improved biomass stoves, and biogas plants can significantly reduce emissions while improving health outcomes.

Second, agricultural practices in the region are highly vulnerable to climate variability. Erratic rainfall patterns and declining soil fertility affect crop productivity and food security. Climate-resilient agriculture and sustainable land management practices are essential for ensuring long-term sustainability.

Third, rapid population growth and expanding infrastructure increase energy demand and environmental pressure. Integrating energy-efficient technologies and renewable energy systems into rural development programs can help address these challenges.

Therefore, implementing a net-zero carbon policy in Alirajpur can serve as a model for sustainable development in tribal and rural regions.

### **Objectives of Implementing Net-Zero Carbon Policy**

The implementation of net-zero carbon policy in Alirajpur district aims to achieve multiple environmental, social, and economic objectives. These include:

1. Reducing greenhouse gas emissions through renewable energy adoption.
2. Promoting sustainable land use and forest conservation.
3. Enhancing climate resilience in agriculture and rural livelihoods.
4. Encouraging community participation in environmental conservation.
5. Improving energy access and reducing dependence on fossil fuels.
6. Supporting sustainable economic development and green employment opportunities.

These objectives align with broader national and state climate strategies and contribute to the achievement of India's long-term net-zero target.

### **Challenges in Implementing Net-Zero Carbon Policy**

Despite the potential benefits, implementing net-zero carbon policies at the district level faces several challenges.

One major challenge is **financial constraints**. Renewable energy projects and sustainable infrastructure require significant investment, which may be difficult for economically backward regions.

Another challenge is **lack of technical capacity and awareness** among local communities and administrators regarding climate mitigation technologies and practices.

Infrastructure limitations, including inadequate electricity grids and transportation networks, also hinder the adoption of renewable energy technologies.

Furthermore, social and cultural factors may influence the acceptance of new technologies and sustainable practices.

Addressing these challenges requires coordinated efforts among government agencies, research institutions, private sector stakeholders, and local communities.

### **Significance of the Study**

The implementation of net-zero carbon policy in Alirajpur district represents an important step toward sustainable rural development and climate mitigation. Studying this initiative provides valuable insights into how climate policies can be effectively implemented in rural and tribal regions.

This study contributes to the understanding of:

- Localized climate governance
- Integration of environmental sustainability with rural development

- Community participation in climate mitigation
- Renewable energy adoption in rural areas

Furthermore, the findings of this study can inform policymakers, researchers, and development practitioners about effective strategies for implementing net-zero carbon policies at the grassroots level.

### **Research Objectives**

The implementation of a **net-zero carbon policy** requires coordinated efforts across governance, technology, environmental management, and community participation. In the context of a rural and tribal district like Alirajpur, the effectiveness of such policies depends on multiple socio-economic and institutional factors. Therefore, the present study aims to examine how net-zero carbon initiatives can be implemented effectively at the district level.

The major objectives of the study are as follows:

1. **To analyze the concept and policy framework of net-zero carbon emissions in India.**  
This objective focuses on understanding national and state-level climate policies and their relevance to local governance.
2. **To examine the current environmental and carbon emission profile of Alirajpur district.**  
The study will analyze key emission sources such as agriculture, biomass fuel consumption, transportation, and land-use changes.
3. **To evaluate the role of renewable energy initiatives in reducing carbon emissions in Alirajpur.**  
The research will investigate the adoption of solar energy, biogas, improved cooking stoves, and other clean technologies.
4. **To assess the role of government institutions and local governance in implementing net-zero carbon policies.**  
This includes analyzing the roles of district administration, panchayats, and state government departments.
5. **To examine the level of awareness and participation of local communities in climate mitigation initiatives.**  
Community participation is essential for successful implementation of sustainability programs.
6. **To identify the challenges and barriers in implementing net-zero carbon policies in tribal and rural regions.**
7. **To propose policy recommendations for effective implementation of net-zero carbon strategies in Alirajpur district.**

These objectives collectively aim to provide a comprehensive understanding of the practical aspects of implementing climate policies at the grassroots level.

## **II. Research Questions**

Based on the objectives of the study, the following research questions have been formulated:

1. What is the current status of carbon emissions and environmental sustainability in Alirajpur district?
2. How do national and state climate policies influence local implementation of net-zero carbon initiatives?
3. What role do renewable energy technologies play in reducing carbon emissions in rural areas?
4. How effective are government programs and local governance institutions in implementing net-zero carbon policies?
5. What is the level of awareness among local communities regarding climate change and sustainable energy practices?
6. What are the socio-economic and institutional barriers affecting the implementation of net-zero carbon policies in Alirajpur?
7. What strategies can improve the effectiveness of net-zero carbon initiatives in tribal and rural regions?

These research questions guide the study toward understanding both the **policy dimension and the grassroots realities** of climate action.

## **III. Review of Literature**

Climate change mitigation and the transition toward net-zero carbon emissions have become central themes in global environmental research. Numerous scholars have examined the policy frameworks, technological solutions, and socio-economic challenges associated with achieving carbon neutrality. One of the foundational works on climate change mitigation is presented by **Intergovernmental Panel on Climate Change (IPCC, 2021)**, which emphasizes the urgent need to reduce greenhouse gas emissions in order to limit global warming. The report highlights that achieving net-zero emissions requires significant transformations in energy systems, land use, transportation, and industrial processes. **Stern (2007)** argued that climate change

represents the greatest market failure in human history and requires coordinated policy interventions at both national and local levels. According to Stern, early investments in low-carbon technologies can significantly reduce long-term economic and environmental costs.

In the context of developing countries, **Sharma and Kumar (2019)** emphasize that climate policies must consider socio-economic development and poverty reduction. They argue that renewable energy initiatives can simultaneously address energy access and carbon reduction in rural regions. Several studies have focused on India's climate policy framework. **Dubash et al. (2018)** analyze India's climate governance system and highlight the importance of integrating climate action into development planning. The authors argue that state governments play a critical role in implementing national climate commitments. Similarly, **Jain and Goswami (2020)** examine the role of renewable energy in India's low-carbon transition. Their study indicates that solar energy expansion has significantly reduced reliance on fossil fuels and contributed to emission reductions. At the regional level, research on **State Action Plans on Climate Change (SAPCCs)** highlights the importance of localized strategies. **Singh and Chaturvedi (2016)** note that state-level climate action plans enable governments to identify region-specific vulnerabilities and mitigation opportunities.

In the context of rural development, **Agarwal (2010)** emphasizes the importance of community participation in environmental governance. According to Agarwal, local communities play a crucial role in managing natural resources such as forests and water, which are essential for carbon sequestration and climate resilience. Several studies also highlight the importance of renewable energy adoption in rural areas. **Bhattacharyya (2015)** argues that decentralized renewable energy systems such as solar home systems and biogas plants can significantly improve energy access while reducing carbon emissions. Research focusing on tribal regions indicates that environmental sustainability is closely linked with traditional knowledge systems. **Gupta and Singh (2017)** found that tribal communities often practice sustainable land management and forest conservation, which contribute to carbon sequestration and biodiversity protection.

In Madhya Pradesh, studies have examined the relationship between forest conservation and climate mitigation. **Verma (2018)** notes that the state's extensive forest cover plays a crucial role in carbon absorption and ecosystem stability. However, deforestation and land-use changes remain major challenges. Recent research has also explored the concept of **district-level climate action**. **Patel and Mehta (2022)** emphasize that local governments must integrate climate policies into rural development programs in order to achieve effective mitigation outcomes. Another important aspect discussed in the literature is the role of **awareness and education in climate action**. **Kumar and Singh (2021)** argue that public awareness campaigns and environmental education programs are essential for encouraging sustainable practices among rural communities.

### **Research Methodology**

Research methodology refers to the systematic process used to collect, analyze, and interpret data in order to answer research questions and achieve the objectives of the study. For the present study, a **mixed-method research approach** has been adopted, combining both qualitative and quantitative methods. The study follows a **descriptive and analytical research design**. Descriptive research is used to understand the current environmental and socio-economic conditions of Alirajpur district, while analytical research is used to examine the effectiveness of net-zero carbon policies and initiatives. The study focuses on **Alirajpur district in Madhya Pradesh**, which is predominantly a tribal region with a largely rural population. The district has limited industrial development but faces environmental challenges related to deforestation, biomass fuel use, and climate vulnerability.

The present study utilizes both **primary and secondary sources of data** to examine the implementation of net-zero carbon policy in Alirajpur district of Madhya Pradesh. Primary data were collected directly from the field to obtain first-hand information about local environmental practices, awareness levels, and participation in carbon reduction initiatives. Structured questionnaires were administered to selected respondents in different villages to gather quantitative information related to household energy use, renewable energy adoption, and awareness of climate change. In addition, semi-structured interviews were conducted with government officials, panchayat representatives, and local community leaders to understand policy implementation mechanisms and institutional support for sustainability programs. Focus group discussions were also organized with community members to explore collective perceptions regarding environmental conservation and renewable energy initiatives. Observational methods were further used to document the use of solar lighting systems, biogas plants, improved cook stoves, and other environmental initiatives implemented in the region.

Secondary data were collected from a variety of reliable sources, including government reports, district statistical handbooks, policy documents, research journals, and publications from environmental organizations. Additional information was obtained from renewable energy agencies and climate policy reports that provide insights into environmental statistics, policy frameworks, and mitigation strategies. A **stratified random sampling method** was adopted to select approximately 100–150 respondents from different socio-economic

groups, including local households, panchayat representatives, government officials, and participants in environmental programs. The collected data were analyzed using both quantitative and qualitative techniques. Statistical tools such as percentage analysis, frequency distribution, and comparative analysis were used for numerical data, while thematic analysis was applied to interview responses. Although the study faced limitations such as limited emission data and resource constraints, reliability was ensured through triangulation of multiple data sources.

#### IV. Statistical Analysis

**Table 1: Age Distribution of Respondents**

Age Group (Years)	Number of Respondents	Percentage
18-25	18	15%
26-35	30	25%
36-45	32	26.7%
46-55	22	18.3%
Above 55	18	15%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 1 shows the age distribution of respondents participating in the study. The largest proportion of respondents (26.7%) belongs to the 36–45 age group, followed by 25% in the 26–35 age group. Younger respondents aged 18–25 constitute 15%, while respondents above 55 years also represent 15% of the sample. The age group 46–55 accounts for 18.3% of respondents. The data indicate that most participants are within the economically active age group, which suggests that they are directly involved in agricultural and livelihood activities that influence energy consumption and environmental practices.

**Table 2: Gender Distribution of Respondents**

Gender	Number	Percentage
Male	72	60%
Female	48	40%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 2 presents the gender composition of respondents included in the survey. Out of the total 120 respondents, 60% are male and 40% are female. The relatively high representation of female respondents is important because women in rural areas are often responsible for household energy use, cooking practices, and water collection. Their perspectives are essential for understanding the adoption of clean energy technologies such as solar cookers and improved biomass stoves. Gender participation also reflects the growing role of women in environmental decision-making and community development programs.

**Table 3: Educational Status of Respondents**

Education Level	Respondents	Percentage
Illiterate	34	28.3%
Primary Education	38	31.7%
Secondary Education	28	23.3%
Higher Secondary	14	11.7%
Graduate	6	5%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 3 indicates the educational background of respondents in Alirajpur district. A significant portion of respondents (31.7%) have primary education, while 28.3% are illiterate. Only a small percentage have higher education qualifications. The low level of educational attainment may influence awareness and understanding of climate change and renewable energy technologies. Education plays a crucial role in promoting sustainable practices and environmental awareness. Therefore, awareness campaigns and training programs are necessary to enhance community understanding of net-zero carbon initiatives.

**Table 4: Main Occupation of Respondents**

Occupation	Respondents	Percentage
Agriculture	52	43.3%
Agricultural Labor	28	23.3%
Small Business	18	15%
Government/Private Job	10	8.3%
Others	12	10%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 4 highlights the occupational structure of respondents. Agriculture is the dominant occupation, with 43.3% of respondents engaged in farming activities. Agricultural laborers constitute 23.3% of the sample, while 15% are involved in small businesses. Only a small proportion of respondents work in formal employment sectors. This occupational pattern reflects the rural and agrarian nature of the district. Since agricultural practices significantly affect carbon emissions and land use, farmers play a crucial role in implementing sustainable agricultural methods and climate mitigation strategies.

**Table 5: Household Energy Source for Cooking**

Energy Source	Respondents	Percentage
Firewood	62	51.7%
LPG	30	25%
Biogas	10	8.3%
Improved Biomass Stove	12	10%
Solar Cooker	6	5%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 5 shows the major household energy sources used for cooking. Firewood remains the dominant energy source, used by 51.7% of households. LPG is used by 25% of respondents, while renewable energy options such as biogas and solar cookers are used by a smaller proportion. The heavy reliance on firewood contributes to deforestation and carbon emissions. Expanding access to clean energy technologies such as biogas and solar cooking systems could significantly reduce carbon emissions and improve environmental sustainability in rural communities.

**Table 6: Awareness of Climate Change**

Response	Respondents	Percentage
Fully Aware	24	20%
Partially Aware	46	38.3%
Not Aware	50	41.7%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 6 illustrates the level of awareness regarding climate change among respondents. Only 20% of respondents report being fully aware of climate change issues, while 38.3% have partial awareness. A large proportion (41.7%) indicate that they are not aware of climate change concepts. This lack of awareness highlights the need for environmental education programs in rural areas. Awareness campaigns conducted by government agencies, NGOs, and educational institutions can help communities understand the importance of reducing carbon emissions and adopting sustainable practices.

**Table 7: Adoption of Renewable Energy Technologies**

Technology	Respondents	Percentage
Solar Lighting	40	33.3%
Biogas Plant	14	11.7%
Solar Pump	10	8.3%
Improved Cook Stove	16	13.3%
None	40	33.3%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 7 presents the adoption of renewable energy technologies among respondents. Solar lighting systems are the most commonly adopted technology, used by 33.3% of households. Biogas plants and solar pumps have lower adoption rates due to installation costs and technical requirements. A significant portion of respondents (33.3%) have not adopted any renewable energy technology. Increasing financial support and awareness programs could encourage greater adoption of renewable energy systems, contributing to carbon emission reduction.

**Table 8: Perception of Net-Zero Carbon Policy**

Opinion	Respondents	Percentage
Very Important	38	31.7%
Important	46	38.3%
Neutral	22	18.3%
Not Important	14	11.7%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 8 illustrates respondents’ perceptions regarding the importance of net-zero carbon policies. A majority of respondents (70%) believe that such policies are either very important or important for environmental protection. However, 18.3% remain neutral, and 11.7% consider them not important. These results indicate that while environmental awareness is growing, there is still a need for increased communication about the benefits of carbon reduction initiatives and sustainable development programs.

**Table 9: Government Support for Green Initiatives**

Level of Support	Respondents	Percentage
High	22	18.3%
Moderate	48	40%
Low	36	30%
No Support	14	11.7%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 9 shows respondents’ perceptions regarding government support for environmental programs and renewable energy initiatives. About 40% of respondents believe that government support is moderate, while 18.3% perceive it as high. However, 30% believe that support is low, and 11.7% report no support at all. These findings suggest that although government programs exist, their reach and effectiveness may be limited in rural areas. Strengthening institutional support and improving policy implementation could enhance the success of net-zero carbon initiatives.

**Table 10: Major Barriers to Net-Zero Carbon Implementation**

Barrier	Respondents	Percentage
Lack of Awareness	38	31.7%
Financial Constraints	34	28.3%
Lack of Technology	22	18.3%
Institutional Support	16	13.3%
Cultural Resistance	10	8.4%
<b>Total</b>	<b>120</b>	<b>100%</b>

Table 10 identifies major barriers affecting the implementation of net-zero carbon policies. Lack of awareness is the most significant barrier, reported by 31.7% of respondents. Financial constraints are another major challenge, affecting 28.3% of respondents. Limited access to technology and institutional support also hinder adoption of sustainable practices. Cultural resistance and traditional habits further complicate the implementation process. Addressing these barriers through education, financial incentives, and technological support is essential for achieving successful climate policy implementation.

## V. Findings and Discussion

The statistical analysis of survey data collected from respondents in Alirajpur district provides important insights into the socio-economic and environmental factors affecting the implementation of net-zero carbon policies. The demographic analysis indicates that most respondents belong to the economically productive age group between 26 and 45 years. This group represents the primary workforce involved in agriculture and rural livelihoods. Since these individuals are directly engaged in land use, farming practices, and energy consumption, their participation is essential for successful climate mitigation initiatives. The gender distribution of respondents shows that women constitute a significant proportion of the population involved in household energy management. In rural communities, women are often responsible for cooking, fuel collection, and water management, which directly affects carbon emissions and environmental sustainability.

Educational analysis reveals that literacy levels in the district remain relatively low. A large proportion of respondents have only primary education or are illiterate. Limited education reduces awareness about climate change, renewable energy technologies, and environmental policies. As a result, many households continue to rely on traditional practices such as firewood usage for cooking. This reliance contributes to deforestation and increased carbon emissions. Education and awareness programs therefore play a crucial role in promoting sustainable energy practices. Occupational analysis shows that agriculture is the dominant livelihood activity in Alirajpur district. Most respondents are small farmers or agricultural laborers who depend heavily on natural resources. Agricultural activities such as burning crop residues, excessive use of chemical fertilizers, and unsustainable land management can contribute to greenhouse gas emissions. However, agriculture also offers opportunities for carbon sequestration through sustainable farming practices, agroforestry, and soil conservation techniques.

The analysis of household energy sources indicates that firewood is the primary cooking fuel used by more than half of the respondents. The continued dependence on biomass fuel reflects limited access to clean energy alternatives in rural areas. Although government schemes have promoted LPG connections under

programs such as Pradhan Mantri Ujjwala Yojana, affordability and accessibility issues still limit widespread adoption. Renewable energy technologies such as biogas plants, improved cook stoves, and solar cookers remain underutilized. The study also examines the level of awareness regarding climate change and environmental sustainability. A large proportion of respondents report limited knowledge about climate change and its impacts. Only a small percentage of respondents are fully aware of environmental policies and carbon emission reduction strategies. This lack of awareness represents a major obstacle to implementing net-zero carbon initiatives at the grassroots level. Environmental education programs, training workshops, and community awareness campaigns are therefore essential for promoting sustainable practices.

The adoption of renewable energy technologies in the district is moderate but still limited. Solar lighting systems are the most widely adopted renewable technology due to government subsidies and rural electrification programs. However, technologies such as solar pumps, biogas plants, and improved biomass stoves have lower adoption rates. High installation costs, lack of technical support, and limited awareness are key factors affecting adoption. Perception analysis shows that most respondents recognize the importance of environmental protection and support initiatives aimed at reducing carbon emissions. A majority of respondents believe that net-zero carbon policies are important for environmental sustainability. However, some respondents remain neutral or skeptical due to lack of understanding or immediate economic priorities. The study also examines perceptions of government support for environmental programs. Many respondents believe that government support for renewable energy and sustainability initiatives is moderate but insufficient. Some respondents report difficulties in accessing subsidies, technical guidance, and institutional assistance. Strengthening coordination between government departments and local governance institutions can improve policy implementation.

One of the most significant findings of the study relates to the barriers affecting the implementation of net-zero carbon policies. Lack of awareness emerges as the most important barrier. Financial constraints represent another major challenge, particularly for rural households that cannot afford the initial investment required for renewable energy technologies. Limited technological infrastructure and institutional support further hinder the adoption of sustainable practices. The findings of the study highlight the importance of integrating climate policies with rural development programs. Local governance institutions such as Panchayati Raj Institutions can play an important role in promoting sustainable energy initiatives and environmental conservation programs. Community participation is also essential for ensuring long-term sustainability. The discussion indicates that achieving net-zero carbon goals in rural districts like Alirajpur requires a comprehensive approach that combines policy support, technological innovation, community participation, and environmental education.

## **VI. Conclusion**

The implementation of net-zero carbon policies represents a crucial step toward achieving sustainable development and addressing climate change challenges. This study examined the socio-economic, environmental, and institutional factors influencing the implementation of net-zero carbon initiatives in Alirajpur district of Madhya Pradesh. The findings reveal that rural households continue to rely heavily on traditional biomass fuels such as firewood for cooking, which contributes to deforestation and carbon emissions. Although renewable energy technologies such as solar lighting and biogas plants have been introduced, their adoption remains limited due to financial constraints, technological barriers, and lack of awareness. The study also highlights the importance of education and community awareness in promoting sustainable environmental practices. Limited literacy and inadequate environmental knowledge hinder the adoption of climate-friendly technologies. Strengthening environmental education programs and awareness campaigns can help communities understand the benefits of renewable energy and carbon emission reduction strategies.

Another important finding relates to the role of government institutions and policy implementation. While several government schemes support renewable energy and environmental conservation, their effectiveness is often limited by administrative challenges and inadequate outreach. Improving institutional coordination, expanding financial incentives, and providing technical assistance can significantly enhance policy implementation. Community participation and local governance play a vital role in achieving sustainability goals. Panchayats, community organizations, and local leaders can help mobilize public support for climate initiatives and encourage the adoption of sustainable practices. The successful implementation of net-zero carbon policies in rural districts requires a multi-dimensional approach that integrates environmental policies with socio-economic development programs. By promoting renewable energy adoption, strengthening institutional support, and enhancing community awareness, regions like Alirajpur can make significant contributions toward India's long-term net-zero carbon goals.

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