# An Institutional Perspective on the Sustainable Energy Transition in India

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**Abstract - Research Problem Statement**

The ongoing drive for sustainable transformation has evoked immense interest in the energy sector. As a part of the National Energy Policy – NEP14, India has set for itself a daunting target of achieving 280 Gigawatts of installed solar energy capacity by 2030 from their present level of 25 Gigawatts. This 11-fold increase in the installed capacity needs to be complimented by an equally stark increase in the diffusion of solar energy technologies in India. Unlike the cases of sourcing renewable energy from water, ocean, geothermal and wind resources where the government exclusively owns or shares the right to develop sustainable solutions, solar energy solutions are de-centrally open to development by both the public and private entities. In other words, solar energy infrastructure – ranging from the scale of a widespread solar farm to a small, rooftop home installation – entices not just the public to set it up due to policy incentives but also through voluntary contribution by the private entities. Such a diffusion involves (i) policymakers at the top, (ii) central energy authorities, (iii) regional/state governments and their energy authorities, (iv) private corporations, (v) solar energy product companies, (vi) allied firms such as consultants, dealers and maintenance firms, (vi) urban local bodies and municipalities, (vii) resident communities/associations and (viii) individual households. In consequence, there exists a plurality of stakeholders who are required to be proactive in the rapid diffusion of solar energy technologies from policy to customers. The corresponding social science literature on the diffusion of sustainable technologies has often adopted an institutional theory-based approach to (i) account for policy-level transformation through studies on 'institutional change' (Kivima & Rogge, 2022) (ii) studies on 'institutional entrepreneurship' to appraise the role of key change agents

(Heiskanen et al., 2019) and (iii) unveiling the dynamics of business adoption through studies on 'institutional work' (Gregori et al, (2019). Attempts to coherently explain such diffusion in other contexts have been divided between top-down and bottom-up perspectives, where broader institutional changes pave way for institutional work on the embedded customers (Markatoni, 2016) or voluntary and seemingly disassociated contributions consolidate as a broader institutional movement (Jacob et al., 2019) respectively. Further, these explanations seldom shed light on the governance of de-centralised environment in solar energy diffusion which requires orchestration of plural stakeholders such as the policymakers, quasi-government bodies, intermediaries, normative agencies, businesses, and customers who are required to make embedded or voluntary contributions (Velter et al., 2020). In other words, there are limited studies to understand how plural stakeholders need to be engaged for an increase in the diffusion of solar energy technologies to meet the 2030 National Energy Policy goals. To this end, the proposed research intends to investigate: *i) how solar energy technologies can be diffused from policy to customers, ii) how plural stakeholders can be proactively orchestrated from top to bottom through embedded modalities or from bottom to up in voluntary modalities, and iii) how solar energy reforms can transform into actual organizational practices.* Second, urban and town governance is poorly equipped in terms of technical and financial means to embrace solar energy solutions (Struminska-Kutra et al., 2023). The study thereby necessitates consideration of inter-institutionalism in solar energy reforms where a broader reform coherently cascades to sub-reforms, as shown by Johnstone et al. (2017) as 'policy mixes' – where policies do not just lead to unilateral mandates for public sector but also involve a multitude of horizontal and vertical layers for inclusion of and action by other stakeholders. The proposed research is objectivized to investigate inter-institutional factors that bridge or break the coherence between the central solar energy reforms and other sectoral or state reforms and policies.

**Brief Research Methodology and Approach**

The research uses an inductive, qualitative approach to address this research question. The in-depth empirical evidence is based on primary and secondary data collected at three levels: policy-level, organization-level and actor-level, grounded on extant advocations of multi-level perspective in institutional studies for sustainable energy transition (Roberts & Geels, 2019). Primary data was collected through interviews while secondary data was collected from official reports, policy notes, news articles and online resources. The research used ethnographic coding techniques and applied both open and axial coding to draw insights on solar adoption, policy effects, financing models, and social factors in rural and urban contexts.

**Key findings and Implications**

The study attempts to contribute to social science research by our work on institutional theory in the energy sector to understand the sustainable energy transition. In specific, it offers to unveil how green reforms diffuse? For instance, whether it is through a top-down approach such as from policy change to embedded organizational transformation or through a bottom-up modality, say from embedded organizational transformation to policy change or whether it is a combination of both. The study proposes to uncover valuable insights from a sustainability research perspective on the shaping of sustainable reforms through appropriate actor configurations to create tangible value-based businesses. The proposed research primarily holds significance for adoption of solar energy solutions from the grassroots of a simple household to major organizations that have embarked on net-zero initiatives (like the Cochin International Airport Limited's Kochi Airport which is recognized globally by the International Civil Aviation Organization as the world's first fully solar-powered airport). Foremost, at the policy-level, the study intends to examine the pivots for institutionalization of central solar energy reforms to other sectoral and state reforms or policies. For instance,

inspired by the achievements of Kochi airport's green energy initiative, the Airports Authority of India issued targets to all airports in India to achieve 100% use of green energy by 2024 and obtain net-zero status by 2030. On the contrary, road and rail transportation infrastructure asset policies have been able to garner only 5-10% of the energy needs in their assets through solar energy by virtue of incoherent governance (Dawda, 2024). In parlance, best practices demonstrated by the Delhi Metro or pilot projects of National Highways Authority of India, especially on the use of outsourced solar energy to meet 40% of the energy demand failed to inspire broader adoption. Thus, the findings garnered at the policy level offers interesting insights across sectors.

Second, at the actor-level, the study is instrumental first to appraise the role of quasi-government agencies, normative bodies, and intermediaries in the diffusion of the solar energy reforms at the policy-level amidst the inter-institutional environment. For instance, Energy Efficiency Services Limited, a quasi-government agency has been successful in providing technical and financial support to sectoral and state government bodies for implementing energy reforms through innovative project delivery models. Secondly, these actors can bring forth normative compliances for organizations from public and private (industrial, commercial, and residential) arenas. Indian Green Building Council is one such normative body which is instrumental in setting and implementing normative benchmarks for net-zero performance of buildings. The study attempts to not only characterize such intermediary actors necessary for the diffusion of solar energy technologies but also elucidate their appropriate positioning in the solar reform ecosystem. Though intermediary actors have been recognized in the institutional literature (citation) commonly to resolve inter-institutional conflicts (such as Mahalingam (2022)), the solar reform ecosystem provides an opportunity to understand the role of these actors as institutional entrepreneurs in the diffusion of solar energy technologies.

Third, at the organizational level, the proposed research aims to study the organizational and business transformations that are manifested by the institutional work during adoption of solar energy technologies. For instance, it is imperative for metro rail organizations to change their design and power sourcing practices to implement solar energy solutions. Technology providers are required to customize their offering to provide solar energy solutions to residential customers in Kerala where houses are typically characterized by thatched roofing systems. Business models are to be shaped considering flexible and innovative financing/funding mechanisms for solar energy solutions. To this end, the proposed research unveils the modalities of institutional work that is required to diffuse solar energy technologies to the end customers.

Potential implications for practice pertain to governance of green reforms by the government, creation, and re-positioning of regulative-normative-mediative bodies for coordination, enabling and reinforcing sustainable transformation in organizations. The non-contextual contributions from this study aid to understand how green reforms that involve multitude of stakeholders diffuse in a de-centralized governance setting. First, the study will offer insights into how policies — such as India's National Solar Mission to increase solar capacity– affect deployment in regular practice of stakeholders. This will facilitate countries in meeting its renewable energy penetration targets, to enable a transition towards clean source of energy. Second, the study will illuminate the actor environment that is required to supplement the policy deployment to user-level. Third, this study will identify the successful business models that can be deployed to fill in this space between policies promoting solar energy on the one hand and end users of these technologies on the other. Potential implications for theory encompass modalities of institutional work for diffusion of sustainable initiatives.

**Keywords:** *Institutional theory, Solar energy, Governance, Sustainability, Energy Transition*

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