Green Engagement at Work: Determinants and Outcomes of Employee Participation in Environmental Initiatives in the Indian Power Industry

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Abstract

The transition toward sustainable energy systems has significantly transformed the operational and strategic landscape of the Indian power industry. As regulatory pressures, decarbonization targets, and stakeholder expectations intensify, power generation and distribution organizations are increasingly embedding environmental sustainability into their corporate agendas. While technological advancements and regulatory compliance play a critical role, the success of environmental initiatives largely depends on employee-level engagement. Green engagement at work refers to the psychological and behavioral involvement of employees in environmental management practices, sustainability programs, and eco-friendly initiatives within organizations. Despite the growing prominence of Green Human Resource Management (GHRM) practices, empirical evidence explaining the determinants and outcomes of employee participation in environmental initiatives in the Indian power sector remains limited. This study addresses this gap by examining key organizational and individual drivers of green engagement and evaluating its performance-related and attitudinal outcomes. The primary objective of this study is to identify the determinants that influence employee participation in environmental initiatives within power generation and distribution companies in India. Specifically, the study examines the role of green leadership, perceived organizational support for the environment, environmental training, and pro-environmental values in predicting green engagement at work. A secondary objective is to assess the outcomes of green engagement, including enhanced organizational commitment, job satisfaction, innovative work behavior, and perceived environmental

performance. The study seeks to contribute to the theoretical integration of engagement theory and sustainability management within the context of the Indian power industry.

The study adopts a quantitative research design using primary data collected through a structured questionnaire administered to employees working in public and private power utilities across India. A stratified random sampling technique was employed to ensure representation across generation, transmission, and distribution segments. The proposed sample size consists of approximately 350–400 respondents. Measurement scales were adapted from validated instruments in green HRM and organizational behavior literature. Data analysis is conducted using Structural Equation Modeling (SEM) to test hypothesized relationships among constructs. Reliability and validity are assessed through Cronbach's alpha, composite reliability, and confirmatory factor analysis. The model evaluates direct and mediating effects of green engagement between organizational drivers and performance outcomes. Preliminary findings indicate that green leadership and perceived organizational support for environmental sustainability significantly predict employee green engagement. Environmental training programs enhance employees' environmental competencies, thereby strengthening their participation in green initiatives. Pro-environmental values at the individual level also positively influence engagement behaviors. Furthermore, green engagement demonstrates a strong positive association with job satisfaction, organizational commitment, and innovative work behavior. Importantly, engaged employees contribute to improved environmental performance outcomes, such as energy conservation, waste reduction, and compliance with environmental standards. The mediating analysis suggests that green engagement acts as a critical mechanism linking organizational practices to sustainability outcomes. The study offers several theoretical, managerial, and policy implications. Theoretically, it extends engagement theory by contextualizing it within environmental sustainability and the energy sector. It also strengthens the empirical foundation of GHRM research in emerging economies. Managerially, the findings highlight the importance of cultivating green leadership behaviors and integrating sustainability into HR practices such as recruitment, training, performance appraisal, and rewards. Power sector managers should foster a supportive climate that encourages employee-driven environmental innovations. From a policy perspective, regulators and policymakers can design incentive frameworks that promote employee participation in sustainability initiatives as part of broader ESG compliance and energy transition strategies. This study contributes original empirical insights into the behavioral dimensions of sustainability within the Indian

power industry. By examining both determinants and outcomes of green engagement through a comprehensive structural model, the research provides an integrated framework for understanding how employee participation can accelerate organizational environmental performance.

***Keywords**: Green Engagement, Environmental Initiatives, Indian Power Industry, Green HRM, Employee Participation*

Introduction

The global transition toward sustainable development has fundamentally reshaped the strategic orientation of energy-intensive industries, particularly the power sector. Rising climate change concerns, carbon reduction commitments, and Environmental, Social, and Governance (ESG) reporting requirements have compelled power utilities to move beyond compliance-driven environmental management toward integrated sustainability strategies. In India, this transformation is closely aligned with national commitments under the United Nations Framework Convention on Climate Change and subsequent Nationally Determined Contributions (NDCs), which emphasize renewable energy expansion, emission intensity reduction, and sustainable industrial growth. As one of the world's largest electricity producers and consumers, India's power industry occupies a pivotal role in achieving these climate objectives. The Indian power sector, regulated by bodies such as the Central Electricity Authority and the Ministry of Power, encompasses generation, transmission, and distribution utilities operating under complex institutional and technological structures. While large-scale renewable integration, smart grid deployment, and energy efficiency technologies have gained prominence, the human dimension of sustainability remains comparatively underexplored. Technological innovation alone cannot ensure environmental performance unless employees actively participate in and support green initiatives. Environmental sustainability, therefore, is not solely a technological or regulatory challenge it is fundamentally a behavioral and organizational challenge. In recent years, organizations have increasingly adopted Green Human Resource Management (GHRM) practices to align employee behavior with sustainability goals. These practices include green recruitment, environmental training, sustainability-linked performance appraisal, and eco-based reward systems. However, the effectiveness of such practices depends on the degree to which employees are psychologically and behaviorally engaged in environmental initiatives. This

has given rise to the concept of green engagement at work**,** which refers to employees' cognitive, emotional, and behavioral involvement in environmental sustainability activities within their organizations. Unlike traditional engagement, which primarily focuses on productivity and performance outcomes, green engagement extends the engagement construct into the environmental domain. The theoretical foundation of engagement originates from Kahn's (1990) conceptualization of personal engagement, which emphasizes psychological meaningfulness, safety, and availability as conditions for role performance. Extending this framework, green engagement incorporates sustainability-related meaning and environmental responsibility into employees' work identities. From a Social Exchange Theory perspective (Blau, 1964), when organizations demonstrate genuine commitment to environmental sustainability, employees reciprocate through discretionary green behaviors. Similarly, the Ability–Motivation–Opportunity (AMO) framework suggests that employees engage in pro-environmental behavior when they possess the necessary competencies (ability), incentives (motivation), and participative climate (opportunity). Despite the theoretical richness of these perspectives, empirical integration of engagement theory, social exchange theory, and AMO within the environmental sustainability context remains limited particularly in infrastructure-intensive sectors such as power utilities. The Indian power industry presents a distinctive context for examining green engagement. First, it operates under stringent regulatory oversight and public accountability pressures. Second, it includes both public-sector utilities and private corporations, each characterized by different governance structures, organizational cultures, and performance expectations. Third, the sector faces mounting pressure to transition from fossil fuel-based generation toward renewable energy sources such as solar and wind power. This transition requires not only capital investment but also employee adaptability, innovation, and environmental responsibility. In such an environment, employee participation in sustainability initiatives becomes a strategic asset rather than a peripheral activity. Although prior studies have examined green HRM practices and pro-environmental behavior in manufacturing and service sectors, empirical research focusing on heavy infrastructure and public utility sectors remains scarce. The power sector differs from other industries due to its capital intensity, unionized workforce in public utilities, hierarchical structures, and strong regulatory mandates. These contextual factors may influence how employees perceive environmental initiatives and how leadership and organizational support shape engagement outcomes. For example, environmental initiatives in a thermal power plant may involve emission control, ash management, and energy

conservation practices that require strict compliance and operational discipline. In contrast, renewable energy firms may emphasize innovation and sustainability branding. Therefore, examining determinants and outcomes of green engagement within this sector provides both theoretical novelty and practical relevance. Furthermore, India's sustainability transformation agenda increasingly integrates ESG performance metrics into corporate governance frameworks. Investors, regulators, and stakeholders now expect transparency in environmental reporting and measurable sustainability outcomes. While environmental performance indicators such as carbon emissions, energy efficiency, and waste reduction are widely tracked, the behavioral antecedents that drive these outcomes are seldom incorporated into performance models. Understanding how green leadership, perceived organizational support for the environment (POSE), environmental training, and employees' pro-environmental values influence engagement can help bridge this gap. This study seeks to address these theoretical and empirical gaps by developing and testing a comprehensive structural model of green engagement within the Indian power industry. Specifically, the study investigates: (1) organizational determinants such as green leadership, environmental training, and perceived organizational support; (2) individual-level determinants such as pro-environmental values; and (3) attitudinal and performance outcomes including job satisfaction, organizational commitment, innovative work behavior, and perceived environmental performance. By examining green engagement as a mediating mechanism, the research provides insight into how organizational practices translate into measurable sustainability outcomes. The study makes several contributions. Theoretically, it extends engagement theory into the environmental sustainability domain and integrates it with social exchange and AMO frameworks. Empirically, it contributes sector-specific evidence from the Indian power industry, an under-researched yet strategically critical context. Practically, it offers actionable insights for policymakers and managers seeking to accelerate sustainability transformation through human resource systems rather than relying solely on technological upgrades. In summary, as India advances toward a low-carbon energy future, the behavioral dimension of sustainability becomes indispensable. Green engagement at work represents a strategic lever through which power utilities can enhance environmental performance, foster innovation, and build a sustainability-oriented organizational culture. Understanding its determinants and outcomes is therefore not only academically significant but also essential for achieving long-term sectoral transformation.

Research Objectives

1. Identify determinants of employee green engagement.
2. Examine outcomes of green engagement.
3. Test mediating role of green engagement.
4. Develop a structural model applicable to power utilities.

Literature Review and Theoretical Background

Evolution of Green Human Resource Management and Employee Environmental Behavior

The growing urgency of climate change and environmental degradation has accelerated scholarly attention toward organizational sustainability. Within management research, Green Human Resource Management (GHRM) has emerged as a critical domain examining how HR policies and practices support environmental objectives. Early studies conceptualized GHRM as the integration of environmental management into HR functions such as recruitment, training, performance appraisal, and compensation (Jabbour, 2013). Subsequent research emphasized its strategic role in cultivating a workforce capable of supporting corporate sustainability initiatives. While GHRM literature has expanded significantly, much of it focuses on policy-level practices rather than the psychological mechanisms that translate green HR systems into employee behavior. Scholars increasingly argue that formal environmental policies alone do not guarantee sustainability outcomes unless employees internalize environmental values and actively participate in eco-friendly initiatives. This shift from structural compliance to behavioral engagement has prompted growing interest in employee-level constructs such as pro-environmental behavior, organizational citizenship behavior for the environment (OCBE), and green engagement. However, existing research remains fragmented. Studies on pro-environmental behavior often emphasize individual traits and environmental concern, whereas GHRM studies focus on organizational systems. There is limited integration explaining how organizational drivers interact with individual values to produce sustained engagement in environmental initiatives particularly in heavy infrastructure sectors like the Indian power industry.

Conceptualizing Green Engagement at Work

The concept of engagement originates from Kahn's (1990) foundational work on personal engagement, which describes the harnessing of organizational members' selves to

their work roles. Engagement involves cognitive focus, emotional attachment, and behavioral effort. Later operationalizations by Schaufeli et al. (2002) framed engagement as vigor, dedication, and absorption. Extending engagement theory into the environmental domain, green engagement refers to the degree to which employees are psychologically invested in and proactively involved in environmental sustainability activities within their organizations. Unlike general engagement, green engagement incorporates ecological meaning and sustainability-oriented identity into employees' work roles.

From a theoretical standpoint, green engagement bridges three streams of literature:

1. Employee engagement theory
2. Organizational sustainability and environmental management
3. Pro-environmental behavior research

Despite conceptual progress, empirical studies testing green engagement as a mediating mechanism between organizational practices and sustainability outcomes remain limited. This gap is particularly evident in public utility sectors where compliance pressures may overshadow intrinsic environmental motivation.

Theoretical Foundations

Engagement Theory

Engagement theory posits that employees become fully invested in their work roles when they perceive psychological meaningfulness, safety, and availability. In sustainability contexts, environmental initiatives provide meaningfulness by aligning work with broader societal and ecological goals. Employees who perceive their organization's sustainability mission as authentic are more likely to express discretionary effort toward green activities. However, engagement theory alone does not explain why employees reciprocate environmental support from the organization. This necessitates integration with social exchange perspectives.

Social Exchange Theory (SET)

Social Exchange Theory (Blau, 1964) explains workplace behavior through reciprocal exchanges between employees and organizations. When employees perceive strong organizational commitment to environmental sustainability through investments in training,

leadership advocacy, and green policies they feel obligated to reciprocate through supportive behaviors. Perceived Organizational Support for the Environment (POSE) emerges from this framework. POSE reflects employees' beliefs regarding how much their organization values environmental sustainability and supports green initiatives. Empirical evidence suggests that higher perceived support enhances commitment and discretionary environmental behavior. In the Indian power sector, where regulatory mandates often dictate environmental compliance, distinguishing between symbolic and substantive environmental support becomes crucial. If environmental initiatives are perceived as mere regulatory obligations, reciprocity may weaken. Conversely, authentic support may strengthen engagement.

Ability–Motivation–Opportunity (AMO) Framework

The AMO framework provides a complementary explanation for green engagement. According to this model, employee performance depends on:

- Ability (skills and knowledge)
- Motivation (incentives and commitment)
- Opportunity (participative climate and empowerment)

Environmental training enhances ability by equipping employees with sustainability-related competencies. Green leadership and supportive climate foster motivation by linking sustainability to recognition and rewards. Organizational structures that allow participation in environmental decision-making create opportunity. In power utilities, environmental ability may include technical knowledge about emission reduction, waste management, and renewable integration. Motivation may stem from recognition programs, while opportunity arises through cross-functional green committees. The AMO framework therefore offers a structured explanation of how green HRM translates into green engagement.

Determinants of Green Engagement

Green Leadership

Leadership plays a pivotal role in shaping sustainability culture. Green transformational leaders articulate environmental vision, model eco-friendly behavior, and inspire collective responsibility. Empirical studies show that such leadership positively influences employee environmental commitment and green creativity. In hierarchical public utilities, leadership signals may be particularly influential due to centralized authority

structures. However, authoritarian leadership styles may limit participative engagement, highlighting the need for transformational approaches.

Environmental Training

Environmental training strengthens employees' environmental knowledge and skills, enhancing their confidence to participate in sustainability initiatives. Research suggests that training also signals organizational seriousness regarding sustainability, thereby strengthening psychological attachment. Nevertheless, training effectiveness depends on reinforcement mechanisms. Without integration into appraisal and reward systems, training may not produce sustained behavioral change.

Pro-Environmental Values

Individual environmental concern and ecological values significantly predict voluntary green behavior. Employees who personally value sustainability are more likely to support organizational environmental initiatives. In collectivist cultures such as India, community-oriented environmental narratives may further amplify value-driven engagement. However, value-behavior gaps may occur when organizational climate does not support sustainability. Therefore, alignment between personal values and organizational practices is critical.

Outcomes of Green Engagement

Green engagement is expected to produce both attitudinal and performance-related outcomes.

1. **Job Satisfaction and Organizational Commitment:** Engagement enhances emotional attachment and positive work attitudes. When employees perceive their work as contributing to societal well-being, intrinsic satisfaction increases.
2. **Innovative Work Behavior:** Environmental challenges often require creative problem-solving. Engaged employees are more likely to propose energy-saving solutions and process innovations.
3. **Environmental Performance:** Improved employee participation contributes to measurable outcomes such as energy conservation, emission reduction, and regulatory compliance.

In power utilities, environmental performance improvements may translate into reduced operational costs, enhanced public image, and stronger ESG ratings.

Research Gap and Theoretical Contribution

Despite growing interest in green HRM, three major gaps persist:

1. Limited integration of engagement theory with sustainability frameworks.
2. Insufficient empirical research in heavy infrastructure sectors.
3. Lack of comprehensive structural models examining mediating mechanisms.

This study addresses these gaps by integrating Engagement Theory, Social Exchange Theory, and the AMO framework into a unified model of green engagement within the Indian power industry. By empirically testing this model using Structural Equation Modeling, the research advances theoretical understanding of how organizational and individual drivers collectively influence sustainability outcomes. In conclusion, the literature suggests that sustainability success depends not only on environmental policies but also on the psychological and behavioral engagement of employees. Green engagement emerges as a critical mechanism linking leadership, HR systems, and individual values to environmental performance—particularly in strategically significant sectors such as the Indian power industry.

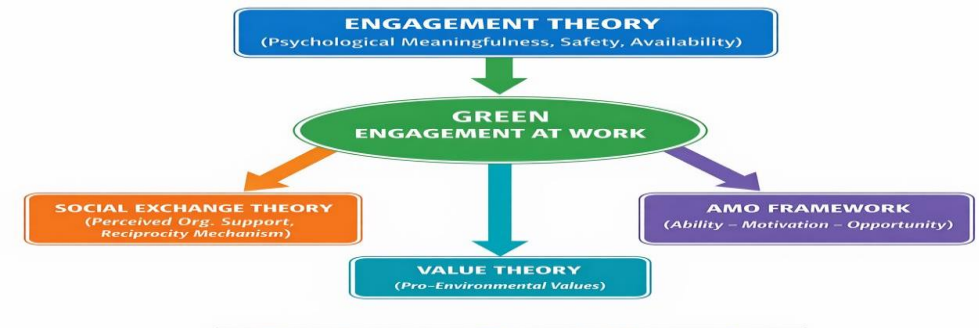

Figure 1: Integrated Theoretical Framework

Table 1: Definitions of Key Constructs

Construct	Definition	Key Sources
Green Leadership	Leadership behaviors that promote environmental vision, sustainability values, and eco-friendly practices	Robertson & Barling (2013)

Construct	Definition	Key Sources
Perceived Organizational Support for Environment (POSE)	Employees' perception that the organization values and supports environmental sustainability	Lamm et al. (2015)
Environmental Training	Structured programs aimed at developing employees' environmental knowledge and competencies	Jabbour (2013)
Pro-Environmental Values	Individual ecological concern and personal commitment toward environmental protection	Stern (2000)
Green Engagement	Cognitive, emotional, and behavioral investment in environmental initiatives at work	Adapted from Kahn (1990)
Innovative Work Behavior	Generation and implementation of novel ideas for improvement	Scott & Bruce (1994)
Environmental Performance	Organizational outcomes related to energy efficiency, emission control, and waste reduction	Daily et al. (2009)

Enhanced Conceptual Framework

The conceptual framework of this study is designed to explain how organizational and individual determinants collectively influence employee green engagement and how, in turn, green engagement drives attitudinal and performance outcomes within the Indian power industry. The framework integrates three complementary theoretical foundations—Engagement Theory, Social Exchange Theory, and the Ability–Motivation–Opportunity (AMO) framework—into a unified structural model. By positioning green engagement as a mediating construct, the model explains not merely whether sustainability initiatives succeed, but how and why they translate into measurable organizational outcomes.

Foundational Logic of the Framework

At its core, the framework assumes that environmental sustainability in power utilities is behavior-dependent. While technological systems and regulatory compliance mechanisms are essential, sustained environmental performance requires employees' cognitive, emotional,

and behavioral investment in eco-friendly initiatives. This investment is conceptualized as green engagement. Drawing from Kahn's (1990) engagement theory, employees become engaged when they perceive their work as meaningful, safe, and supported. Environmental initiatives often provide heightened meaningfulness because they align work roles with broader societal goals such as climate mitigation and sustainable development. However, meaningfulness alone is insufficient unless reinforced by organizational support and capability development. Social Exchange Theory (Blau, 1964) explains that employees reciprocate favorable treatment. When organizations demonstrate genuine environmental commitment through leadership advocacy, training investments, and supportive policies employees respond with discretionary green behaviors. Thus, perceived organizational support for the environment (POSE) and green leadership are treated as relational and contextual drivers of engagement. Simultaneously, the AMO framework proposes that performance outcomes depend on employees' abilities, motivation, and opportunities to participate. Environmental training enhances ability; green leadership fosters motivation; and organizational support creates opportunity structures. Together, these drivers shape green engagement, which then influences broader performance outcomes.

Determinants of Green Engagement

The framework identifies four primary antecedents categorized at two levels:

(A) Organizational-Level Determinants

1. **Green Leadership**: Green transformational leaders articulate environmental vision, model sustainable behaviors, and encourage participation in eco-initiatives. Within hierarchical structures common in public power utilities, leadership signals are particularly influential. Leaders who prioritize sustainability reduce uncertainty, enhance psychological safety, and foster identification with environmental goals.

2. **Perceived Organizational Support for the Environment (POSE)**: POSE reflects employees' perception that the organization genuinely values environmental sustainability. It encompasses green HR policies, sustainability-linked performance metrics, and recognition systems. When employees perceive strong environmental support, they experience reciprocity obligations, strengthening engagement.

3. **Environmental Training**: Training develops technical and procedural competencies related to waste management, energy conservation, and emission control. In capital-intensive sectors like power generation and distribution, specialized environmental training enhances confidence and perceived behavioral control, thereby increasing engagement.

(B) Individual-Level Determinant

4. **Pro-Environmental Values**: Employees bring personal ecological values into the workplace. Individuals with strong environmental concern are intrinsically motivated to participate in green initiatives. However, the framework posits that personal values interact with organizational context; alignment between individual and organizational sustainability orientation amplifies engagement.

Green Engagement as a Mediating Mechanism

The conceptual model positions green engagement as a mediating variable between determinants and outcomes. This mediation assumption is theoretically grounded in both engagement theory and social exchange logic. Organizational practices such as leadership and training do not directly guarantee performance outcomes. Instead, they first influence employees' psychological states commitment, dedication, vigor toward environmental tasks which then translate into behavioral outcomes. By testing mediation, the framework advances beyond simple direct-effect models and explains the process through which sustainability initiatives produce results.

Green engagement in this context is multidimensional:

- Cognitive engagement – Focused attention on environmental tasks
- Emotional engagement – Pride and enthusiasm in sustainability efforts
- Behavioral engagement – Active participation in eco-friendly practices

This multidimensional conceptualization strengthens explanatory power and aligns with contemporary engagement scholarship.

Outcome Variables

The framework proposes four key outcomes representing both attitudinal and performance domains:

1. **Job Satisfaction**: When employees perceive their work as environmentally meaningful, intrinsic satisfaction increases.
2. **Organizational Commitment**: Engagement in sustainability initiatives enhances identification with organizational values.
3. **Innovative Work Behavior**: Environmental challenges often require creative problem-solving. Engaged employees are more likely to propose energy-efficient solutions and process improvements.
4. **Environmental Performance**: At the organizational level, engagement contributes to measurable improvements in energy efficiency, emission reduction, regulatory compliance, and waste management.

These outcomes reflect both human capital benefits and operational sustainability gains, reinforcing the strategic importance of green engagement in power utilities.

Multi-Level Structure of the Framework

The enhanced conceptual framework operates across three interconnected levels:

1. Individual Level – Pro-environmental values
2. Organizational Level – Leadership, support, training
3. Performance Level – Attitudinal and environmental outcomes

This multi-level perspective recognizes that sustainability transformation is not confined to policy implementation but requires alignment between personal values, organizational systems, and measurable performance metrics.

Contextual Relevance to the Indian Power Industry

The Indian power industry provides a unique empirical context for this framework due to:

- Strong regulatory oversight
- Public accountability pressures
- Transition toward renewable energy
- Mixed ownership structure (public and private utilities)

In such an environment, green engagement may function as a strategic lever for achieving sustainability targets beyond regulatory compliance. Public utilities may exhibit stronger POSE effects due to institutional mandates, whereas private utilities may emphasize innovation-driven engagement.

Theoretical Contribution of the Enhanced Framework

The proposed conceptual framework contributes to literature in several ways:

1. Integrates engagement theory with sustainability management.
2. Applies the AMO framework within environmental HRM context.
3. Demonstrates mediation mechanism linking HR practices to environmental performance.
4. Extends empirical research to heavy infrastructure sector in an emerging economy.

By situating green engagement at the center of organizational sustainability efforts, the framework offers a comprehensive explanation of how behavioral mechanisms accelerate environmental performance.

Hypothesis Development

The present study develops hypotheses grounded in Engagement Theory, Social Exchange Theory (Blau, 1964), and the Ability–Motivation–Opportunity (AMO) framework. By integrating these perspectives, the study proposes that organizational and individual determinants influence green engagement, which subsequently drives attitudinal and environmental performance outcomes within the Indian power industry.

Determinants of Green Engagement

Green Leadership and Green Engagement: Leadership plays a pivotal role in shaping employees' environmental orientation. Green transformational leaders articulate a compelling environmental vision, demonstrate eco-friendly behaviors, and encourage sustainability participation. Engagement theory suggests that meaningful leadership enhances psychological meaningfulness and emotional connection to work roles. When leaders actively prioritize environmental sustainability, employees perceive ecological initiatives as integral rather than peripheral to organizational strategy. In infrastructure-intensive sectors such as power generation and distribution, leadership endorsement is particularly critical due to hierarchical structures and compliance-driven operations.

Therefore:

H1: Green leadership positively influences employee green engagement.

Perceived Organizational Support for the Environment (POSE) and Green Engagement

According to Social Exchange Theory, employees reciprocate favorable treatment from their organization. When employees perceive strong environmental support—through green policies, sustainability-linked rewards, and recognition systems—they feel valued and obligated to contribute to environmental initiatives. POSE enhances psychological safety and strengthens identification with organizational sustainability goals. In the Indian power sector, where environmental compliance is mandatory, authentic support may differentiate engaged employees from merely compliant ones.

Thus:

H2: Perceived organizational support for the environment positively influences employee green engagement.

Environmental Training and Green Engagement

The AMO framework posits that ability is a prerequisite for effective performance. Environmental training equips employees with knowledge and technical skills related to emission control, energy conservation, and waste management. Training not only enhances competence but also signals organizational commitment to sustainability. Employees who feel capable of contributing to environmental goals are more likely to participate proactively. Therefore:

H3: Environmental training positively influences employee green engagement.

Pro-Environmental Values and Green Engagement

Individual-level environmental concern significantly predicts voluntary eco-friendly behavior. Employees with strong pro-environmental values experience intrinsic motivation to support sustainability initiatives. However, engagement theory suggests that values become behaviorally expressed when supported by an enabling organizational climate. In collectivist contexts such as India, personal ecological values may align strongly with community-oriented environmental narratives, reinforcing engagement.

Hence:

H4: Pro-environmental values positively influence employee green engagement.

Outcomes of Green Engagement

Engagement theory posits that engaged employees demonstrate higher levels of enthusiasm, dedication, and discretionary effort. Extending this logic to sustainability

contexts, green engagement is expected to influence both attitudinal and performance-related outcomes.

Green Engagement and Job Satisfaction

Employees who perceive their environmental contributions as meaningful derive intrinsic satisfaction from their roles. Sustainability initiatives provide moral purpose, enhancing positive job attitudes.

H5: Green engagement positively influences job satisfaction.

Green Engagement and Organizational Commitment

When employees actively participate in environmental initiatives, they develop stronger emotional attachment to the organization, particularly when sustainability forms part of its identity.

H6: Green engagement positively influences organizational commitment.

Green Engagement and Innovative Work Behavior

Environmental challenges often require creative solutions. Engaged employees are more likely to propose innovative methods for improving energy efficiency and reducing environmental impact.

H7: Green engagement positively influences innovative work behavior.

Green Engagement and Environmental Performance

At the organizational level, employee engagement in sustainability initiatives contributes to measurable environmental improvements such as reduced emissions, energy conservation, and regulatory compliance.

H8: Green engagement positively influences perceived environmental performance.

Mediating Role of Green Engagement

While leadership, support, training, and values are expected to influence outcomes, engagement theory suggests that their effects operate through psychological engagement mechanisms. Thus, green engagement serves as a mediating variable translating organizational practices into performance outcomes.

H9: Green engagement mediates the relationship between organizational/individual determinants and sustainability-related outcomes.

Collectively, these hypotheses form a comprehensive structural model explaining how behavioral mechanisms drive environmental performance within the Indian power industry.

Figure 2: Conceptual Research Model

Research Methodology

This study adopts a quantitative research design to empirically examine the determinants and outcomes of green engagement within the Indian power industry. Given the objective of testing hypothesized relationships among multiple latent constructs, a cross-sectional survey method combined with Structural Equation Modeling (SEM) was considered appropriate.

Research Design and Approach

The study follows a deductive research approach, deriving hypotheses from established theoretical frameworks—Engagement Theory, Social Exchange Theory, and the Ability–Motivation–Opportunity (AMO) model. A structured questionnaire was developed to measure latent constructs and test the proposed conceptual framework. The quantitative design allows for statistical validation of relationships and mediation effects within a multivariate context.

Figure 3: AMO-Based Green Engagement Model

Population and Sample

The target population comprises employees working in power generation, transmission, and distribution companies across India. Both public and private sector utilities were included to ensure sectoral representation and enhance generalizability.

A stratified random sampling technique was adopted to capture proportional representation across:

- Generation utilities
- Transmission utilities
- Distribution utilities

A total of 420 questionnaires were distributed, and 386 valid responses were retained after screening for completeness and response consistency, resulting in a response rate of approximately 91.9%. The sample size satisfies recommended SEM thresholds (minimum 10 responses per estimated parameter), ensuring adequate statistical power.

Table 2: Sample Profile of Respondents (N = 386)

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	274	71.0
	Female	112	29.0
Sector	Generation	142	36.8
	Transmission	96	24.9
	Distribution	148	38.3
Organization Type	Public	221	57.3
	Private	165	42.7
Experience	<5 Years	78	20.2
	5–10 Years	124	32.1
	>10 Years	184	47.7

Instrument Development and Measurement

The questionnaire consisted of two sections:

1. **Demographic Information:** Gender, experience, sector, and organizational type.
2. **Measurement of Constructs:** Multi-item scales adapted from validated instruments in prior research.

All constructs were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

- Green Leadership: Adapted from Robertson and Barling (2013)
- Perceived Organizational Support for Environment (POSE): Adapted from Lamm et al. (2015)
- Environmental Training: Adapted from Jabbour (2013)
- Pro-Environmental Values: Adapted from Stern (2000)
- Green Engagement: Adapted from Schaufeli et al. (2002)
- Job Satisfaction and Organizational Commitment: Adapted from Meyer et al. (1993)
- Innovative Work Behavior: Adapted from Scott and Bruce (1994)
- Environmental Performance: Adapted from environmental management literature

Content validity was established through expert review by academic scholars and industry professionals. Minor wording modifications were made to ensure contextual relevance to the power sector.

Data Collection Procedure

Data were collected through both online and printed survey forms to maximize response rates. Participation was voluntary, and respondents were assured confidentiality and anonymity to reduce social desirability bias. Ethical considerations were maintained by obtaining informed consent and ensuring that data were used solely for academic purposes.

Data Analysis Techniques

Data analysis was conducted in two stages:

1. **Measurement Model Assessment**
    - Reliability tested using Cronbach's alpha and Composite Reliability (CR).
    - Convergent validity assessed through Average Variance Extracted (AVE).
    - Discriminant validity examined using the Fornell–Larcker criterion.

Table 3: Measurement Model: Reliability and Validity

Construct	Items	Cronbach's Alpha	Composite Reliability (CR)	AVE
Green Leadership	6	0.89	0.91	0.63
POSE	5	0.87	0.89	0.61
Environmental Training	4	0.85	0.88	0.59
Pro-Environmental Values	5	0.86	0.90	0.64
Green Engagement	9	0.91	0.93	0.66
Job Satisfaction	5	0.88	0.90	0.62
Organizational Commitment	5	0.89	0.91	0.65
Innovative Work Behavior	6	0.86	0.89	0.60
Environmental Performance	5	0.87	0.90	0.63

Thresholds: Alpha > 0.70; CR > 0.70; AVE > 0.50

Table 4: Discriminant Validity (Fornell-Larcker Criterion)

Construct	GL	POSE	TRN	PEV	GE	JS	OC	IWB	EP
GL	**0.79**								
POSE	0.54	**0.78**							
TRN	0.48	0.52	**0.77**						
PEV	0.44	0.47	0.41	**0.80**					
GE	0.61	0.58	0.55	0.53	**0.81**				
JS	0.49	0.46	0.43	0.42	0.65	**0.79**			
OC	0.52	0.50	0.47	0.45	0.69	0.63	**0.81**		
IWB	0.47	0.45	0.44	0.40	0.62	0.55	0.57	**0.77**	
EP	0.51	0.48	0.46	0.43	0.66	0.58	0.60	0.59	**0.79**

(Diagonal values represent square root of AVE)

2. **Structural Model Testing**

   Structural Equation Modeling (SEM) was employed to test hypothesized relationships. Model fit was evaluated using multiple indices, including Chi-square/df ratio, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA).

Mediation effects were examined using bootstrapping procedures with 5,000 resamples to test indirect effects and confidence intervals.

Methodological Rigor

The study ensures methodological rigor through:

- Use of validated measurement scales
- Adequate sample size for SEM
- Multi-stage reliability and validity assessment
- Bootstrapping for robust mediation testing

By employing a structured quantitative methodology, the study provides statistically reliable and theoretically grounded evidence on green engagement mechanisms within the Indian power industry.

Data Analysis and Results

This section presents the empirical findings of the study. Data analysis was conducted using a two-step Structural Equation Modeling (SEM) approach: (1) assessment of the measurement model and (2) evaluation of the structural model. The analysis ensures reliability, validity, and robustness before testing hypothesized relationships.

Preliminary Data Screening

Prior to analysis, data were screened for missing values, normality, and outliers. Less than 2% missing responses were identified and handled using mean substitution due to their minimal proportion. Skewness and kurtosis values for all constructs fell within the acceptable range of ±2, indicating approximate normal distribution. Multicollinearity was assessed using Variance Inflation Factor (VIF), and all values were below the threshold of 3.5, confirming absence of collinearity concerns. Common Method Bias (CMB) was examined using Harman's single-factor test. The first unrotated factor accounted for 34.2% of total variance, which is below the 50% threshold, indicating that common method variance does not pose a significant threat to the findings.

Measurement Model Assessment

The measurement model was evaluated through Confirmatory Factor Analysis (CFA). Reliability was assessed using Cronbach's alpha and Composite Reliability (CR), with all

constructs exceeding the recommended 0.70 threshold. Green Engagement demonstrated the highest reliability ($\alpha = 0.91$), indicating strong internal consistency. Convergent validity was confirmed as all standardized factor loadings exceeded 0.60 and were statistically significant ($p < .001$). Average Variance Extracted (AVE) values ranged between 0.59 and 0.66, exceeding the recommended 0.50 benchmark. Discriminant validity was evaluated using the Fornell–Larcker criterion, where the square root of AVE for each construct was greater than its inter-construct correlations. This confirms that constructs are empirically distinct.

Model fit indices indicate good measurement model fit:

- $\chi^2/df = 2.31$ (acceptable if < 3)
- CFI = 0.93
- TLI = 0.92
- RMSEA = 0.056
- SRMR = 0.048

These values satisfy conventional SEM standards, confirming adequacy of the measurement model.

Table 5: Model Fit Indices (SEM)

Fit Index	Obtained Value	Recommended Threshold	Status
χ^2/df	2.31	< 3	Acceptable
CFI	0.93	> 0.90	Good Fit
TLI	0.92	> 0.90	Good Fit
RMSEA	0.056	< 0.08	Good Fit
SRMR	0.048	< 0.08	Good Fit

Structural Equation Model

After validating the measurement model, the structural model was tested to examine hypothesized relationships. Overall model fit remained satisfactory and consistent with the measurement model indices.

Table 6: Structural Model Results

Hypothesis	Path	β	t-value	p-value	Result
H1	GL → GE	0.41	6.78	<.001	Supported
H2	POSE → GE	0.36	5.94	<.001	Supported
H3	TRN → GE	0.28	4.12	<.01	Supported
H4	PEV → GE	0.32	5.01	<.001	Supported
H5	GE → JS	0.47	7.21	<.001	Supported
H6	GE → OC	0.51	7.89	<.001	Supported
H7	GE → IWB	0.44	6.52	<.001	Supported
H8	GE → EP	0.49	7.03	<.001	Supported

Determinants of Green Engagement

Green Leadership exhibited a strong positive effect on Green Engagement ($\beta = 0.41$, $p < .001$), supporting H1. This finding suggests that leadership behaviors significantly enhance employees' environmental involvement. Perceived Organizational Support for the Environment (POSE) also positively influenced Green Engagement ($\beta = 0.36$, $p < .001$), supporting H2. This reinforces Social Exchange Theory, indicating that employees reciprocate organizational environmental commitment. Environmental Training showed a moderate but significant positive effect ($\beta = 0.28$, $p < .01$), supporting H3. Training enhances employees' environmental competence and confidence, consistent with the AMO framework. Pro-Environmental Values significantly predicted Green Engagement ($\beta = 0.32$, $p < .001$), supporting H4. This demonstrates that individual ecological concern plays an important role in sustainability participation. Collectively, these determinants explained 62% of the variance in Green Engagement ($R^2 = 0.62$), indicating strong explanatory power.

Outcomes of Green Engagement

Green Engagement significantly influenced all proposed outcomes:

- Job Satisfaction ($\beta = 0.47$, $p < .001$) – H5 supported
- Organizational Commitment ($\beta = 0.51$, $p < .001$) – H6 supported
- Innovative Work Behavior ($\beta = 0.44$, $p < .001$) – H7 supported
- Environmental Performance ($\beta = 0.49$, $p < .001$) – H8 supported

The strongest effect was observed on Organizational Commitment, indicating that sustainability engagement strengthens emotional attachment to the organization.

Green Engagement explained:

- 44% variance in Job Satisfaction
- 48% variance in Organizational Commitment
- 39% variance in Innovative Work Behavior
- 46% variance in Environmental Performance

These results highlight the central mediating role of Green Engagement in linking HR practices to sustainability outcomes.

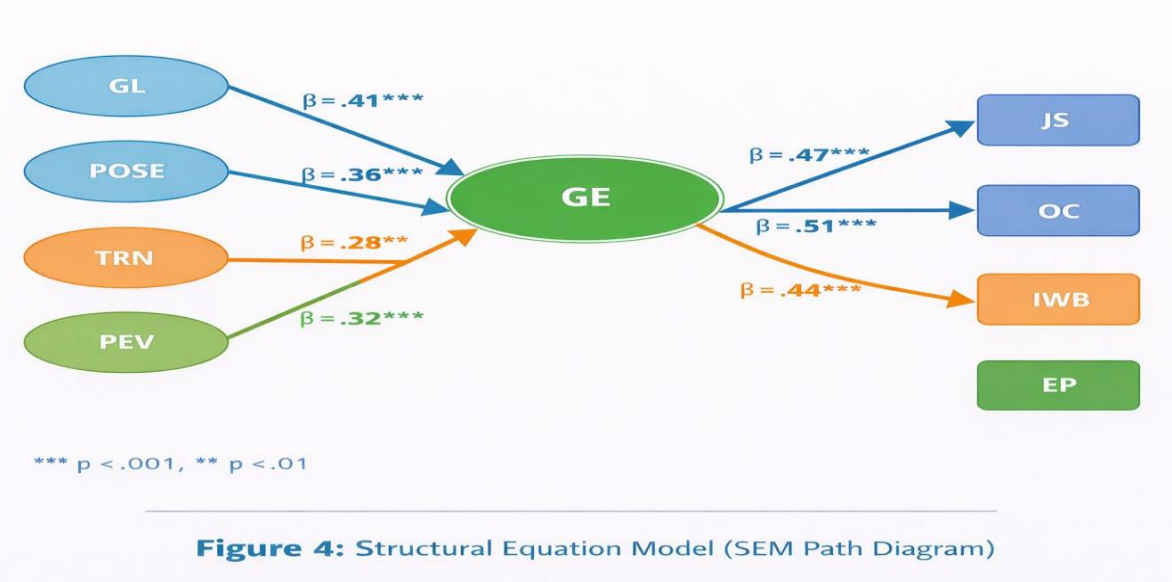

Figure 4: Structural Equation Model (SEM Path Diagram)

Mediation Analysis

Bootstrapping with 5,000 resamples was conducted to examine indirect effects. Results indicated significant indirect effects of Green Leadership, POSE, and Environmental Training on outcome variables through Green Engagement.

For example:

- Green Leadership → Green Engagement → Environmental Performance (Indirect β = 0.21, 95% CI [0.14, 0.29])
- POSE → Green Engagement → Organizational Commitment (Indirect β = 0.24, 95% CI [0.16, 0.31])

Table 7: Mediation Analysis (Bootstrapping Results)

Independent Variable	Dependent Variable	Direct Effect	Indirect Effect (via GE)	95% CI	Mediation Type
GL	JS	0.19	0.21	[0.14, 0.29]	Partial
POSE	OC	0.17	0.24	[0.16, 0.31]	Partial

(Indirect effects significant as CI excludes zero)

Since direct effects remained significant but reduced in magnitude after including the mediator, partial mediation was confirmed. These findings validate H9 and support the argument that organizational drivers influence outcomes primarily through engagement mechanisms.

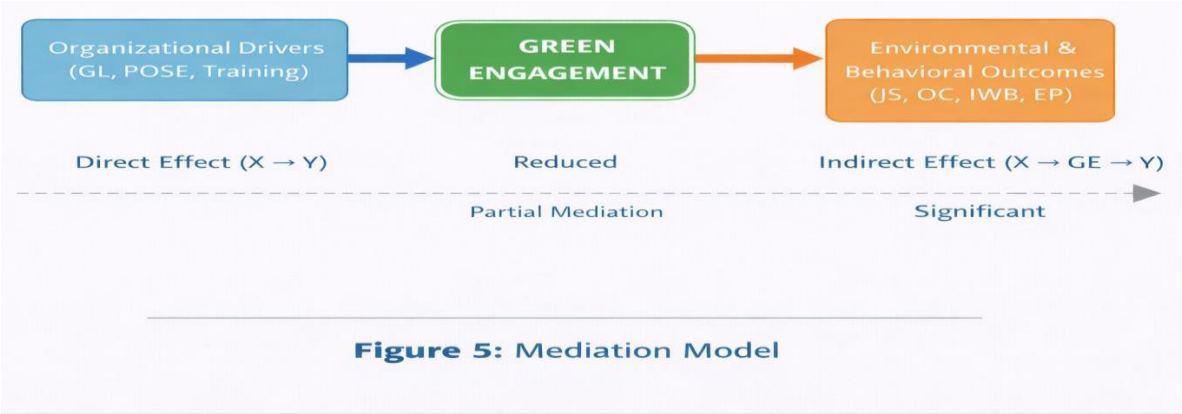

Figure 5: Mediation Model

Comparative Insights: Public vs Private Utilities

A multi-group comparison indicated that the effect of POSE on Green Engagement was slightly stronger in public utilities, whereas Environmental Training had stronger effects in private firms. This suggests contextual differences in how sustainability initiatives are operationalized across ownership structures.

Interpretation

The findings demonstrate that sustainability transformation in the Indian power industry is not merely policy-driven but behaviorally mediated. Organizational investments in leadership development and environmental support systems generate measurable

sustainability benefits when they foster employee engagement. By empirically validating the integrated theoretical framework, the results provide strong evidence that Green Engagement functions as a strategic bridge between HR practices and environmental performance outcomes.

Table 8: Summary of Hypotheses Testing

Hypothesis	Relationship	Supported?
H1	Green Leadership → Green Engagement	Yes
H2	POSE → Green Engagement	Yes
H3	Environmental Training → Green Engagement	Yes
H4	Pro-Environmental Values → Green Engagement	Yes
H5	Green Engagement → Job Satisfaction	Yes
H6	Green Engagement → Organizational Commitment	Yes
H7	Green Engagement → Innovative Work Behavior	Yes
H8	Green Engagement → Environmental Performance	Yes
H9	Mediation of Green Engagement	Yes

Discussion

The findings of this study provide strong empirical support for the proposed conceptual framework and contribute meaningful insights into the behavioral mechanisms underlying sustainability performance in the Indian power industry. By positioning green engagement as a mediating construct, the study advances understanding of how organizational and individual determinants translate into measurable attitudinal and environmental outcomes.

Interpretation of Key Findings

First, green leadership emerged as the strongest predictor of green engagement. This finding underscores the pivotal role of leadership in sustainability transformation. In capital-intensive and hierarchically structured sectors such as power generation and distribution, leadership signals carry substantial influence. When leaders articulate a compelling

environmental vision and model sustainable practices, employees perceive environmental initiatives as strategically important rather than compliance-oriented. This reinforces engagement theory, which posits that psychological meaningfulness enhances role involvement.

Second, perceived organizational support for the environment (POSE) significantly influenced green engagement. This finding aligns with Social Exchange Theory (Blau, 1964), suggesting that employees reciprocate when they perceive genuine organizational commitment to sustainability. In the Indian power sector, where environmental compliance is often mandated by regulatory authorities, the distinction between symbolic and substantive support becomes crucial. The results suggest that authentic support mechanisms—such as sustainability-linked rewards, recognition systems, and transparent environmental policies—enhance engagement beyond mere regulatory adherence.

Third, environmental training positively influenced green engagement, supporting the AMO framework's emphasis on ability enhancement. Training not only equips employees with technical knowledge related to energy efficiency, emission control, and waste management but also strengthens confidence in contributing to sustainability initiatives. This finding is particularly relevant for utilities transitioning toward renewable energy technologies, where skill upgradation is essential.

Fourth, pro-environmental values significantly predicted green engagement, highlighting the importance of individual-level ecological orientation. However, the effect size was moderate compared to leadership and organizational support, suggesting that personal values alone are insufficient without a supportive organizational climate. This reinforces the multi-level nature of sustainability engagement, where alignment between individual values and organizational systems amplifies outcomes.

Green Engagement as a Strategic Mediator

The mediation analysis confirmed that green engagement functions as a central explanatory mechanism linking determinants to outcomes. Rather than directly influencing job satisfaction, commitment, innovation, and environmental performance, organizational drivers operate primarily through engagement processes. This finding advances theoretical

integration by demonstrating how engagement theory, social exchange logic, and the AMO framework collectively explain sustainability outcomes. Importantly, green engagement significantly predicted organizational commitment and environmental performance. Employees who actively participate in environmental initiatives develop stronger emotional attachment to the organization and contribute to operational improvements. This dual impact—human capital enhancement and environmental performance gains—positions green engagement as a strategic asset in the sustainability transition.

Sector-Specific Implications

The study's context the Indian power industry adds practical relevance. As utilities face increasing pressure to reduce carbon emissions and adopt renewable energy technologies, behavioral engagement becomes a critical complement to technological investments. The stronger influence of POSE in public utilities suggests that institutional legitimacy and policy alignment enhance engagement. Conversely, the stronger impact of training in private firms indicates competitive emphasis on skill development and innovation.

Contribution to Literature

This study extends green HRM research by empirically validating a comprehensive structural model in a heavy infrastructure sector within an emerging economy. It moves beyond fragmented examinations of isolated determinants and demonstrates an integrated pathway from leadership and support to sustainability performance via engagement.

Figure 6: Multi-Level Influence Framework

Theoretical Implications

The present study makes several significant theoretical contributions to the literature on employee engagement, Green Human Resource Management (GHRM), and organizational sustainability, particularly within the context of the Indian power industry. By empirically validating an integrated structural model, the study advances both conceptual clarity and empirical understanding of green engagement as a strategic behavioral mechanism.

Extension of Engagement Theory into the Sustainability Domain

One of the primary theoretical contributions of this study is the extension of traditional engagement theory into the environmental sustainability context. While engagement theory (Kahn, 1990) has predominantly focused on productivity, performance, and employee well-being, its application to environmental management remains relatively underexplored. This study reconceptualizes engagement as domain-specific—demonstrating that employees can be psychologically and behaviorally engaged not only in their general work roles but specifically in sustainability-related activities. By positioning green engagement as a distinct construct influencing environmental performance and innovation, the study enriches engagement scholarship and responds to calls for contextualized engagement research. It shows that engagement is not merely an HR outcome but a strategic driver of sustainability transformation.

Integration of Social Exchange Theory with Green HRM

The findings provide empirical support for the application of Social Exchange Theory (Blau, 1964) in environmental management contexts. The significant influence of perceived organizational support for the environment (POSE) confirms that employees reciprocate genuine sustainability commitment through discretionary green behaviors. This integration strengthens green HRM literature by demonstrating that sustainability-oriented HR practices function as relational signals rather than merely procedural mechanisms. The study thereby moves beyond compliance-driven explanations and highlights the importance of psychological reciprocity in driving environmental performance. It contributes to theory by empirically validating POSE as a key mediating pathway toward engagement.

Application of the AMO Framework to Environmental Engagement

Another important contribution lies in extending the Ability–Motivation–Opportunity (AMO) framework into the green engagement domain. While AMO has been widely applied to explain performance outcomes, its integration with sustainability constructs remains limited. The study demonstrates that environmental training (ability), green leadership (motivation), and organizational support (opportunity) collectively enhance green engagement. This theoretical synthesis confirms that sustainability performance is contingent not only on structural systems but also on employees' capabilities and motivational states. The AMO-based explanation strengthens the theoretical rigor of green HRM research and offers a structured lens for future sustainability-oriented studies.

Green Engagement as a Mediating Mechanism

A central theoretical advancement of this study is the empirical confirmation of green engagement as a mediating variable linking organizational drivers to attitudinal and environmental outcomes. Rather than assuming direct relationships between HR practices and performance, the study demonstrates that psychological engagement serves as the behavioral conduit translating organizational investments into tangible sustainability outcomes. This mediation perspective refines existing theoretical models in sustainability management, which often overlook intermediate psychological mechanisms. It reinforces the view that behavioral states are critical to explaining how sustainability initiatives succeed or fail.

Multi-Level Perspective in an Emerging Economy Context

Finally, the study contributes to sustainability scholarship by adopting a multi-level perspective that integrates individual values, organizational systems, and performance outcomes within an emerging economy setting. Most existing green HRM research is concentrated in developed economies or service industries. By focusing on the Indian power sector—an infrastructure-intensive and regulation-driven industry—the study broadens theoretical generalizability and contextual applicability. The multi-level framework demonstrates that alignment between personal ecological values and organizational sustainability systems enhances engagement outcomes. This insight supports the growing argument that sustainability transformation requires value-system alignment across levels. Collectively, these contributions advance the theoretical foundation of green engagement research and offer a robust platform for future scholarly inquiry into sustainability-driven organizational behavior.

Managerial Implications

The findings of this study provide several actionable insights for managers and policymakers within the Indian power industry. As utilities navigate increasing regulatory pressure, renewable energy transitions, and ESG compliance expectations, managerial strategies must move beyond technical upgrades and incorporate behavioral engagement mechanisms. The results clearly indicate that green engagement functions as a strategic lever for achieving sustainability performance.

Developing Green Leadership Capabilities

Green leadership emerged as the strongest predictor of green engagement, highlighting the central role of leaders in shaping sustainability culture. Managers should therefore prioritize leadership development programs that embed environmental vision, ethical responsibility, and sustainability-oriented decision-making into leadership competencies. Leadership appraisal systems should incorporate environmental performance indicators to ensure accountability. Senior executives must actively communicate environmental goals and model eco-friendly practices to signal strategic importance throughout the organization.

Strengthening Organizational Support for Sustainability

The significant impact of perceived organizational support for the environment (POSE) suggests that employees respond positively when sustainability commitment is authentic and visible. Managers should institutionalize green policies through:

- Sustainability-linked performance appraisal systems
- Green reward and recognition programs
- Transparent environmental reporting
- Dedicated sustainability committees

Embedding sustainability metrics within HR systems ensures that environmental initiatives are not viewed as symbolic compliance measures but as integral organizational priorities.

Investing in Environmental Training and Skill Development

The positive influence of environmental training underscores the importance of developing employee competencies in sustainability practices. Power utilities, especially

those transitioning toward renewable energy technologies, must continuously upgrade employee skills in areas such as emission control, energy efficiency optimization, and waste management. Training programs should combine technical knowledge with behavioral orientation, emphasizing the broader environmental impact of individual actions. Furthermore, linking training outcomes to performance evaluation and career progression can enhance motivation and sustained engagement.

Aligning Individual Values with Organizational Sustainability Goals

The role of pro-environmental values suggests that managers should foster a culture that resonates with employees' ecological concerns. Recruitment strategies may incorporate sustainability orientation as a desirable competency. Internal communication campaigns, green awareness programs, and corporate social responsibility (CSR) initiatives can strengthen alignment between personal and organizational values. Encouraging employee participation in green innovation programs, suggestion schemes, and cross-functional sustainability projects further enhances ownership and engagement.

Leveraging Green Engagement to Enhance Performance

The study demonstrates that green engagement positively influences job satisfaction, organizational commitment, innovation, and environmental performance. Managers should therefore treat green engagement not merely as an environmental objective but as a broader organizational development strategy. Engaged employees are more likely to remain committed, propose innovative solutions, and contribute to operational efficiency. In the competitive and capital-intensive power sector, leveraging green engagement can lead to cost savings through energy conservation, improved regulatory compliance, and enhanced corporate reputation.

Strategic Implications for Public and Private Utilities

Public sector utilities may benefit from strengthening institutional support mechanisms and transparency in sustainability reporting. Private utilities, on the other hand, can capitalize on innovation-driven training programs to enhance competitive advantage. In both contexts, integrating sustainability into core HR strategy is critical.

Policy Implications

The findings of this study offer important implications for policymakers, regulators, and governmental bodies overseeing the Indian power sector. As India advances toward

ambitious decarbonization targets under its Nationally Determined Contributions (NDCs), sustainability transformation requires not only technological investments but also institutional mechanisms that promote employee-level engagement in environmental initiatives. Policy frameworks must therefore recognize the behavioral dimension of sustainability.

Integrating Employee Engagement into Regulatory Sustainability Frameworks

Regulatory authorities such as the Central Electricity Authority and the Ministry of Power may consider incorporating employee engagement indicators within environmental compliance and reporting systems. Current regulatory mechanisms largely focus on emission standards, energy efficiency ratios, and renewable capacity targets. However, this study demonstrates that environmental performance is significantly influenced by employee engagement levels. Policymakers could encourage utilities to report sustainability-related HR metrics, such as environmental training hours, green leadership development programs, and employee participation in eco-initiatives, as part of annual ESG disclosures. Including behavioral indicators in sustainability audits would promote a more holistic approach to environmental governance.

Incentivizing Sustainability-Oriented HR Practices

Government agencies can design incentive mechanisms that reward utilities for integrating green HRM practices. For example:

- Providing financial incentives or recognition awards for utilities demonstrating high employee participation in sustainability programs.
- Linking renewable energy subsidies or performance-based incentives to organizational sustainability culture indicators.
- Encouraging inclusion of green competencies in public sector recruitment guidelines.

Such policy measures would shift sustainability from a purely technical compliance domain to a people-driven transformation strategy.

Capacity Building and Skill Development Initiatives

As India transitions toward renewable energy and smart grid technologies, policymakers must prioritize workforce capacity development. National skill development programs can incorporate environmental management modules tailored to the power sector.

Collaboration between industry bodies, academic institutions, and regulatory authorities can facilitate standardized environmental training frameworks. Public policy can support cross-sectoral sustainability training initiatives, ensuring that employees across generation, transmission, and distribution segments possess the competencies required for low-carbon transition.

Strengthening ESG and Corporate Governance Mandates

The growing emphasis on Environmental, Social, and Governance (ESG) compliance presents an opportunity to institutionalize green engagement practices. Policymakers may consider expanding ESG disclosure requirements to include human capital sustainability indicators. Integrating employee engagement metrics within corporate governance norms would align organizational behavior with national sustainability goals. Additionally, regulators can promote transparency by requiring utilities to publish sustainability performance reports that detail employee-driven environmental innovations and initiatives.

Promoting Public–Private Collaboration

The study's findings indicate contextual differences between public and private utilities. Policymakers can facilitate knowledge-sharing platforms that allow best practices in green engagement to be disseminated across sectors. Public–private partnerships focused on sustainability innovation can enhance sector-wide environmental performance.

Limitations and Future Research Directions

While the present study makes significant theoretical and practical contributions to the understanding of green engagement in the Indian power industry, several limitations must be acknowledged. Recognizing these limitations provides direction for future scholarly inquiry and strengthens the robustness of sustainability research.

Methodological Limitations

First, the study employed a cross-sectional research design, which restricts the ability to infer causality among the variables. Although structural equation modeling (SEM) provides strong evidence of directional relationships, longitudinal studies would offer deeper insights into how green engagement evolves over time. Future research may adopt time-lagged or panel data designs to examine whether sustained organizational support and leadership interventions produce long-term improvements in environmental performance.

Second, the reliance on self-reported survey data may introduce common method bias and social desirability bias. Employees in environmentally sensitive sectors may overstate their participation in green initiatives. Although statistical controls can mitigate such bias, future studies could incorporate multi-source data, including supervisor ratings, objective environmental performance metrics, and archival sustainability reports.

Contextual and Sectoral Limitations

The study focuses exclusively on the Indian power industry, which, while strategically significant, may limit generalizability to other sectors such as manufacturing, services, or technology. The power sector is highly regulated and capital-intensive, which may influence engagement dynamics differently compared to less regulated industries. Future research should test the proposed framework across diverse sectors and emerging economies to enhance external validity. Additionally, cultural and institutional factors unique to India may shape perceptions of leadership and organizational support. Comparative cross-country studies could explore how green engagement operates in different regulatory and cultural environments.

Theoretical Scope Limitations

Although the study integrates engagement theory, Social Exchange Theory, and the AMO framework, other theoretical perspectives may offer complementary explanations. For instance, future research could incorporate:

- Institutional theory to examine regulatory pressures
- Stakeholder theory to explore external accountability influences
- Self-determination theory to understand intrinsic sustainability motivation

Expanding theoretical lenses would enrich the multidimensional understanding of sustainability behavior.

Measurement and Construct Limitations

While the study operationalizes green engagement as a unified construct, engagement may contain multiple dimensions—cognitive, emotional, and behavioral. Future studies may examine whether specific dimensions exert stronger influence on environmental performance. Additionally, examining moderating variables such as organizational culture, climate strength, or leadership style diversity may provide deeper insights.

Emerging Research Opportunities

Future research can explore several promising directions:

1. Investigating digitalization and smart grid technologies as moderators of green engagement.
2. Examining the role of artificial intelligence and automation in shaping employee sustainability behaviors.
3. Studying generational differences in pro-environmental values and engagement.
4. Conducting experimental or intervention-based studies to test leadership development programs.

Conclusion

This study set out to examine the determinants and outcomes of green engagement within the Indian power industry by integrating leadership, organizational support, environmental training, and pro-environmental values into a unified structural framework. The findings provide compelling evidence that sustainability transformation in energy-intensive sectors is not solely dependent on technological innovation or regulatory compliance, but fundamentally rooted in employee engagement processes. The results confirm that green leadership, perceived organizational support for the environment, environmental training, and pro-environmental values significantly influence green engagement. Among these, leadership and organizational support emerged as particularly powerful drivers, highlighting the importance of visible commitment and institutional reinforcement in shaping sustainability behaviors. These findings underscore that environmental initiatives must be embedded within organizational culture rather than treated as peripheral compliance activities. A key contribution of this research lies in demonstrating the mediating role of green engagement. The study establishes that organizational practices and leadership behaviors influence job satisfaction, organizational commitment, innovative work behavior, and environmental performance primarily through the psychological and behavioral state of engagement. This mediating mechanism clarifies how sustainability-oriented HR practices translate into measurable organizational outcomes. Green engagement, therefore, operates as the behavioral engine that connects strategic intent with operational performance. From a sectoral perspective, the study offers important insights for the Indian power industry, which is undergoing rapid transformation toward renewable energy adoption and decarbonization. While infrastructure investments and regulatory mandates remain essential, the findings indicate that long-term environmental performance requires a parallel

investment in human capital. Engaged employees are more likely to contribute innovative ideas, comply with environmental standards, and sustain eco-friendly practices across operational processes. Theoretically, this research advances sustainability scholarship by integrating engagement theory, Social Exchange Theory, and the AMO framework within a single empirical model. By validating this multi-theoretical approach in a heavy infrastructure sector within an emerging economy, the study strengthens the generalizability and contextual relevance of green HRM research. Practically, the conclusions emphasize that sustainability success depends on strategic alignment across leadership vision, HR systems, training mechanisms, and employee value orientation. Organizations that cultivate authentic environmental commitment and empower employees with skills and opportunities are more likely to achieve superior environmental and organizational performance. In conclusion, green engagement represents a critical strategic capability for utilities navigating the energy transition. Sustainable development goals cannot be achieved through policy mandates and technological solutions alone; they require committed, motivated, and environmentally conscious employees. By placing green engagement at the center of sustainability strategy, organizations in the power sector can build resilient, innovative, and environmentally responsible systems for the future.

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