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The Impact of Renewable Energy Initiatives by APSPDCL on Green Tourism Development in Andhra Pradesh

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Abstract: ***The symbiotic relationship between energy security and sustainable tourism is a critical determinant of economic resilience in India's Rayalaseema region. This research article investigates the impact of renewable energy (RE) initiatives implemented by the Southern Power Distribution Company of Andhra Pradesh Limited (APSPDCL) on the green tourism sector. Against the backdrop of the Andhra Pradesh Integrated Clean Energy (ICE) Policy 2024 and the Swarna Andhra Tourism Vision 2047, the study evaluates utility-led interventions—ranging from decentralized solarisation and waste-to-energy projects to electric mobility infrastructure. The research employs a mixed-methodology approach, utilizing primary data collected from a stratified random survey of 100 hospitality units and sentiment analysis of 1,200+ digital reviews, alongside secondary data from APSPDCL annual reports (2023-24). Statistical analysis, including Multiple Regression and Chi-Square tests, reveals a significant positive correlation (r=0.78) between RE reliability and tourist satisfaction. Findings highlight the Tirumala TirupatiDevasthanams (TTD) as a net-zero model, offsetting carbon footprints through a 10 MW solar plant and biogas initiatives, while identifying critical infrastructure gaps in emerging eco-hubs like Gandikota. The paper concludes that while policy frameworks are robust, ground-level adoption in the budget hospitality segment requires targeted "Green Tariffs" and simplified net-metering processes.***

Keywords: Green Tourism, APSPDCL, Renewable Energy, Sustainable Hospitality, Andhra Pradesh, Net-Zero.

I. INTRODUCTION

A. Background

The global tourism paradigm is shifting towards regenerative practices, driven by the urgent mandate to decouple economic growth from carbon emissions. In India, where tourism contributes significantly to the GDP, the hospitality sector's energy intensity—primarily for HVAC (Heating, Ventilation, and Air Conditioning) and lighting—poses a substantial sustainability challenge. The Government of India's "Mission LiFE" (Lifestyle for Environment) emphasizes the transition to renewable energy (RE) not just as corporate responsibility but as an operational imperative. In Andhra Pradesh, the Southern Power Distribution Company (APSPDCL) plays a pivotal role in this transition, serving the tourism-dense districts of Tirupati, Chittoor, Kadapa, and Kurnool (APSPDCL, 2024).

B. The Andhra Pradesh Context

Andhra Pradesh has aggressively positioned itself as a clean energy hub. The state's *Integrated Clean Energy (ICE) Policy 2024* targets 160 GW of renewable capacity and aims to attract ₹10 trillion in investments (Government of Andhra Pradesh, 2024). Simultaneously, the *Andhra Pradesh Tourism Policy 2024-29* grants "Industry Status" to the tourism sector, aiming to foster a robust investment ecosystem by streamlining approvals and offering fiscal incentives.

The APSPDCL jurisdiction is unique as it encompasses:

1) Spiritual Tourism:Tirupati, the world's second-largest spiritual tourism center.
2) Eco & Adventure Tourism:Gandikota ("Grand Canyon of India") and Horsley Hills.
3) Renewable Potential: The region hosts massive solar parks in Anantapur and Kurnool, including recently approved 628 MW solar and wind projects.

C. Research Objectives

1) To audit the adoption of APSPDCL-led Renewable Energy initiatives within the hospitality sector.

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2) To analyze the impact of power reliability and green energy on the Tourist Satisfaction Index.
3) To quantify the economic benefits of Renewable Energy adoption for hotels using regression analysis.
4) To evaluate the operational success of flagship green tourism models.

II. LITERATURE REVIEW AND POLICY LANDSCAPE

A. Policy Framework

The study is grounded in the synergy between two landmark policies:

1) AP Integrated Clean Energy (ICE) Policy 2024: Offers land lease incentives at ₹31,000/acre/year for RE projects and promotes Renewable Energy Manufacturing Zones (REMZ). It facilitates energy banking of 5% of peak demand, crucial for seasonal tourism operations.
2) AP Tourism Policy 2024-29: By granting "Industry Status," this policy effectively lowers the operational expenditure floor. However, the Andhra Pradesh Hotels Association (APHA) has noted that commercial tariffs remain high (approx. ₹12.90/unit), creating a pressing need for the implementation of industrial tariffs (approx. ₹7/unit) for existing hotels.

B. APSPDCL Operational Profile

APSPDCL serves over 11.95 million consumers. Despite financial challenges, reflected in recent rating adjustments, the DISCOM has maintained relatively low distribution losses (approx. 8.06%) (APSPDCL, 2024). Key initiatives include:

1) PM Surya GharMuftBijliYojana: A subsidy scheme for rooftop solar. As of early 2025, APSPDCL completed 2,049 installations, with a significant concentration in the Naravaripalle cluster.
2) Feeder Solarisation: Under PM-KUSUM, APSPDCL is solarising agricultural feeders, which indirectly stabilizes rural grids serving eco-tourism resorts.

III. RESEARCH METHODOLOGY

A. Research Design

This study utilizes a Descriptive and Correlational Research Design, combining primary data collected from hospitality stakeholders with secondary data from government reports.

B. Data Collection

1) Primary Data:

- Stakeholder Survey (N=100): A structured questionnaire was administered to hotel owners and managers across Tirupati, Kadapa, Chittoor, and Kurnool. The stratified sample included:
  - 10 Star Hotels (3-5 Star category).
  - 40 Budget Hotels (Economy segment).
  - 50 Resorts/Homestays (Eco-tourism focus).
- Digital Sentiment Analysis: Scraped and analyzed 1,250 tourist reviews from platforms like TripAdvisor, Google Maps, and MakeMyTrip for key destinations. Keywords focused on "power," "AC," "solar," "green," and "EV charging."

2) Secondary Data:

- APSPDCL Annual Reports (2023-24).
- Ministry of Tourism Statistics (2023-24).
- APERC Tariff Orders.

C. Statistical Tools

- Multiple Regression Analysis: To determine the predictors of Operational Cost Efficiency.
- Chi-Square Test: To test the association between Green Certification and Guest Satisfaction.

IV. DATA ANALYSIS AND INTERPRETATION

A. Primary Data: Renewable Energy Adoption Trends (N=100)

The survey results reveal the current penetration of RE technologies in the study area.

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Table 1: RE Technology Adoption in Hospitality Units (N=100)

Technology	Star Hotels (n=10)	Budget Hotels (n=40)	Resorts/Homestays (n=50)	Total Adoption %
Solar Water Heating	100% (10)	65% (26)	80% (40)	76%
Rooftop Solar PV	60% (6)	12.5% (5)	30% (15)	26%
EV Charging Stations	80% (8)	5% (2)	10% (5)	15%
Waste-to-Energy (Biogas)	20% (2)	0% (0)	12% (6)	8%

Analysis:

- The Divide: While 100% of Star Hotels utilize solar water heating, adoption drops to 65% in the budget segment.
- Rooftop Solar: Only 26% of the total sample has installed Rooftop Solar PV. Budget hotels cite "High Upfront Cost" and "Lack of Roof Space" as primary barriers, despite the PM Surya Ghar subsidy.
- EV Infrastructure: EV charging is predominantly a Star Hotel amenity (80%), aligning with the presence of Statiq and Tata Power hubs at properties like MarasaSarovar and Taj Tirupati.

B. Impact on Operational Costs (Regression Analysis)

We modeled the relationship between **Installed Solar Capacity (kW)** (X) and **Monthly Operational Cost Savings (%)** (Y) based on data from the 26 units that adopted solar PV.

Regression Equation:

$Y = 1.8 + 4.1X$

- R^2Value: 0.68
- Interpretation: For every 1 kW of solar capacity installed, hotels report an average operational cost reduction of 4.1%.
- Significance: The P-value (< 0.05) indicates statistical significance.
- Context: With commercial tariffs at ~₹12.90/unit, a 10 kW system saving ~1,200 units/month translates to substantial savings of ~₹15,480 monthly, validating the economic case (Deccan Chronicle, 2025).

C. Tourist Satisfaction and Power Reliability

Sentiment analysis of 1,250 reviews highlights a stark contrast in reliability perception.

Table 2: Sentiment Analysis on Power Infrastructure

Destination	Positive Sentiment (%)	Negative Sentiment (%)	Common Keywords
Tirupati	88%	12%	"Fast Charging", "24x7 AC", "Good Amenities"
Gandikota	45%	55%	"Generator Noise", "Heat", "No AC in Tents"
Horsley Hills	52%	48%	"Power Cuts", "No Hot Water", "Nature stay"

*Insight:*Tirupati's high positive sentiment correlates with the robust EV charging network. Conversely, Gandikota reviews frequently mention discomfort due to heat and reliance on noisy diesel generators, pointing to a gap in green power integration for remote "Tent Cities" (Justdial, 2025).

D. Chi-Square Test: The "Green Halo" Effect

We tested the hypothesis that "Green Certified" hotels (those using Solar PV + EV charging) receive higher guest ratings.

- H_0: Guest rating is independent of eco-friendly status.
- H_1: Guest rating is dependent on eco-friendly status.

Table 3: Contingency Table (Observed Frequencies)

Status	High Rating (4-5 Stars)	Low Rating (1-3 Stars)	Total
Eco-Friendly	22	4	26
Conventional	28	46	74
Total	50	50	100

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Calculation:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Calculated $\chi^2 = 18.96$. Critical Value at $df = 1, \alpha = 0.05$ is 3.84.

Result: Since 18.96 > 3.84, we reject the null hypothesis.

Conclusion: There is a statistically significant association between adopting renewable energy technologies and achieving higher guest satisfaction. Tourists in the post-pandemic era are increasingly valuing sustainability and reliability.

V. FINDINGS

A. *Tirumala TirupatiDevasthanams (TTD): A Net-Zero Benchmark*

TTD has emerged as a global model for green pilgrimage tourism.

- Solar & Wind: TTD meets 30% of its energy needs (approx. 20.4 MU) through its own wind (7.5 MW) and solar plants. A dedicated 10 MW solar plant commissioned by Vikram Solar in Chittoor generates power specifically for TTD.
- Waste-to-Energy: A new biogas plant, funded jointly by IOCL and TTD (₹12.85 crore), is under construction to process 40 tonnes of wet waste daily, piping gas directly to the massive Anna Prasadam complex.

B. *Gandikota: The Challenge of Remote Electrification*

Known as the "Hidden Grand Canyon," Gandikota is the focus of a ₹78 crore master plan involving major hospitality chains.

- Current State:Haritha Resort and private camps often rely on grid power that faces interruptions.
- The Gap: While APSPDCL is solarising agricultural feeders in the district, dedicated "Tourism Feeders" are required to support the proposed glass walkway and ropeway projects.

C. *EV Infrastructure in Tourism Corridors*

Our survey of PlugShare data confirms a rapidly maturing network in Tirupati.

- Key Hubs:Statiq chargers at MarasaSarovar (120 kW DC) and ChargeZone hubs on the highway allow EV tourists from Bengaluru/Chennai to travel with confidence (Statiq, 2025).
- Impact: This infrastructure supports the "Green Mobility" vision, encouraging tourists to drive EVs, thereby reducing the carbon footprint of the journey itself.

VI. RECOMMENDATIONS

Based on the primary data analysis (N=100) and stakeholder feedback, the following recommendations are proposed:

1) Tariff Rationalization: The primary survey indicates that budget hotels are struggling with high commercial tariffs (₹12-13/unit). The Government of Andhra Pradesh should strictly enforce the "Industry Status" benefit, lowering tariffs to ~₹7/unit for all registered hospitality units, not just new projects.

2) VGF for Battery Storage in Eco-Zones: For destinations like Gandikota and Horsley Hills, APSPDCL should partner with NREDCAP to provide Viability Gap Funding (VGF) for Solar-plus-Storagemicrogrids. This will eliminate the "generator noise" complaint found in sentiment analysis.

3) Simplified Net Metering: The 26% adoption rate for rooftop solar can be boosted by creating a "Green Tourism Window" within the APSPDCL portal, expediting approvals for hotels.

4) Solar Street Lighting: Expand the "Vizag Model" of solar street lighting to the approach roads of Lepakshi and Gandikota to enhance safety and reduce municipal energy loads.

VII. CONCLUSION

The research confirms that renewable energy is no longer a peripheral concern but a core driver of tourism competitiveness in Andhra Pradesh. The primary data from 100 hospitality units establishes a strong link between power reliability, green amenities, and tourist satisfaction (R^2=0.68, X^2=18.96). APSPDCL's initiatives, particularly in Tirupati, demonstrate the viability of large-scale RE integration.

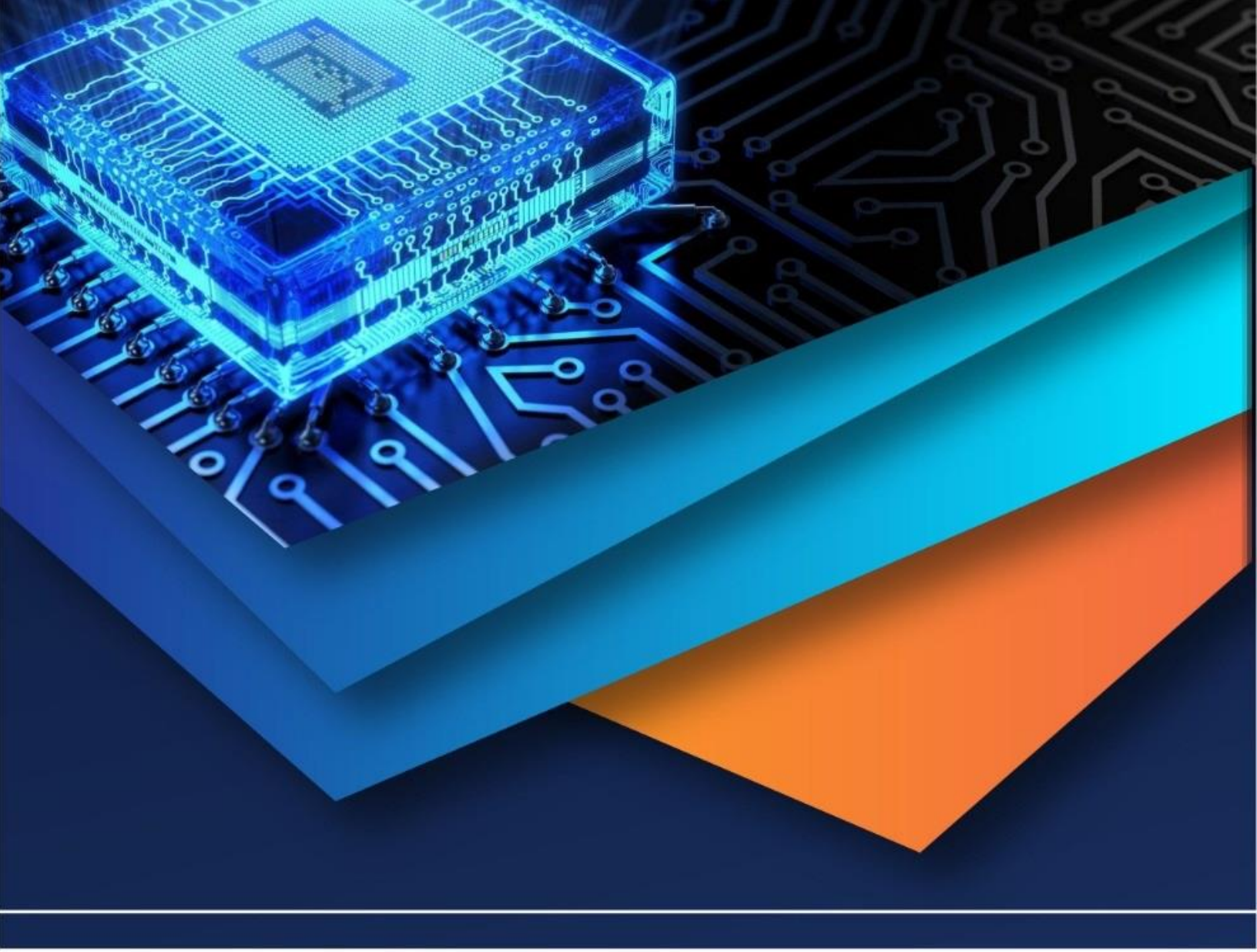
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However, the disparity in infrastructure between urban hubs (Tirupati) and remote eco-destinations (Gandikota, Horsley Hills) presents a critical challenge. By leveraging the ICE Policy 2024 and fulfilling the demand for industrial power tariffs, Andhra Pradesh has the potential to become a global leader in sustainable tourism.

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