

*Routledge Advances in Management and Business Studies*

# **SUSTAINABLE ENTREPRENEURSHIP AND THE GLOBAL SOUTH**

**RESOLVING THE ENERGY, ECONOMY, AND  
ENVIRONMENT TRILEMMA IN INDIA**

Stuti Haldar



# Sustainable Entrepreneurship and the Global South

This book contributes to the emerging global discourse on sustainable entrepreneurship by highlighting its transformative potential to harmonise economic growth with environmental sustainability. It emphasises the role of innovative, sustainability-driven entrepreneurs in reshaping production and consumption practices to achieve just and equitable economic, social, and environmental outcomes. By empirically investigating the renewable energy transitions in India, this book offers valuable perspectives from the Global South, enriching existing frameworks with insights into the unique contexts, opportunities, and challenges in emerging economies.

Through a mixed-methods approach, the research synthesises diverse data sources, including personal interviews, field observations, policy documents, corporate reports, and secondary data analysis. This comprehensive methodology provides a detailed understanding of how sustainable entrepreneurial niches contribute to energy transitions, offering actionable insights for achieving systemic change.

This book intends to serve as a resource for researchers in sustainability; innovation studies; ecological economics; and Science, Technology, and Society (STS) studies. It also provides practical guidance for policymakers and practitioners working at the interface of energy, environment, and entrepreneurship. By integrating theory and practice, this work calls for collaboration among multilevel stakeholders, particularly in the emerging economy contexts, to co-develop sustainability-oriented strategies that drive economic growth while addressing pressing environmental and societal challenges.

**Stuti Haldar** is a postdoctoral researcher at CIRCLE (Centre for Innovation Research) Lund University, Sweden, and is affiliated with the Indian Institute for Human Settlements, Bengaluru, India. She has worked extensively on issues of climate change mitigation through transdisciplinary and place-based approaches. Her work spans multiple areas including sociotechnical transitions, governance, sustainable entrepreneurship and innovation, climate finance, energy and development policy, and justice perspectives.

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*Stuti Haldar*

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Resolving the Energy, Economy, and  
Environment Trilemma in India

**Stuti Haldar**

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*In loving memory of Mukti Dhara Singh, Abuti Haldar  
and Kamal Haldar, and dedicated to my dear brother  
Stav Haldar*

*These words of yours have always been a source of  
persistence and ambition for me*

“For every living thing that falls on this earth,  
Life lays and befalls on it, some moments of joy and dearth.  
When I fall off the branches of life,  
I know I will have memories some grey and rife,  
But for you swayed with me on the same branch,  
I shall fall, and fall into greener pastures,  
and hope and hope to see you rise.  
Rise beyond the horizon, rise beyond the light,  
rise above the zenith, rise above the plight.  
The storms will not worry you,  
the tides will not make you wry,  
you will not relent you will not be shy.  
What else shall please me more, if you rise beyond my hope,  
What else shall please me more, when I fall,  
If I was but a small part of the rope.”



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# Foreword

Growing and unsustainable inequality is, in my opinion, the biggest challenge that the contemporary world is either grappling with or failing to recognise. Fair chances at improving lives, driven by structured processes of enabling access to opportunities and means to acquire human capital, are and should be a normative and non-negotiable goal. We have struggled with this but have made some progress. A lot needs to be done and should be done. At the core of this puzzle is an underappreciation of the realities of the fact that it is *social and technical* and not just *social or technical*. This book does exactly what is desirable, brings social and technical together, and leverages the moment and experience of entrepreneurship and its role in driving simultaneous social and technical transitions.

As someone who has long engaged with questions of system transformation and climate action, I see this book as an essential addition to the discourse, not because it challenges existing frameworks, but because it thoughtfully creates virtuous evolutionary building blocks, extends those, stretches them, and illuminates on the idea of what change means and how it can be enabled and scaled. By focusing on renewable energy transitions in India, the author leverages an important moment in contemporary India to lay down the heuristic of transformative change.

One of the book's key contributions lies in its recognition of the multi-layered and place-specific dynamics that shape energy and for that matter, any transitions. Drawing on a detailed case study of Gujarat – an entrepreneurial hub and a leader in renewable energy adoption – this work illuminates how entrepreneurs navigate the interplay of niche innovations, entrenched regimes, and broader landscape-level forces. This multilevel perspective offers valuable insights not only for understanding energy transitions in India but also for advancing conversations on sustainable development.

What particularly resonates with me is the book's ability to integrate conceptual rigor with grounded, empirical insights. The author's engagement with the multilevel perspective is particularly noteworthy – skilfully adapting this framework to the realities of the Global South, addressing its

often-criticised technocentric and apolitical tendencies. By foregrounding the agency of entrepreneurs and embedding this analysis within India's socio-economic and cultural context, the author contributes to a more inclusive and human-centric understanding of sociotechnical transitions. And this is what place-based transformative dynamics constitutes.

Equally significant is the book's focus on the transformative potential of sustainable entrepreneurship. Sustainability-oriented entrepreneurs are not merely innovators; they are change agents who challenge dominant paradigms while creating pathways for more equitable and just futures. The book adds to our understanding of how these actors leverage opportunities, overcome barriers, and foster systemic change in resource-constrained and institutionally complex environments. This perspective not only deepens the theoretical foundations of sustainable entrepreneurship but also provides actionable insights for policymakers, practitioners, and entrepreneurs.

For India, which stands at the cusp of a massive energy transition, the relevance of this work cannot be overstated. The country's ambitious decarbonisation goals are underpinned by the need to ensure energy access, affordability, and reliability for its diverse population. By highlighting the conditions that enable sustainable entrepreneurship, the book offers a roadmap for creating ecosystems that could potentially support innovation, simultaneously decentralise and empower development processes and overcome system discontinuities.

From my perspective, this book's significance extends far beyond its immediate focus on renewable energy. It serves as a reminder of the power of interdisciplinary thinking and collaborative action in addressing global challenges. It aligns closely with my belief that systemic change requires collaboration, collective thinking, and testing of ideas, and to locate these dynamics in the context of people, institutions, and systems. The author's commitment to bridging theory and practice, while centring the lived realities of entrepreneurs, makes this work a valuable resource for all who are committed to building a sustainable and just future.

I commend the author for her contribution to this critical field and invite readers to engage with the insights in this book with curiosity and purpose. It is a work that not only informs but also inspires, offering a lens through which we can reimagine the role of entrepreneurship in creating sustainable, equitable, and resilient societies and futures.

Dr. Amir Bazaz,  
Associate Dean,  
School of Environment and Sustainability  
Head, Infrastructure and Climate  
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This monograph has come to life through the collaboration and support of many people – spanning both my academic and personal networks. My journey of working on this area began during my doctoral studies, where I developed a deep interest in exploring how economic value creation could serve as a means to social and environmental value creation. Within this broader question, I was fortunate to be supported and trained by my mentors, Dr. Tulika Tripathi and Prof. Indira Dutta, at the Centre for Studies in Economics and Planning, Central University of Gujarat. I extend my heartfelt gratitude to them and the faculty of the School of Social Sciences, who played a pivotal role in shaping my research trajectory. Their guidance enabled me to approach what is often perceived as competing goals – economic development and environmental sustainability – with a solution-focused perspective. This laid the foundation for green entrepreneurship to emerge as a critical area of inquiry in my work, especially given its fragmented scholarship and lack of extensive empirical evidence – more so when it comes to Global South contexts. Starting from this concept, I was able to expand my understanding of various forms of entrepreneurship and the value propositions they embody – including institutional, social, and now sustainable entrepreneurship, which is the core of this work.

I am deeply thankful to the Indian Council of Social Science Research for providing funding that supported my initial research and ultimately forged the path for this monograph. I also owe gratitude to the Indian Institute for Human Settlements, where this idea began to take shape. My sincere thanks to my mentors, Amir Bazaz and Aromar Revi, and my colleagues Chandni Singh, Prathijna Poonacha, and Ketaki Ghoge, as many insightful conversations with them helped me refine my understanding of a whole-systems approach to actor dynamics.

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Stuti Haldar

# Abbreviations

BoP	Bottom of Pyramid
CAGR	Compound Annual Growth Rate
CSR	Corporate Social Responsibility
Discoms	Distribution companies
EPC	Engineering, Procurement, and Construction
EU	European Union
FDI	Foreign Direct Investments
FiT	Feed-in-Tariffs
GBI	Generation Based Incentives
GEDA	Gujarat Energy Development Agency
GERMI	Gujarat Energy Research and Management Institute
GHG	Greenhouse Gas
GISE	Gujarat Institute of Solar Energy
GST	Goods and Services Tax
GW	Gigawatts
IPCC	Intergovernmental Panel on Climate Change
KW	Kilowatt
MLP	Multilevel Perspective
MNRE	Ministry of New and Renewable Energy
MoP	Ministry of Power
MSDE	Ministry of Skill Development and Entrepreneurship
MSME	Micro Small and Medium Enterprises
Mtoe	Million tonnes of oil equivalent
NCEF	National Clean Energy Fund
NDC	Nationally Determined Commitments
NSM	National Solar Mission
O&M	Operations and Management
PLI	Production Linked Incentive
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
PPA	Power Purchase Agreement
PPP	Public Private Partnerships

PV	Photovoltaic
R&D	Research and Development
RE	Renewable Energy
REC	Renewable Energy Certification
RES	Renewable Energy Source
RPO	Renewable Purchase Obligation
SE	Sustainable Entrepreneurship
UN	United Nations

# 1 Setting the stage

## Sustainable entrepreneurship in sociotechnical transitions

### 1.1 The rationale

The 21st century stands at a crossroads. Climate change is no longer a distant threat but an urgent reality, demanding transformative shifts in how economies function, societies evolve, and systems are organised (Calvin et al., 2023; Revi et al., 2022). Energy system transition is a key to such transformative change as 75.7 percent of the global greenhouse gas (GHG) emissions are attributed to energy utilities by end-use (Ge et al., 2024). Especially in emerging economies of the Global South, grappling with high cost of capital, resource scarcity, and social stratification, two dynamic concepts – sustainable entrepreneurship (SE) and sociotechnical transitions (including energy transition) – emerge as critical drivers of change. Against this premise, this book takes a deep dive into unravelling the complex and multifaceted processes that determine how entrepreneurial innovation can catalyse systemic shifts towards sustainability, particularly in the energy sector in the Global South context.

SE is more than just the creation of businesses; it is a heterodox paradigm of innovation that prioritises environmental and social value alongside economic goals. Entrepreneurs operating in this space are not merely market participants; they are change agents who envision and enact new ways of producing, consuming, and living sustainably (Haldar, 2019c; Terán-Yépez et al., 2020; Thompson et al., 2011). Their efforts are intrinsically tied to sociotechnical transitions, which refer to large-scale shifts in societal systems – such as energy, transportation, or agriculture – towards more sustainable modes of production and consumption (Geels & Schot, 2007). These transitions are complex, requiring not only technological breakthroughs but also shifts in societal norms, policies, and market structures.

India offers a compelling case study to examine this nexus. As a global leader in decarbonisation commitments, India has set ambitious targets – 500 GW of renewable capacity by 2030 amounting to 50 percent of its installed electricity capacity through non-fossil sources (MNRE, 2024). These efforts are underpinned by significant private-sector participation, with 51 percent

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of installed renewable energy (RE) capacity driven by the private sector. This indicates how private entrepreneurial ventures have the potential to convert policy ambitions into transformative outcomes.

Yet, gaps remain in the extant theoretical and empirical understanding of SE and sociotechnical transitions as distinct yet overlapping concepts. This becomes even more pronounced when dealing with often-Western-centric conception and operationalisation of these concepts. Given the emergent nature of scholarship on SE, there is a lack of consensus on what attributes sustainable entrepreneurial practices in different institutional, geographical, and sociocultural contexts. SE literature is hence highly fragmented and lacks extensive empirical enquiry – being mostly skewed towards conceptualising this phenomenon (Abbas & Bulut, 2024; Haldar, 2019c; Magro & Wilson, 2013; Shepherd & Patzelt, 2011). There is even less attention to exploring how entrepreneurship can serve as a tool for transforming whole systems towards more just and sustainable outcomes (Rosário et al., 2022). Thus, through this book we aim to develop a nuanced approach to understand energy transitions through the conceptual lever of sociotechnical transitions. In doing so, SE serves as an entry point to our exploratory approach. Under this broad objective, the book is organised around the following interrelated questions.

- How can SE be conceptualised to integrate place-based dynamics and institutional contexts?
- In what ways do sustainability-oriented entrepreneurs act as change agents, shaping and driving sociotechnical transitions in energy and other critical systems?
- How do multilevel processes – spanning institutional frameworks, policy environments, market forces, and sociocultural conditions – facilitate or inhibit SE within India’s energy transition?
- What actionable insights can be drawn from the interplay of these processes to propose research, policy, and practice pathways that nurture ecosystems for SE in India and comparable contexts in the Global South?

### 1.2 **A note on methods and intended audience**

Adopting an inductive mixed methods approach, this work offers a place-based analysis of intrinsic and extrinsic characteristics, barriers, and opportunities for SE in the RE sector of India, which can be applied to similar Global South economies. In doing so extensive review of secondary materials including government databases (e.g. Ministry of New and Renewable Energy (MNRE) and Ministry of Power (MoP)), policy documents, technical reports, scientific articles, and grey literature was conducted to derive a theoretical, conceptual and contextual foundation for our analysis.

Thereafter, a convergent research design (Creswell & Creswell, 2018) was deployed to collect information on the multilevel processes and conditions that deter or strengthen performance of entrepreneurs across six districts of Gujarat, India.

Gujarat presents an interesting case as it is known for its culture of entrepreneurship (Streefkerk, 1997) – with ranking among top five Indian states in terms of ease of doing business<sup>1</sup>. The state boasts an impressive 28 gigawatts (GW) of RE capacity, which constitutes 51.41 percent of its total installed electricity capacity and contributes over 12 percent to the national RE mix. The critical role of the private sector is evident in Gujarat’s energy transition ambition – with 72 percent of the installed capacity being privately owned, followed by 15 percent state owned and 13 percent centrally owned (NITI Aayog & Vasudha Foundation, 2025).

To collect primary insights, 54 entrepreneurs – mostly micro, small, and medium enterprises (MSMEs) – established in Gujarat, operating in the RE sector, were interviewed. These respondents were purposively sampled from a universe of around 300 entrepreneurs registered in the empanelled list of Gujarat Energy Development Agency (GEDA), Government of Gujarat. GEDA is the nodal agency for RE development in the state. The interviews comprised a mix of open- and closed-ended questions. The responses were then coded and analysed across types of business activity they were engaged in – services, manufacturing, and hybrid (i.e. both manufacturing and service). Follow-up semi-formal interviews were also conducted to obtain explanatory insights into the emerging patterns regarding motivations, challenges, and policy impacts. These insights help advance the Global North-South discourse by surfacing how sustainability-oriented entrepreneurs navigate complex environments, foster innovation, and drive sociotechnical change in specific institutional, economic, political, cultural, and geographic contexts.

The importance of this exploration lies not only in its place-based and sector-specific approach but it also presents wider global implications. SE as key driver of energy transitions – and similar systemic shifts – represents a critical frontier for research and practice. It sits at the intersection of policy, market opportunities, and technological innovation, offering a lens to understand how large-scale transformations can emerge from localised entrepreneurial actions. The stakes are particularly high in the Global South, where sociotechnical transitions must address not only sustainability goals but also issues of equity, access, and social inclusion. Often alluded to as the energy, environment, and economy trilemma (Haldar, 2021b; Haldar et al., 2023). Thus, this inquiry is not just academic – it is also relevant for entrepreneurs, policymakers, researchers, and students interested in entrepreneurship, sociotechnical transitions, energy policy, and innovation policy. Overall, it intends to open up a space for deliberating actionable solutions that balance

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economic growth with environmental stewardship and social wellbeing. Although the empirical focus of this work lies within a Global South context, it is framed to speak to a broader global perspective. This surfaces both the transformative potential and the inherent complexities of aligning entrepreneurship with sustainability – a phenomenon critical for achieving systemic change. By situating India's experience within the broader multilevel perspective framework, we offer insights that are not only locally grounded but also highly relevant to audiences seeking to understand the dynamics of whole-system transformations worldwide.

### 1.3 **Organisation of the book**

In line with its objectives, this book is organised into six interconnected chapters, each addressing critical facets of SE and its role in fostering sociotechnical transitions, particularly with regard to transforming energy systems. By blending conceptual rigor with empirical insights, the chapters construct a coherent narrative that not only situates SE within the context of system transformation but also amalgamates global perspectives with place-based realities.

The second chapter establishes the conceptual groundwork for understanding SE. It traces the evolution of the concept, highlighting its integration of economic, environmental, and social principles – advancing beyond the scope of conventional entrepreneurship. The chapter introduces core principles, such as entrepreneurial processes and sustainability management, that characterise this heterodox phenomenon. It also examines how SE has been interpreted and operationalised across diverse regional, institutional, and sociocultural contexts, offering a comparative lens to explore similarities and distinctions between the Global North and South.

The third chapter situates SE within the sociotechnical transitions literature, with a focus on multilevel perspectives (MLP) and their application to energy transitions. This chapter explores the dynamic between environmental value creation, the imperative for energy transitions as a pathway to decarbonisation and development, in general, and SE's role in navigating these complex processes. The analysis then moves to India, where the RE landscape is examined in terms of installed capacity, market size, and policy drivers, before narrowing in on Gujarat which is the site for our empirical analysis. As a leader in India's energy transition and a hub for entrepreneurial activity, Gujarat provides a rich context for uncovering the dynamics of SE and systemic change. The chapter also entails an exploration of the characteristics of sustainability-oriented entrepreneurs (niche actors), who emerge as critical change agents within the broader transition imperative.

The fourth chapter investigates the evolution of RE policy in India, with a specific emphasis on the interplay between national frameworks

and subnational implementation. It highlights how central mandates such as the National Solar Mission, Renewable Purchase Obligations (RPOs), and the green open access rules are interpreted and operationalised by states, shaping distinct RE trajectories. The chapter goes on to trace Gujarat's long-standing leadership in this domain, examining how its regulatory instruments, from feed-in tariffs and net metering to repowering incentives and hybrid energy models, have evolved over time. It positions energy policy not merely as a tool of technology governance, but as a tool for institutional experimentation that enables or constrains SE. Drawing on the evolution of policy landscape in Gujarat, the chapter analyses how successive policy iterations have aimed to balance decarbonisation goals with market development, infrastructural readiness, and fostering an entrepreneurial ecosystem. The analysis also identifies persistent challenges, including land acquisition complexities, grid integration gaps, and uneven institutional coordination, which continue to mediate policy effectiveness. This policy backdrop provides critical context for understanding the enabling environment in which sustainability-oriented entrepreneurs operate. By examining the regulatory mechanisms, institutional capabilities, and strategic ambitions embedded in Gujarat's RE policies, the chapter sets the stage for the empirical inquiry that follows.

The fifth chapter then goes on to investigate the factors that enable and constrain the development of SE in India and similar Global South economies. By examining the policy, regulatory, and market conditions within Gujarat's RE sector, this chapter highlights how sustainability-oriented entrepreneurs navigate systemic challenges and leverage windows of opportunity created by shifting regime and landscape dynamics. It offers insights into the multilevel processes that drive or hinder RE transitions, providing a nuanced understanding of how SE actors engage with networks, overcome barriers, and foster innovation in complex, often politically entrenched, and resource-constrained environments.

The concluding chapter synthesises insights from the book so far, to propose a comprehensive multilevel framework for energy (and similar infrastructure) transitions through the lens of SE. It emphasises the importance of a place-based, human-centric perspective on sociotechnical transitions that balances environmental sustainability, economic growth, and social equity. In light of recent climate change debates, the chapter discusses enabling conditions and policy propositions necessary to foster systemic responses to pressing sustainability challenges. The book concludes by outlining avenues for future research and issuing a call to action for policymakers and practitioners to build supportive ecosystems for SE – as it stands as a critical lever to deliver on more equitable, environmentally sustainable and just socioeconomic development.

Thus, this work provides a multidimensional exploration of SE, substantiating theoretical inquiry with empirical evidence and practical applications.

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It offers valuable insights for academics, policymakers, and practitioners interested in understanding and advancing the transformative potential of SE in achieving sustainable systemic change.

### **Note**

- 1 Inclusion. (2024, February 16). Gujarat ranks #5 in the SKOCH state of governance 2023. INCLUSION – Mainstreaming the Marginalised. Retrieved January 3, 2025, from <https://inclusion.in/state-of-governance/2024/02/gujarat-ranks-2-in-the-skoch-state-of-governance-2023/>.

## 2 Sustainability-driven entrepreneurship

### Evolution of the concept and perspectives from Global North and South

#### 2.1 Introduction

As the world grapples with multiple interconnected challenges of resource depletion, climate change, and rising socioeconomic inequities, integrating sustainability principles in entrepreneurial practices is no longer a choice, but is a critical necessity. Several alternatives including social entrepreneurship, green entrepreneurship, institutional entrepreneurship, and, more recently, sustainable entrepreneurship (SE) have gained traction in business and sustainability research, to speak to the trilemma of balancing economic growth, environment, and social welfare. Despite the intuitive intrinsic hostility between entrepreneurship and environmentalism, evidence suggests that entrepreneurship has greater potential to sustain environmentalism, in comparison to any other form of imposed reform (Anderson, 1998). Thus, understanding how entrepreneurial value creation extends beyond purely economic goals is important both for developed and developing economy contexts. Historically, entrepreneurship has been primarily associated with costs and profits through risk taking and innovation (Wennekers et al., 2002). Traditional approaches to businesses have although bolstered economic prosperity and innovation; they have been critiqued for their considerable negative externalities on society and ecosystems (Haldar, 2019b). These challenges are even more pronounced in developing nations where rapid urbanisation and industrialisation often comes at the cost of social and environmental injustices (Haldar et al., 2023; Haldar & Sharma, 2022a). The transition towards this novel paradigm of SE presents an opportunity to integrate social, economic, and environmental value in production practices, for both new enterprises and incumbent firms. Hence, challenging the conventional perceptions on profitability and responsible production and innovation, being mutually exclusive. SE - a heterodox phenomenon that embodies elements of different forms of entrepreneurship including - conventional, green, and social entrepreneurship enables us to demonstrate how such innovative entrepreneurial practices are central to inclusive,

equitable, and environmentally just transformations in production processes (Hall et al., 2010).

However, this is not a simple process. The transition towards SE is complex and entrenched within multiple hurdles especially in resource-constrained economies of the Global South. In terms of extant research, a major gap remains in the lack of a comprehensive theoretical or conceptual framework that fully depicts the dynamism and context-specific characteristics of SE (Thompson et al., 2011). Until recently, research in the field of entrepreneurship was directed towards answering why some individuals become entrepreneurial, while others do not (Erikson, 2001; Kirzner, 2015) – rather than explaining the characteristics of entrepreneurial practices these people engage in. Another core area of study has been on how to foster more entrepreneurship, often measured by entry rates, profitability, investments, etc., rather than how entrepreneurship can lead to social value creation (Eckhardt & Shane, 2003; Kirzner, 1990). However, the past two decades have witnessed a proliferation of scholarly work (mostly from the Global North) exploring the non-economic motives and outcomes of entrepreneurial action. Yet the concept of SE is still emerging, fragmented, and lacks empirical and conceptual rigor especially in the developing nations context, where the need for sustainable development and just transitions is of utmost urgency (Spence et al., 2011).

In addition to academic research, SE especially in the Global South regions is faced with considerable practical challenges. The regulatory and institutional environments in these regions are often inconsistent and underdeveloped, making it difficult for SE to garner support. This results in lack of protected niches for this new breed of entrepreneurs hence pitching them against conventional profit-oriented businesses that do not internalise the environmental and social costs of their operations (Dean & McMullen, 2007). This further highlights the vitality of understanding and implementing policy and regulatory interventions to foster an ecosystem for SE.

Another facet of SE is the need to enable a more socially just transition – i.e. the costs and benefits of such business practices across different sectors are equitably distributed among different actor groups (Haldar et al., 2024). While SE aims at addressing societal challenges, there is a possibility that they may reinforce asymmetric power relations at the cost of the interests of marginalised and vulnerable social groups. This is a key concern in developing nations where the socioeconomic inequities are often more magnified (Bouzarovski & Simcock, 2017; Munro, 2023). This calls for a nuanced approach to entrepreneurship that accounts for diverse contexts and needs and incorporates principles of justice while working towards achieving the goals of sustainable development. Examples of grassroots and frugal innovations that adopt a bottom-up approach to address local needs have hence

garnered attention in SE discourse specific to the Global South (Kumar & Sharma, 2024; Orozco-Meléndez & Paneque-Gálvez, 2022).

In this context, recognising that SE can emerge as a powerful catalyst for transformative change towards more equitable, just and sustainable societies across different regional contexts - there is a need to overcome theoretical gaps and policy bottlenecks - including development of conducive regulatory frameworks, entrepreneurship and industrial policies, and market mechanisms, etc. Thus, this chapter offers a deep dive into the conceptual and theoretical underpinnings of the emerging phenomenon of SE. First, it traces the evolution of SE as a heterodox form of entrepreneurship that mandates an innovative individual's obligations towards the three pillars of sustainability. Highlighting the need for more context-specific understanding and operationalisation of SE, this chapter further goes on to discuss the regional dynamics that shape the outcomes and orientation of sustainable value creation in entrepreneurial practices across the Global North and South economies given their distinct institutional, resource, cultural, socio-economic and policy environments.

## **2.2 Evolution of a heterodox concept**

As discussed above, with growing global consensus on the urgency of climate action both economies in the Global North and South are asserting the need to intensify the pace of economic development, while minimising the risks posed to natural systems. This is especially true for developing economies that strive to meet decent standards of living, develop capacity for adaptation and mitigation against climate risks, while also decarbonising and growing their economies. To this end, entrepreneurship has been established as a mechanism to generate economic benefits, revitalise regional identity, and stimulate innovation processes (Hoogendoorn et al., 2015; Kirzner, 2015; OECD, 2013; Segal et al., 2005). Theories of entrepreneurship identify an entrepreneur as an innovator who bears risks while applying new techniques in production with the motive of reducing costs and thereby raising the profit margin (Pesciarelli, 1989; Smith & Chimucheka, 2014; Stark, 2004). Hence, entrepreneurs are catalysts for economic change; and economic development can be achieved by their actions of inducing innovations to bring about creative destruction in the economy (Swedberg, 2000). But this conceptualisation of entrepreneurship laid sole focus on wealth generation, calling for rethinking of the goals of entrepreneurship in the context of increasing climate vulnerabilities and societal challenges (Sarango-Lalangui et al., 2018). This led to a shift in the conception of entrepreneurship beyond mere economic value creation to achieving non-economic benefits such as environmental sustainability and social wellbeing (Dean & McMullen, 2007; Schaltegger & Wagner,

2011; Shepherd & Patzelt, 2011). As a result, the interest of companies and entrepreneurs has developed in the direction of understanding the real impact of their business on society and environment (Aghelie et al., 2016).

The concept of sustainable entrepreneurship (SE) is rooted in the need to understand how and why existing businesses can be made environmentally and socially responsible? There are several semantic and philosophical arguments attributing to this puzzle. For instance, a couple of concepts including ‘green entrepreneurship,’ ‘ecopreneurship,’ and ‘environmental entrepreneurship’ in the early 1990s, were increasingly being used to study the greening of managerial practices (Bennett, 1991; Berle, 1993; Blue, 1990). Researchers working on green entrepreneurship argued that contrary to conventional belief, the ‘ecological movement’ has potential to create new market opportunities for expansion of sustainability-driven businesses rather than being a drain on economic activities (Elkington, 1986; Quinn, 1971). ‘Social entrepreneurship’ and ‘Corporate Social Responsibility (CSR)’ are also concepts often deployed in an attempt to respond to the question of how start-ups and even incumbent enterprises can function more responsibly. In contrast to ecopreneurship, green entrepreneurship and similar concepts with dominant focus on environmental challenges (Schaefer et al., 2015; Schaltegger, 2002), social entrepreneurship holds social value creation through promoting welfare of people and communities – including marginalised and vulnerable social groups at its core (Schaefer et al., 2015). Hence, under this conception both not-for-profit and profit-oriented enterprises aim at creating social value through deeming profits as a means to such social ends (Nikolaou et al., 2018). Although these concepts demonstrate some overlaps and there have been attempts to define and categorise such sustainability-oriented entrepreneurial practices, this field of enquiry is relatively new and hence is fragmented and poorly understood (Haldar, 2019a, 2019b, 2019c; Schaper, 2002). For instance, CSR is often considered as a separate concept from SE as these are mere strategies of firms to invest in some sustainability areas, while maintaining economic gains as their core principle. Hence, any social or environmental benefits are an accompanying outcome of such enterprises while not being embedded in the operations and organisational goals. This often risks the CSR activities to emerge as superficial and lacking long-term commitments to sustainability goals (Hansen & Schaltegger, 2013).

In generic terms sustainable entrepreneurs extend beyond the purview of conventional and green entrepreneurship, to be positioned as change agents committed to seeking a balance between social, economic, and environmental goals (Aghelie et al., 2016; Belz & Binder, 2017; Haldar, 2021a; Muñoz & Cohen, 2018; Muñoz & Dimov, 2015; Urbaniec, 2018). However, as is common in most emerging concepts, SE witnessed a proliferation of diverse definitions, resulting in a lack of a theoretical framework that can build consensus in the literature.

There are two dominant approaches towards understanding SE. First, the sustainable management perspective – highlights the centrality of the triple bottom line (Elkington, 1986; Slaper & Hall, 2011) and sustainable development agenda, while entrepreneurial activities are subordinate to this conception. Under this approach, SE refers to a conscious decision to analyse the real impact of businesses on social, economic, and environmental dimensions (Urbaniec, 2018). This means “the continuing commitment by businesses to behave ethically and contribute to economic development while improving the quality of life of the workforce, and their families, the local and global community as well as future generations”(Crals & Vereeck, 2005).

Second, the entrepreneurial perspective – positions SE as a mix of the triple bottom line and the entrepreneurship process (Pacheco et al., 2010; Patzelt & Shepherd, 2011). This approach highlights the relationship between entrepreneurs and opportunities – entrepreneurs being perfectly aware of the environmental impact of their businesses (Belz & Binder, 2017; Dean & McMullen, 2007). This points to the understanding that sustainable development presents conditions for creating innovative business models, as entrepreneurs recognise long-term entrepreneurial opportunities. Hence, aligning with the entrepreneurship theory approach, SE refers to “the examination of how opportunities to bring into existence ‘future’ goods and services are discovered, created, and exploited, by whom, and with what economic, psychological, social, and environmental consequences”(Cohen & Winn, 2007). Table 2.1 presents a compilation of definitional attempts at SE from both of the above-mentioned approaches.

So far, it is evident that there are multiple perspectives and semantic debates regarding SE, which results partly from its novelty as a concept. However, sustainable development or sustainability which forms the basis for this new form of entrepreneurship is a more tangible and theoretically evolved concept. The most common understanding of sustainable development refers to “development that meets the needs of the present generation without compromising the ability of the future generation to meet their own needs” (Brundtland & Khalid, 1987). Thus, there exists a general consensus on the three pillars of sustainability – people, planet, and profit – also referred as the triple bottom line (Arowoshegbe et al., 2016). From a policy perspective, this approach is at the core of United Nations (UN) and national and sub-national policies to foster an entrepreneurial ecosystem that synthesises and delivers on social, environmental, and economic dimensions (Larsson et al., 2016).

Similar to conventional entrepreneurship, SE also operates through innovative business models that represent the interaction between value elements and value flows within these ventures. Thus, it is important to explore how SE can make a business case – i.e. ensure profitability by clearly defining

## 12 Sustainable Entrepreneurship and the Global South

Table 2.1 Conceptual evolution of sustainable entrepreneurship

<i>Approach Sustainable management</i>		
<i>S.no</i>	<i>Definition</i>	<i>Sources</i>
1	The continuing commitment by businesses to behave ethically and contribute to economic development while improving the quality of life of the workforce, their families, the local and global community as well as future generations	Crals and Vereeck (2005)
2	An innovative, market-oriented, and personality-driven form of creating economic and societal value by means of break-through environmentally or socially beneficial market or institutional innovations	Schaltegger and Wagner (2011)
3	Is focused on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society	Shepherd and Patzelt (2011)
4	A way of generating competitive advantage by identifying sustainability as new business opportunities, resulting in new and sustainable products, methods of production, or ways of organising business processes in a sustainable way	Lans et al. (2014)
5	The types of business development practices that provide new opportunities for innovative corporate activities at the nexus of ecological and social issues	Urbaniec (2018)
<i>Approach Entrepreneurship process</i>		
<i>S.no</i>	<i>Definition</i>	<i>Sources</i>
1	The process of discovering, evaluating, and exploiting economic opportunities that are present in market failures which detract from sustainability, including those that are environmentally relevant	Dean and McMullen (2007)
2	The examination of how opportunities to bring into existence 'future' goods and services are discovered, created, and exploited, by whom, and with what economic, psychological, social, and environmental consequences	Cohen and Winn (2007)

(Continued)

Table 2.1 (Continued)

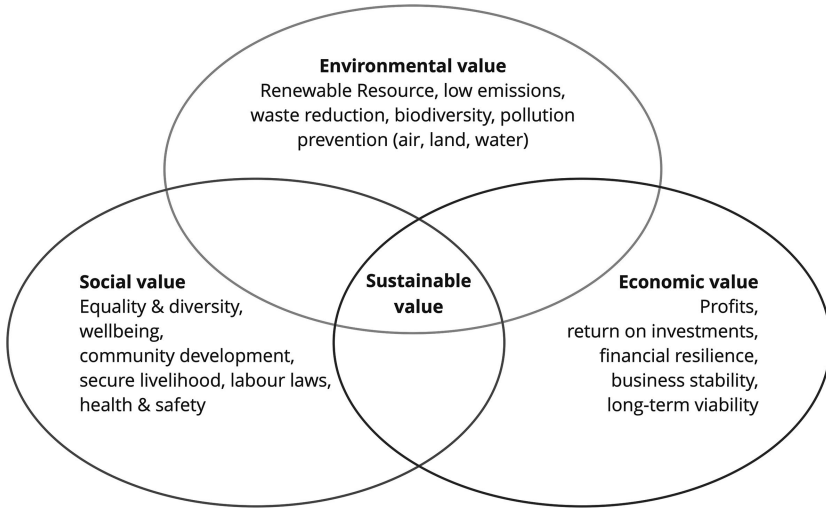
<i>Approach Sustainable management</i>		
<i>S.no</i>	<i>Definition</i>	<i>Sources</i>
3	The teleological process aiming at the achievement of sustainable development, by discovering, evaluating, and exploiting opportunities and creating value that produces economic prosperity, social cohesion, and environmental protection	Katsikis and Kyrgidou (2007)
4	The discovery and exploitation of economic opportunities through the generation of market disequilibria that initiate the transformation of a sector towards an environmentally and socially more sustainable state	Hockerts and Wüstenhagen (2010)
5	The discovery, creation, evaluation, and exploitation of opportunities to create future goods and services that are consistent with sustainable development goals	Pacheco et al. (2010)
6	The discovery, creation, and exploitation of opportunities to create future goods and services that sustain the natural and/or communal environment and provide development gain for others	Patzelt and Shepherd (2011)
7	The recognition, development, and exploitation of opportunities by individuals to bring into existence future goods and services with economic, social, and ecological gains	Belz and Binder (2017)

*Source:* Adapted from (Terán-Yépez et al., 2020).

products and services, target markets, and anticipated costs, risks, etc. (Scott & Thompson, 2012). The next section would therefore identify the core organisational strategies deployed by entrepreneurs to create value across the three pillars of sustainability.

### 2.2.1 *Business models for sustainability*

Sustainable business models entail a simultaneous focus on generation, delivery, and capture of social, environmental, and economic value. Value creation and delivery refer to critical business practices intended towards development of market offerings, managing channels and partners, mobilising resources, and using technologies and innovating (Dhahri et al., 2021). Value capture refers to defining cost structures and acquiring revenue



*Figure 2.1* Value integration for sustainable entrepreneurship.

*Source:* Adapted from (Evans et al., 2017).

streams. Hence, sustainable business models are “sources of competitive advantage in which incorporating sustainable value proposition, value creation, and value capturing mechanisms bear economic benefits to the companies” (Porter & Kramer, 2011).

A crucial development brought about by SE is the transition towards a more service – oriented approach wherein the business model is devised to integrate economic, social, and environmental value – hence creating a more holistic meaning of value itself (Dickel, 2018). Thus, value integration in these business models would mean that enterprises can maximise financial benefits, society benefits from the business activities, and ecological challenges are also catered to (Figure 2.1). In this sense, SE potentially delivers greater stakeholder satisfaction, as such innovative business models are devised to generate higher value for consumers by contributing to society and organisational development.

Strategies predominantly used in sustainability-oriented business models include clean technologies, product stewardship, sustainability visions, and pollution/GHG reduction. These strategies support sustainability targets such as equitable distribution of resources, poverty alleviation, increasing accountability and procedural justice, waste reduction, and minimising carbon footprint (Evans et al., 2017). Hence business models for sustainability in accordance with such strategies and drivers, aim at accounting for the interests of multiple stakeholders, rather than prioritising the demands of shareholders (Contreras & Rodríguez, 2015). Sustainability is not always

achieved through product innovations in the form of introduction of green products and technologies, rather sustainable value creation can also be achieved through process innovations. For instance, innovative business models integrating more procedurally just strategies, based on exchanges and relations with multiple stakeholders (Gray et al., 2014), especially with the emergence of digital technologies, social media, consumer forums, etc., are important spaces through which consumers are empowered to influence business practices. This is an opportunity identified by sustainability-driven entrepreneurs as they innovate business models to transform consumers from passive to active co-creators of value and organisational processes (Evans et al., 2017; Haldar, 2019c). Consumer data including consumption patterns, expectations, and challenges are crucial inputs for SE.

Hence, there are four characteristics that distinguish sustainable business models from conventional ones (Boons & Lüdeke-Freund, 2013). First, the value proposition of a sustainable business model is that of social and/or environmental value, accompanied by economic value. Second, the value chain of these business models also demonstrates supplier responsibility towards the firm's stakeholders. Third, promotion of sustainable consumption is also a key goal. Last, the financial model for sustainable business models also accounts for social and ecological costs in addition to economic gains.

Not only sustainability-oriented businesses from their inception but also incumbent firms that aim at incorporating sustainability principles in their operations at later stages of their establishment are benefitted by sustainable business models across different industrial sectors. Scholarship on SE has explored application of such business models in energy, healthcare, fashion, agri-food, construction and engineering, and hospitality industries. This concept also finds application in both emerging and developed economies. In the next section, we look at how SE perspectives have been articulated and operationalised in the Global North and South economies, given their diverse resource bases, social, institutional, and political contexts.

### **2.3 Surfacing diverse global perspectives**

Recent academic literature has observed a proliferation of SE in both organisational and individual contexts. Given the potential of economic activities to cause ecological disruptions and exacerbate social inequities, understanding the conception and application of SE is imperative for both developed and transition economies. So, in the past three decades (since late 1990s) SE has evolved from an abstract idea to a more practical and pressing phenomenon, driven by multiple global, national, and sub-national challenges such as food and energy security, climate change, economic instability, environmental degradation, and resource scarcity (Anbarasan & Sushil, 2018).

The extant literature on SE suggests notable differences as well as overlaps between the Global North and South economies.

### *2.3.1 Sustainable entrepreneurship in Global North versus South economies*

In terms of impact, number of publications, and publishing systems, the domain of SE is mainly dominated by Global North perspectives (Contreras & Dornberger, 2022). When looking at central concerns, SE scholarship in the Global North is primarily aimed at resolving environmental challenges, while in the Global South – in often emerging economies, research and practice in this domain grapples with societal and economic concerns. This points out to the fact that a one-size-fits-all approach to SE may not benefit all regions and stakeholders equitably (Yazdani & Dola, 2013). SE strategies in the developing world are hence more focused on business success as the primary goal, and social and ecological values, although recognised, are secondary objectives. Conceptually, a major gap remains in the lack of more context-specific theorisation and operationalisation of SE emerging from developing nations, characterised by often-resource-constrained and complex sociopolitical and institutional environments (Contreras & Dornberger, 2022).

A comparison of articulation and implementation of SE across varied global regions demonstrate how the landscape for economic, environmental, and socially beneficial business practices are often shaped by diverse and multilevel socioeconomic, institutional, technological, and cultural contexts (Coenen et al., 2012; Ioannou & Serafeim, 2012; Urbano et al., 2019). The economic conditions for SE are considerably different between Global South and North economies. The Global North – mostly developed economies are characterised by stronger institutions, and robust and formalised industrial sectors. This means entrepreneurial strategies towards sustainability goals often integrate advanced innovation and technological solutions (Wagner, 2017). Entrepreneurial opportunities in these regions stem from economic stability, and institutional support for sustainability objectives which is driven by consumer demand, regulations, and CSR frameworks (Cohen & Winn, 2007; McMullen et al., 2008; Stenholm et al., 2015). The core targets for SE in developed nations comprise making business sense for climate solutions including reducing carbon footprints, transitioning to RE, and greening existing business models (Schaltegger & Wagner, 2011). On the contrary, the economic context in Global South economies is often marked by poverty, informality, resource constraints, and underdeveloped infrastructure (Kumar & Sharma, 2024). Research conducted on SE in these Global South contexts mainly addresses the bottom of the pyramid (BoP) concerns. BoP refers to an impoverished population that is unable to

meet basic needs, most of which reside in developing nations (Vachani & Smith, 2008). Hence, SE in these contexts is often necessity driven, with a dominant focus on addressing immediate socioeconomic paucities including affordable and reliable energy, clean water, healthcare, transport, etc. In this backdrop, grassroots innovation and frugal innovation that aims at developing cost-effective solutions catering local needs are a common phenomenon linked to sustainability (Halme et al., 2012; Radjou & Prabhu, 2015). Hence, entrepreneurs develop practical and low-cost approaches to achieve economic and social sustainability through adaptive solutions that speak to the resource-constrained contexts of the Global South (Read et al., 2016).

Social and cultural contexts are also important determinants of the goals and strategies adopted by SE. In the developed economies of the Global North, the prominent discourse on environmental sustainability shapes consumer demand for sustainably produced goods and services. This cultural and behavioural focus towards environmental sustainability presents opportunities for entrepreneurs to align their business practices to tap into markets that value responsible production and consumption (Parrish, 2010). This societal preference for environmental value reflects in the integration of sustainability principles in brand identity and sophisticated marketing strategies of businesses. However, in the developing economies, sociocultural values are deeply entrenched with community needs, beliefs, and struggles around public infrastructure access. SE in these settings hence takes the form of community-oriented approaches to achieve poverty alleviation, social inclusion, and empower vulnerable social groups (Kimmitt & Muñoz, 2018). Grassroots innovation and bottom-up initiatives are common mechanisms to resolve pressing local concerns. Such an approach to SE depicts more commonality with social entrepreneurship wherein enterprises are embedded within the social and cultural fabric and aim at directly addressing the needs of local communities (Ney et al., 2014). Participatory approaches and co-creation of innovations are a dominant feature of such entrepreneurial practices (Mair & Marti, 2009).

The varied institutional and regulatory contexts also impact the way SE is understood and implemented in different regions of the world. In the developed world, regulatory instruments including tax benefits, preferential funding, research and development (R&D) support, viability gap funding, etc., incentivise sustainable business models. International and government agencies through discourse shaping and policy mechanisms are actively involved in steering business innovations towards sustainable production (York & Venkataraman, 2010). However, Global South economies are often faced with inconsistent and weak institutional environments for SE. This is often due to political instability, resource constraints, complex and lengthy certification and clearance procedures, bureaucracy, and corruption

(Halder, 2022; Halder & Tripathi, 2023). In such contexts, SE is often dependent on informal networks, civil society organisations, subsidies, tax rebates, and international aid to sustain their ventures (George et al., 2012; Halder, 2022). In these emerging economies, as the regulatory ecosystem is typically less mature, SE often develops and operates outside of formal institutional settings, taking a more bottom-up and frugal approach (Ananthram & Chan, 2021; Hossain, 2020).

The form of innovations that drive sustainability in business practices also depicts distinct patterns in the Global North and South economies. Benefiting from well-established infrastructure and services, access to global markets and technologies, the entrepreneurs in Global North economies undertake innovative practices that are high-tech solutions to achieve sustainability targets. Such innovations include RE technologies, green products, and digital platforms that align with consumer preferences and follow environmental standards (Hockerts & Wüstenhagen, 2010). Thus, SE in these regions is often characterised by sophisticated technological innovations. While in the Global South, sustainability values are approached through frugal innovation, i.e., developing affordable and less complex solutions to address local needs, tailored to the local contexts (Basu et al., 2013). Such innovations are more inclined towards generating social and economic value, while environmental value is an accompanying outcome. Some elements of SE in Global South include small-scale RE solutions, agricultural innovations, and low-cost cooling systems, etc. – resource-efficient approaches for addressing concerns of low-income communities (Radjou & Prabhu, 2015). SE in these regions is oriented towards adopting existing technologies to local needs, to achieve affordability and scalability, rather than cutting-edge sophisticated technological innovations (Read et al., 2016).

In terms of core sustainability objectives, the resource, institutions, policy, and social and cultural contexts in different regions shape what is deemed critical for SE. Values prioritised by sustainability-oriented entrepreneurs in diverse global contexts reflect the differing challenges and needs of these regions. In the developed countries, sustainability priorities predominantly align with global environmental goals including biodiversity conservation, reducing GHG emissions, fostering a circular economy, etc. (Schaltegger & Wagner, 2011). These objectives are embedded in business strategies and are pushed by regulatory standards, policy incentives, and consumer demand for sustainable production and consumption. In the Global South, SE objectives include addressing basic infrastructure and service needs –water, energy, sanitation, housing, etc. – hence improving human wellbeing and generating livelihoods. Agricultural innovations are a common outcome of SE given the paucity of resources in these economies (Halder & Sharma, 2022b; Kumar & Sharma, 2024; Mair & Marti, 2009). Hence, the primary

focus of SE in Global South regions entails creating economic and social value, especially for underserved communities, addressing local scarcities, and ultimately contributing to broader development needs.

As discussed in this section, it is evident that SE as a concept has emerged mainly from the Global North, with limited attention to the contextualities and challenges of the developing economies. Although with the proliferation of the field now there is growing evidence how this concept is perceived, articulated, and operationalised differently under diverse regional contexts, that speak to the resource, technology, socioeconomic, and political realities of these regions. It is noticeable that SE priorities in the Global North are aligned more strongly with environmental objectives, while those in the Global South are framed in the context of existing social and economic challenges. This also means that the nature of innovations carried out by such entrepreneurial ventures vary across these regions. Understanding the overlaps and divergence in SE practices and values is crucial to develop strategies that can effectively stimulate and support an ecosystem for sustainable production and consumption in unique and often complex contexts of each of these regions.

## **2.4 Conclusion**

The novel and necessary phenomenon of SE presents profound implications for both theory and practice across industrialised and emerging economies of the world. Tracing the theoretical trajectory of this concept, SE represents an important shift from conventional profit-centric entrepreneurial models towards a responsible approach to innovation and entrepreneurship that integrates social, economic, and environmental dimensions. Such a transformation is particularly central for tackling multifaceted global challenges such as socioeconomic inequities, resource depletion, and climate change. Developing an understanding of the practice-based underpinnings of SE and its evolution as a concept under diverse contextual realities is key to steering more effective and tailored strategies for fostering just and sustainable development across regions.

The analysis of literature on SE practices in the Global North (developed) and South (developing) economies surfaces the dichotomy between its conception and application in these regions. Sustainable business models in the developed economies are often shaped by robust institutional support, policy certainty, advanced technological innovations, and a growing market for sustainably produced goods and services. These conditions serve as opportunities for entrepreneurs to implement sophisticated business models that harmonise economic gains with other sustainability objectives. Comprehensive regulatory frameworks and CSR requirements further support these efforts to create value on multiple sustainability dimensions while

making business sense. For instance, the stringent environmental standards, incentives, and regulations regarding social and environmental costs of businesses to achieve net zero by 2050, under the European green deal, exemplify the conducive infrastructure and policy environments for SE in the Global North. Conversely, in the emerging economies of the Global South, SE appears to be driven by the need to address immediate socioeconomic deprivations. SE is often perceived here as a more bottom-up, frugal, or grassroots innovation developed to deliver on sustainability-oriented outcomes under resource-constrained environments. This perspective on a necessity-driven approach to entrepreneurship surfaces the resilient and adaptive potential of SE in the Global South economies. For instance, examples of solar-powered lanterns in rural Africa, energy-efficient low-cost cooling systems in India, or agro-ecological innovations in Brazil demonstrate how SE can directly offer solutions to critical local needs while performing on sustainable development goals. However, SE initiatives are often encountered with significant challenges including underdeveloped regulatory and market conditions, limited access to resources including capital, and inadequate technology access and advancements.

This evident dichotomy in SE discourse in the Global North and South regions calls for the need to develop context-specific theoretical and conceptual frames that can comprehensively speak to the diverse conditions under which such entrepreneurial practices develop and operate. Moreover, given the urgency of climate action globally, it is imperative to depart from the traditional focus of entrepreneurship theories on competitive advantage, market opportunities, and pure economic gains. This narrow view of the potential of entrepreneurship is often critiqued in contemporary debates for overlooking social and environmental value creation, which is integral to sustainable development. This theoretical expansion to SE is key for guiding effective policymaking and fostering an environment where sustainable businesses can thrive, particularly in resource-constrained settings.

In light of the discussion so far, there are certain propositions that can be considered by diverse actor groups including researchers, policy makers, and practitioners, to foster a place-based and effective ecosystem for SE development at different national, regional, and sub-national scales. First, from the perspective of research, as most of the literature on SE is skewed towards and is emerging from developed Global North countries, there is scope for theoretical and empirical work that integrates the ground realities of socioculturally diverse, often resource- and infrastructure-deficit economies of the Global South. This is important to understand how SE is conceptualised and conditions that shape the nature of such entrepreneurs in the said regions. This also means conducting cross-sectional analysis along with longitudinal studies to not only understand the spatial but also the temporal dynamics and outcomes of SE in the short, medium, and long-term in diverse regional contexts. Such research can highlight similarities and differences in motives, drivers, impacts, and nature of SE across different

global contexts, hence forming the basis for a more informed, empirically grounded theoretical frame for SE. Second, more interdisciplinary research drawing from economics, regional development, management, science and technology studies, innovation studies, environmental science, and institutional theory could offer in-depth understanding of the concept and unravel its true potential to drive transformative change. Third, from a policy and practice perspective, there is a need to develop policies and regulations that support SE tailored to the context in which these entrepreneurs operate. Creating an environment conducive for such entrepreneurial niches would require financial, technological, and policy support. Driving societal change through awareness campaigns and market and policy instruments is also crucial to drive the demand for SE. This is particularly important for developing nations. Some of these measures might include tax benefits for green businesses, public investment on sustainability-driven innovations and research, sustainability focused credit rating, and strict certification and standardisation procedures related to environmental and social costs of businesses. Lastly, given that the ecosystem for such innovative business models is still in its emergent phases and the policy and regulatory infrastructure is not well established in developing nations, capacity building is a core touch point to ensure that the new age entrepreneurs are equipped with the necessary skills and knowledge to navigate this complex terrain of resolving the economy, environment, and society trilemma.

Thus, realising the full potential of SE requires concerted efforts from multiple stakeholders at multiple levels to ensure supportive and stable market and policy conditions, generate robust theoretical insights, and implement effective and just practices across regions. As this new breed of entrepreneurs, along with the global community, continues to navigate the complex dynamics of aligning economic prosperity with social justice and environmental stewardship, the starting point is to map and evaluate the trajectory of SE as a concept. Having done so, thus far, the next chapter situates SE in the domain of renewable energy (RE) transition which is an imperative and inevitable mitigation strategy against climate risks. Energy transitions are established as a massive sociotechnical reordering, and India is one of the forerunners in driving this global shift towards RE with a whooping installed capacity of 149 (approx.) GW<sup>1</sup> by the second quarter of 2024. Hence, the third chapter draws on the concepts of sociotechnical transition to demonstrate how sustainability-driven entrepreneurs are key to driving this massive RE transformation in India. In doing so the chapter also sheds light on the energy and industrial policy environment, and market factors that might drive or hinder SE in the RE sector in India.

## **Note**

1 <https://mnre.gov.in/physical-progress/>.

# 3 Environment, energy, and sustainable entrepreneurship

## Conceptual framing, landscape conditions, and niche characteristics

### 3.1 Introduction

Attempts to define SE like its counterpart green entrepreneurship have established that it is crucial to understand what comprises a sustainable business in order to scope SE. ‘Green’ can be used in both absolute and relative sense as well as from a product and process perspective. Most scholarship in this context, press on the essentiality of a green belief system or intentionality to undertake SE (Isaak, 2016; Schaltegger, 2002) However, the notion that ‘entrepreneurial activity that benefits the environment’ irrespective of portraying ecological motives seems as a more holistic approach to SE (Walley et al., 2016). Although green entrepreneurship emphasis is more towards compliance with environmental standards while generating profits, it is difficult to see how environmental value addition does not benefit societies. Hence, it is quite improbable to separate and prioritise ecological, social, and economic motives in sustainable businesses. As sustainable businesses are driven by a mix of social, economic, and environmental orientation, charitable, voluntary, and public sector foundations are excluded from this conception. It is in this backdrop that ‘an individual who starts -up and/or runs a for-profit, and significantly green, business by virtue of the nature of its end product’ will hereafter be referred to as a sustainability-oriented entrepreneur. A departure from eco-social motivations or intentionality (unlike social and green entrepreneurship) also justifies this work’s adoption of an outcome or end-product oriented approach to SE. By virtue of their end products, sectors or industries hence comprising of businesses including recycling and reuse, waste disposal and collection, research and education, consultancy and monitoring, energy conservation, eco-capital equipment, heritage and ecotourism, in-firm green production, forestry and organic farming, and alternative green product production (Eastwood et al., 2001) can be considered a breeding ground for SE.

Specifically at a time when developing nations like India are susceptible to adverse impacts of climate change in the form of urban heat islands, and infrastructure and economic risks (Babiker et al., 2022), along with

increased health risks due to extreme weather events, energy transitions towards renewable energy (RE) is not only imperative but also inevitable for mitigating and adapting to climate impacts. In line with global discourse on climate action, India's Nationally Determined Commitments (NDC) at the Paris Agreement 2015 marked its intent to take leadership position by rapidly increasing the share of RE to 40 percent in the total energy mix by 2030. India has achieved this target well ahead of time – as by October 2023, 43.81 percent of its installed electricity capacity came from non-fossil sources.<sup>1</sup> With call for urgent action to limit global warming to 1.5 degrees Celsius in the Intergovernmental Panel on Climate Change (IPCC) AR6 reports (Babiker et al., 2022; Revi et al., 2022), it is becoming increasingly evident how in an above 1.5 degrees scenario climate change would cascade from environmental to economic threats. For instance, prolonged droughts leading to food security challenges and high inflation can multiply risks across sectors while reducing the societal resilience to conflicts and pandemics (Calvin et al., 2023). In response, India has revised its NDC to be able to achieve net zero by 2070, through decarbonising the energy sector with an installed RE capacity of 50 percent by 2030 (Haldar et al., 2024).

Transforming the energy sector towards non-fossil technologies is identified as a core foundation for India's climate mitigation and adaptation policy. However, this is not an easy puzzle. While pushing towards a RE dominant power sector regime, India is at a path of rapid urbanisation and infrastructure led economic development. This poses a dilemma of balancing decarbonisation goals with shooting up energy demand for economic development and urbanisation (IEA, 2021a). Hence, by virtue of its end-product that has significant potential for social, environmental, and economic value generation, energy transitions towards renewables paves way for a sustainability-oriented industry. While grappling with political, technological, sociocultural, and economic conditions, sustainability-oriented entrepreneurs serve as critical niche actors that offer an entry point to unfold the processes involved in transitioning from a fossil fuel-based regime to a new RE dominant regime. SE takes up multiple roles at different temporal and spatial levels to intermediate policy processes, legitimise RE technology adoption, shape consumer demand, and make business sense for energy transitions.

In this backdrop, the next section conceptualises energy transitions by evaluating its potential for just and sustainable development and conceptualises it as massive sociotechnical transformation processes. Moving forward, we embed SE as niche (micro) processes that interact with regime (meso) and landscape (macro) level processes to drive the shift from fossil to non-fossil energy futures. In doing so, we explore some of the regime and landscape conditions that shape and are shaped by the SE ecosystem in India. We zoom in to the western Indian state of Gujarat which has

a long-standing culture of entrepreneurship and contributes about 12.5 percent to the country's cumulative installed RE capacity.<sup>2</sup>

### **3.2 Conceptualising energy transitions**

As discussed so far, energy transition is not merely a technological shift from fossil fuels to RE or alternative energy technologies. It is a highly complex and socio-politically entrenched process which entails forming policy discourses, demand creation and shifting behavioural patterns, and identifying and leveraging market opportunities for new product development, and diffusion. Energy is not just a service, but it is a means to achieve multiple ends related to economic development, social, and environmental wellbeing. With shifting global (landscape) and national and sub-national (regime) discourse towards legitimising and diffusing clean energy technologies, there has been an environment of policy certainty and regulatory incentives for renewables over the past two decades. Sustainability oriented entrepreneurs, irrespective of their motivations (e.g. compliance-based environmentalism, market-driven, or value-driven environmentalism) recognised RE technologies as an opportunity to achieve profits while also performing on ecological and social dimensions. However, shifting towards RE poses questions for energy security – potentially hampering India's growth trajectory which is heavily reliant on fossil fuels. Presently, around 80 percent of India's energy demand is being met by oil, coal, and solid biomass. As a result, given the scope for further energy demand and infrastructure is humungous over the next two decades the country needs to add a power system the size of the European Union (EU) in addition to its current capacity (IEA, 2021a). While 21st century decarbonisation efforts are underway, India is still grappling with the 20th century challenges of an inefficient and financially stressed distribution system, continued reliance of around 660 million people on traditional cooking fuels, and rapidly growing urban population exposed to poor air quality and structural inequities (Haldar et al., 2023; Haldar & Sharma, 2022). Thus, the role of SE becomes key in balancing the trilemma of energy, economy and environment in India and other global economies. In doing so entrepreneurs often act at institutional, policy, market and consumer levels to articulate the demand for RE technologies, align policy and market mechanisms towards creating a conducive ecosystem for investments, and learn from feedback (van Lente et al., 2003). To understand how SE is a key driver of energy transitions, it is important to first understand the dynamics of this shift at a temporal and spatial scale.

#### *3.2.1 A massive sociotechnical reconfiguration*

The explanatory efforts towards energy transitions remain somewhat elusive despite a large and expanding literature on this area. This is not alarming

given the disciplinary diversity and real-world complexities in economic development, policy change, and technological innovation dimensions that shape these long-term processes. Energy transitions from a narrower perspective have been understood as shallow and trivial shifts in individual energy technologies in specific markets over a few years. As opposed to this, a systemic thinking on energy transitions aligns more with its key role in mitigating climate risks and addressing sustainable development goals. Thus, deeper shifts involving multiple technologies across multiple, national, sub-national, and global scales over decades reveal the far-reaching scope of energy transitions. Based on this conception energy transitions refer to “a change in the state of an energy system as opposed to a change in individual energy technology or fuel source” (Grubler et al., 2016). Notably, wide and deep energy system transitions do not necessarily mean transitioning towards clean, low-carbon, modern, or distributed energy systems. Historically, grand system transitions are exemplified by the involvement of fossil fuels and, more recently, nuclear energy (Smil, 2010).

At a national scale, energy transitions have been conceptualised as three distinct types of systemic change. First, a *technoeconomic systems* lens focuses on energy flows associated with production and consumption processes, that is coordinated through energy markets. Second, the *sociotechnical systems* perspective concerns practices, knowledge, and networks pertaining to energy technologies. Third, the *systems of political actions* refer to conditions shaping energy policy and regulations (Cherp et al., 2018). Although each of these approaches offers a systemic perspective on national energy transitions, while relying on specific disciplinary roots, variables, concepts, and theories to explain change and continuity in relevant systems, these are also susceptible to criticism based on their limited explanatory scope. For instance, the technoeconomic approaches extensively use quantitative models of energy systems to predict long-term scenarios of change under different assumptions related to energy resource access, economic growth, and historic patterns of renewing energy infrastructure. These models have been used to estimate the climate risks and costs of decarbonisation policies (Clarke et al., 2014), policies needed to achieve development goals like universal energy access (Pachauri et al., 2013), and reducing energy imports (Dalla Longa et al., 2022). However, one of the limitations of this approach is that it does not explain or even explore, whether or under what circumstances, real-life policymakers would be willing and could be able to engage in climate and energy policymaking that can address these above-mentioned and more sustainable development goals. In fact, the technoeconomic perspective considers policies as exogenous and normative targets placing them outside of its focus, as an object or analysis. Another constraint in its explanatory prowess lies in its dependence on historical data to predict the evolution of energy systems. Hence, overlooking the impacts of path dependence, innovation, and inertia in energy technologies (Wilson

et al., 2013). It is important to note that technological innovations, their adoption and diffusion, as well as policymaking also originate from systems different from energy-economy systems that form the focus of technoeconomic perspectives. Similarly, approaches that take a political standpoint to explain energy transitions are critiqued for a poor representation of material factors and hence are limited in their scope in surfacing structure and agency interactions (Cherp et al., 2018; Haldar, 2022).

To understand the dynamics of energy transitions from a more nuanced and holistic lens, it is therefore important to look beyond narrow technocentric and apolitical processes and explain national energy transitions as embedded within complex sociotechnical and political contexts. The mechanisms that determine the emergence and diffusion of new technologies have been approached through multiple disciplinary lenses including science and technology studies (STS), sociology of technology, and evolutionary economics. As opposed to the technoeconomic and political perspectives, sociotechnical framing of technological change involves a more complex and nuanced understanding of technological change as a social phenomenon. This tradition explains sociotechnical systems as

.... configuration of technologies, services and infrastructures, regulations and actors (for example, producers, suppliers, policy makers and users) that fulfils a societal function such as energy provision.

(Schot et al., 2016)

The sociotechnical transition framework hence adopts a broad sociological perspective while combining actor-based microeconomic and institutional conditions with historical macroeconomic conditions to explain adoption and diffusion of new technologies (Geels et al., 2016; Grubler, 2012). The Multilevel Perspectives (MLP) is one of the most influential framings in sociotechnical analysis owing to its merits in explaining technological change through knowledge practices and diffusion processes facilitated by technological innovation systems (Jacobsson & Johnson, 2000; Markard et al., 2012). The MLP is also widely used as it is capable of surfacing how technological lock-ins, regime resistance, and disruptions play out in transition processes. In this context, this approach is key to explaining how energy systems transition from fossil to RE regimes through an interplay of macro, micro, and meso-level phenomenon. The proceeding section discusses the dynamics of the MLP framework in detail.

### 3.2.2 *The Multilevel Perspective to (energy) system transitions*

The central conceptual unit of the sociotechnical perspective is a *sociotechnical regime*. This refers to a shared set of routines and rules that govern the

sociotechnical systems to deliver on the relevant social function (Schot et al., 2016). Regimes are characterised by their stability and resilience against exogenous and endogenous pressures such as supply chain disruptions or market failures. To maintain their status quo and to expand, regimes often support certain innovations, but also block radical innovations that might risk their stability. This is explained as *technological lock-ins* wherein even beneficial innovations and technologies are resisted because they are incompatible with the shared rules and practices of the dominant regime (Unruh, 2000). Some of the lock-in mechanisms that destabilisation of existing regime include regulations, shared beliefs, consumer preferences, barriers to entry, existing infrastructure, vested interest groups, low production costs due to economies of scale, and sunk investments. The innovations that have potential for creative destruction and emerge outside the dominant regime are of interest for a sociotechnical analysis of energy and similar system transitions. These innovations that have potential to overcome regime lock-ins occur in protected *niches* which are characterised by more fluid actors, practices, rules, and boundaries. Such novel technologies from the onset are unable to compete with established or incumbent technologies and practices in the dominant regime. This might be for several reasons, including high initial costs or complexities in usability. Niches serve as breeding ground from such innovations where they can organise, mature, and become competitive to enter the dominant regime. Specifically, proponents of the strategic niche management approach emphasise the development and maintenance of such innovative niches to stimulate creation, adoption, and diffusion of novel technologies (Kemp et al., 1998). The *sociotechnical landscape* is the most stable level of the MLP frame. This refers to the wider exogenous context that influences both the micro-niche and meso-regime level configurations. Political ideologies, social values, spatial structures, global discourses, and macroeconomic trends comprise some of the landscape influences that often shape the directionality of system transitions.

As demonstrated in Figure 3.1, the main premise of the MLP is that sociotechnical transitions stem from a complex multidimensional interplay across the niche (locus of radical innovations), regime (locus of established practices and associated procedures), and landscape (exogenous sociotechnical factors) layers. The MLP displays a form of nested hierarchy. Niches might be embedded within or outside the dominant regime (Geels, 2002). However, sociotechnical regime changes cannot be instilled by individual actors – signalling the iterative nature of this framework.

Although niche innovations build up internal momentum by introducing radical technologies in the market, because of the resilience of the regime, they are not automatically capable of displacing the incumbent regime even if they become more effective in delivering on certain social functions. To displace the dominant regime, the lock-ins and supporting structures need

Increasing structuration  
of activities in local practices

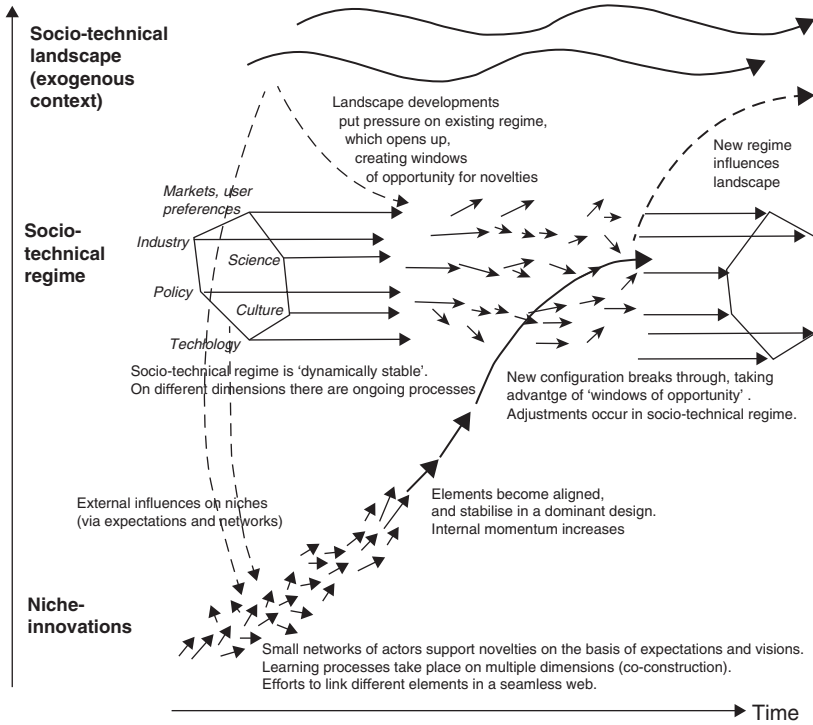


Figure 3.1 Multilevel perspectives on sociotechnical transition.

Source: Geels (2012)

to be destabilised. This could occur through multiple distinct yet simultaneous processes, for instance, by external landscape pressures that create windows of opportunity for niche actors to further destabilise the regime. Pathways to regime destabilisation mostly represent rapid nonlinear change hence deviating from the assumptions of simple causality (Geels & Schot, 2007). An important implication of the MLP approach is its advocacy for *circular causality* surfacing that there is no single driver of sociotechnical change. Thus, transition is an outcome of interactions among mutually reinforcing, multidimensional processes.

Based on this perspective, energy transitions towards renewables can be understood as a massive sociotechnical reordering wherein sustainability-driven entrepreneurs serve as key niche actors who identify new opportunities arising through landscape conditions such as global discourse on decarbonisation and India's response through ambitious NDCs

and supportive policy. These entrepreneurs help to adopt and diffuse RE innovations by mobilising resources, shaping consumer perceptions, and developing business models to make RE technologies competitive with the existing regime that is fossil fuel dominant. The next section makes a case for integration of SE into the MLP framework by arguing that this heterodox form of entrepreneurship is a crucial entry point into understanding how energy systems transition from conventional to RE regimes.

### *3.2.3 Sustainability-oriented entrepreneurs as niche actors*

The Schumpeterian theory of entrepreneurship introduced a conceptual shift by identifying entrepreneurship as a function of innovation – thereby serving as a catalyst for economic development and change through creative destruction of existing (regime) practices (Swedberg, 2009). Schumpeter discussed five typologies of entrepreneurial innovation namely, (1) introduction of new product or service, (2) introduction of a new method of production, (3) opening of new market, (4) conquest of new source of supply of raw materials, and (5) creation of new organisation of industry, for instance, breaking up a monopoly or acquiring monopoly position (Scherer, 2011). Entrepreneurs engaged in SE, who combine financial, social, and environmental value creation rather than being solely driven by either profits or green motives, are essential for transforming the existing regime. This also excludes not-for-profit, charitable, and public organisations that are solely focused on social impact. Such entrepreneurs either establish *green-green* businesses (Isaak, 2016) or radically transform existing businesses to achieve sustainability outcomes by virtue of their end products (Eastwood et al., 2001). As key niche actors, they play a vital role in fostering development and gaining a competitive advantage in sustainable innovations.

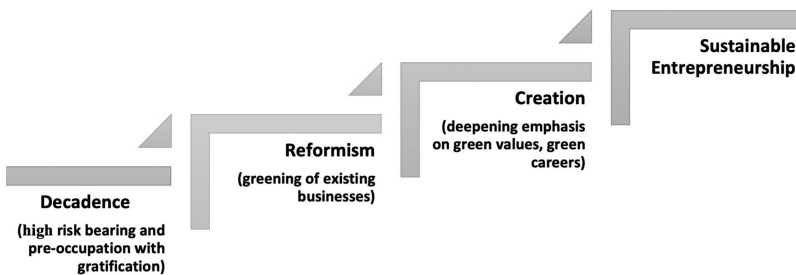
In this context, energy transitions considered sustainable by virtue of their end-result (i.e. RE or GHG reduction), emerges as an ideal sociotechnical process, wherein we analyse the significance of sustainability-oriented entrepreneurs as key agents of change. Sustainability-oriented entrepreneurs can be argued to be operating at the regime level as well, for instance, supplying inputs to incumbent firms. However, the Schumpeterian function of innovation and creative destruction is most certainly fulfilled at the niche (micro) level (Hockerts & Wüstenhagen, 2010; Petersen, 2016; Schaltegger, 2002). This is because, incumbent companies are often locked-in due to past investments and path dependencies, hence having limited potential to drive transformative change (Hockerts & Wüstenhagen, 2010). However, emergent innovative ventures such as start-ups or micro, small, and medium enterprises (MSMEs) are more open to radical changes and risk takings demonstrating potential for transformative sustainability outcomes.

Thus, in terms of energy transitions, SE is pivotal for creating safe breeding grounds for new RE innovations (products and services) to destabilise the existing fossil fuel regime. However, only developing RE innovations and technologies is not sufficient to ensure economy-wide adoption and diffusion. This means SE to be able to trigger energy (or other system) transitions need to increase the market share and shape consumer demand in favour of their products and services while maintaining high sustainability values. But this cannot be accomplished solely at the niche level. Interaction with regime (meso) and landscape (macro) level conditions, such as public policy, global politics, and producer networks, including established firms, is also necessary. Interactions with niche processes support integration of sustainable innovations into the mainstream. This integration is achieved through mechanisms such as economies of scale, fair trade labels, shifting consumer perceptions, and supportive policy environments (Geels, 2011).

Creating protected spaces for innovations, exploiting windows of opportunities being created by landscape conditions, and organising these innovations to achieve competitive advantage, hence disrupting the existing (fossil fuel) regime, occur through a learning curve (Figure 3.2).

As the market shifts from the initial stage of *decadence* to the final stage where SE becomes the dominant phenomenon, characterised by “radically reducing risk to the natural environment by supporting only green-green entrepreneurship and sustainable economic growth,” entrepreneurs engage in market creation and innovation diffusion to pursue societal and environmental goals by means of profit-oriented enterprises (Isaak, 2016).

But as discussed thus far, destabilising the dominant regime does not occur solely through niche processes. Now zooming in on the energy transitions in India, the next sections surface the regime and landscape conditions that support niche actors in mainstreaming RE technologies and innovations. Given the Western Indian state Gujarat’s historical reputation for entrepreneurship and its contribution of 12.5 percent to India’s installed



*Figure 3.2* Learning curve for sustainability-oriented entrepreneurs.

*Source:* Author’s Composition Based on (Isaak, 2016).

renewable energy capacity, this region has been selected as the focus for niche, regime, and landscape analysis.

### **3.3 Identifying niche, regime, and landscape conditions**

Building on the MLP framework, we frame sustainable entrepreneurship as a niche phenomenon. In this section, we shift focus to the contextual conditions shaping RE entrepreneurship in Gujarat. We specifically discuss how niche innovations interact with regime structures and broader landscape pressures. In the state of Gujarat, these interactions are influenced by both local industrial conditions and overarching national policies that govern state-level initiatives. National climate commitments, global climate discourse, and economic imperatives represent landscape conditions that shape the state's regulatory environment (Geels, 2014) and the opportunities available to sustainability-oriented (RE) entrepreneurs. At the regime level, state policies, infrastructure, and market dynamics, are crucial in either enabling or constraining the development of niche actors. Having said so, sustainability-oriented entrepreneurs are supported by a diverse array of niche and regime actors who operate across multiple levels of governance, transcending strict analytical boundaries. This highlights the complex, iterative nature of interactions within and between governance levels. In the following section, we examine how these multilayered and dynamic interactions between niche innovations, regime structures, and landscape conditions collectively shape the development and diffusion of sustainable entrepreneurial practices in Gujarat's RE sector.

#### **3.3.1 *Renewable energy market in India***

Renewable energy has been increasingly positioned in India as a means to enhance economic development, energy security, energy access, and affordability, while mitigating climate risks. Recognising the growing attractiveness of global RE markets, India's national policy framework, coupled with favourable economic conditions, is strategically positioned to propel the country towards a leadership role in the global RE landscape (Venkatesan et al., 2015). RE also serves as a key vehicle for attracting foreign direct investment (FDI) and mobilising domestic private capital, which are critical for addressing the country's broader development needs, including infrastructure development, employment generation, and expansion of public services (Raihan et al., 2024).

Given the existing policy certainty and economic opportunities in this sector, India has made rapid strides in terms of capacity addition of various forms of RE technologies including wind, solar, small hydro, biomass, and waste to energy, both through grid-connected and off-grid systems.

Especially given its Paris Agreement, 2015 – Nationally Determined Contributions (NDCs) to achieve 40 percent of cumulative installed electricity capacity from non-conventional sources by 2030 – India has been on the path to finetune policy and regulatory environment to support transition towards RE sources. Interventions such as competitive bidding, feed-in-tariffs (FiT), renewable energy certificates (REC), and renewable purchase obligation (RPO) are some of the national-level institutional mechanisms that influence rapid uptake of RE at sub-national levels. These interventions have yielded positive results; as on 31 October 2023, India had already achieved its NDC with 43.81 percent of the cumulative installed capacity being from RE sources. In response, in August 2022, the NDC was revised to 50 percent from non-fossil fuel sources by 2030.<sup>5</sup>

An analysis of the trajectory of nationwide RE capacity addition in the past decade (2014–2015 to 2023–2024) offers insights into how the market share for RE entrepreneurship has expanded in India, resulting from landscape conditions in the form of international and national commitments, policy, and regulations (Figure 3.3).

A significant increase in installed capacity per annum can be observed from 2013–2014 to 2017–2018, with a peak in 2017–2018. The cumulative capacity of RE in 2013–2014 was around 36 GW, which witnessed a fivefold increase over the decade, i.e. approximately 153 GW by 2023–2024 (Figure 3.3). This transformative shift in India’s energy landscape resulted from an aggregate impact of landscape, regime, and niche

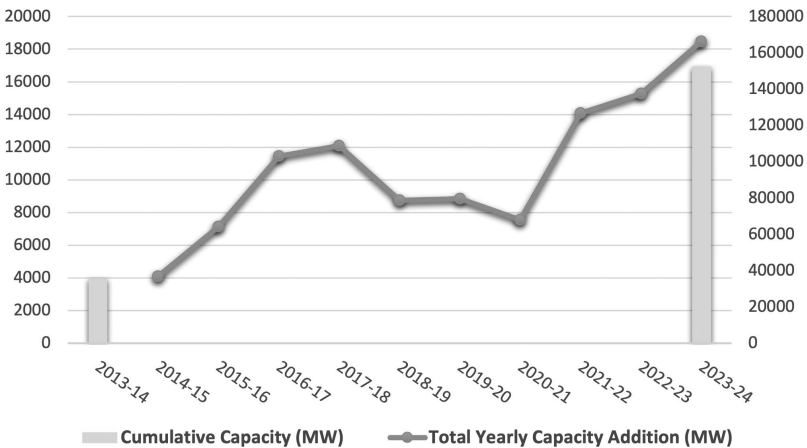


Figure 3.3 Cumulative and year-wise installed renewable energy capacity (excluding large hydropower) (2014–2015 to 2023–2024).

Source: Author’s Compilation (Ministry of New and Renewable Energy, Government of India).

interactions. Landscape pressures – both global and national – shaped the policy and market environments that support or resist SE in the RE sector in India.

In response to the broader landscape pressures meant to destabilise the fossil fuel dominant regime, India's annual capacity additions for RE grew exponentially, starting with a notable 60 percent year-on-year increase between 2014–2015 and 2015–2016. This was followed by another year of year-on-year growth by 60.6 percent in 2016–2017. One of the major landscape shifts that stimulated growth in RE capacity was the National Solar Mission (NSM), 2010. This precluded India's broader climate commitment and decarbonisation ambitions under the Paris Agreement, 2015, where India committed to achieving 175 GW RE installed capacity by 2022 (Styczynski, 2024). Critical regulatory instruments including the RPO in 2003 and financial incentives like the generation-based incentives (GBI) in 2011<sup>4</sup> aimed at positioning entrepreneurs at the forefront of India's energy transition by offering long-term market security and subsidies that incentivised new ventures, particularly in the wind and solar energy segment (Chawla et al., 2024).

However, there was a considerable slowdown in RE capacity addition between 2017–2018 and 2020–2021, with annual capacity additions declining at an average of 14.54 percent over this period. This deceleration corresponds to flux in policy mechanisms, including the transition from FiTs to auction-based competitive bidding, which, while driving down costs, also introduced significant price volatility (Sarkar, 2024). Thus, auction mechanisms often called reverse bidding, though promoting competition and grid parity for renewables, disproportionately affected smaller sustainable entrepreneurs, who are often incapable of competing against large incumbents in auction-based procurement systems. Moreover, this slowing down of the uptake also resulted from policy uncertainties and risks attributed to Power Purchase Agreements (PPAs) and challenges with grid integration of renewables. One of the main bottlenecks with PPAs pertains to the complexity of negotiation processes that typically comprise multiple stakeholders (developers, distribution companies – Discoms, legal firms, and lenders). The inadequacy in terms of a standardised PPA framework in India adds to this complexity, often leading to delays in finalising agreements, impeding project financing, and extended execution timelines (Srinivasan et al., 2023). Another layer of transition risk is added by regulatory uncertainty. The Indian electricity market is highly regulated, and this landscape is dynamic, with frequent changes in tariff designs, policies, and incentives for RE. Especially uncertainties, around tariffs reduce the predictability that both developers and buyers rely on, leading to hesitation from financial institutions and investors to fund projects dependent on long-term PPAs (Acharya, 2021).

The intermittent nature of RE sources like wind and solar power means that weather conditions often determine the developers' capability to deliver on agreed-upon energy production schedules (Charles Rajesh Kumar & Majid, 2024). Strict penalties associated with failure to deliver on contracted supply obligations under PPA's is even more challenging in emerging economies like India, where RE grid integration is still evolving and current infrastructure constraints do not fully allow for seamless balancing of intermittent sources with conventional electricity generation. Bankability of PPAs is also a challenge. Given the existing poor financial health of Discoms, delay in payments to RE developers under long- and mid-term PPAs is a common cause of contestation. Hence, the absence of secure, long-term revenue predictability hinders lenders' confidence in financing RE infrastructure (Acharya, 2021). Such landscape-level conditions including regulatory instabilities and fluctuations in global commodity prices, or geopolitical conflicts, translate to resistance for smaller RE enterprises (niche actors) to enter and expand their market share (Sawhney, 2024).

Despite this loss in momentum, the RE sector bounced back strongly post-2020–2021 with an increase of around 87 percent between 2020–2021 and 2021–2022 (Figure 3.3). The production-linked incentive (PLI) scheme for the National Programme on High-Efficiency Solar Photovoltaic (PV) Modules was approved by the Union Cabinet in the first quarter of 2021<sup>5</sup>. This step towards strengthening the RE supply chain and reducing dependence on imports can be partially attributed to the resurgence in RE capacity addition during this period. Thus, landscape interventions including the National Solar-Wind Hybrid Policy, 2018 (Das et al., 2020) Green Energy Corridors, Startup India and Priority Sector Lending schemes proved to be critical in realigning the existing regime with broader landscape pressures. The uptake was further strengthened by declining costs of RE technologies and global discourse on increasing climate finance and technology transfer (Srinivasan et al., 2023), creating new windows of opportunities for SE to tap into the expanding RE market. This is evidenced by the robust growth trajectory of India's RE market with a compound annual growth rate (CAGR) of approximately 35 percent between 2020–2021 and 2023–2024.

Looking at the trends in capacity addition for RE reveals how RE infrastructure, particularly in the electricity sector, has been expanding in the country in response to positive policy and market signals. However, it is also important to analyse the trends in how much is the actual proportion of RE sources in the total primary energy mix of the country. This reveals how much of the total energy supply across multiple sectors including cooking, electricity, transport, industries, etc., is produced through non-conventional sources (Figure 3.4).

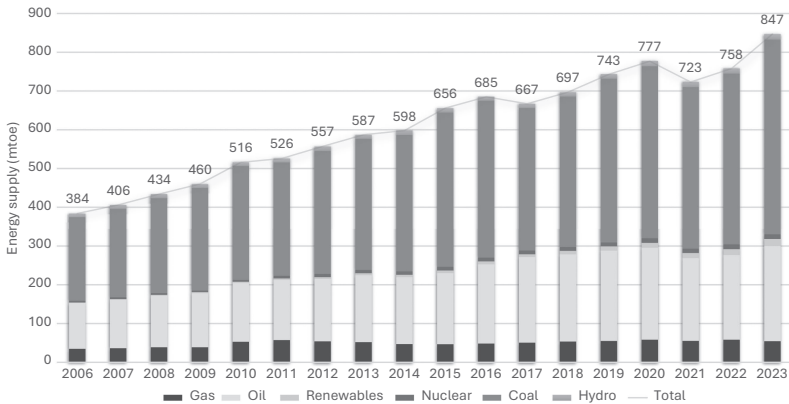


Figure 3.4 Source-wise contribution to primary energy mix (supply) in India (2006–2023).

Source: Author’s compilation (NITI Aayog).

With around 43 percent of total installed capacity accruing to RE, India’s commitment to ‘greening’ the grid is evident. At the same time, the integration of renewables into the broader energy mix remains a humongous challenge – given its actual contribution of merely around 2 percent in the country’s total primary energy supply.

Even after significant RE capacity addition in the electricity sector, the country’s energy landscape is still highly dependent on coal followed by oil and gas. In 2023 alone, 59 percent of the primary energy supply was attributed to coal, accounting to 502.46 million tonnes of oil equivalent (mtoe). Oil (245.46 mtoe) and gas (54.63 mtoe) also remain critical components of the energy mix owing to their reliability and higher efficiency in meeting India’s rapidly expanding energy demand (Figure 3.4). Hence, despite growing political consensus on the need for climate change mitigation, fossil fuels are still seen as indispensable for ensuring energy security and continuous power generation against the massive economic development and urbanisation projections for India.

RE, on the other hand contributed only 2.16 percent (18.27 mtoe) to the total primary energy mix in 2023. This although reflects a significant growth from 0.59 mtoe in 2006, with a CAGR of 13.7 percent between 2020 and 2023. The significant disparity between installed RE capacity and their actual contribution to energy supply alludes to the challenges of intermittency, inadequate grid integration, and lower base load capacities (Medina et al., 2022). Solar and wind energy, in particular, while central to India’s clean energy strategy, face limitations due to their dependence on weather conditions and the absence of large-scale energy storage solutions (Gangopadhyay et al., 2024).

Coal, however, grew at a steady pace – a CAGR of 4.2 percent between 2020 and 2023 catering to the high economic and industrial demands. Hydropower and nuclear, unlike solar and wind, are relatively stable sources but contributed merely 1.56 percent (13.97 mtoe) and 1.43 percent (11.95 mtoe), respectively, to the total primary energy mix in 2023. As discussed so far, while national and sub-national policies and regulations like the NSM, RECs, and RPOs have accelerated RE infrastructure development particularly in the power sector, the real feat is to translate this generation capacity into meaningful contributions to the broader energy supply across sectors.

Now we move to a more focused analysis of how sub-national policies and market processes support or restrict SE in the RE industry in the western Indian state of Gujarat, which with its historic focus on entrepreneurship and significant contributions to the RE basket of the country, has established itself as one of the forerunners in the RE landscape. Here we look into the market share, some specific landscape, regime, and niche attributes to understand how SE emerges and is being influenced by multilevel actors, institutions, and processes while operating within a state.

3.3.2 *Gujarat as the frontrunner*

Gujarat ranks second in terms of total RE installed capacity among all Indian states, next only to Rajasthan as on 31 August 2024 (MNRE, 2024<sup>6</sup>). The state contributes approximately 15 percent to the total RE basket of India, with around 17 percent of India’s solar capacity and 26 percent of the wind energy capacity (Figure 3.5). Hosting around 29 GW of RE capacity, wind

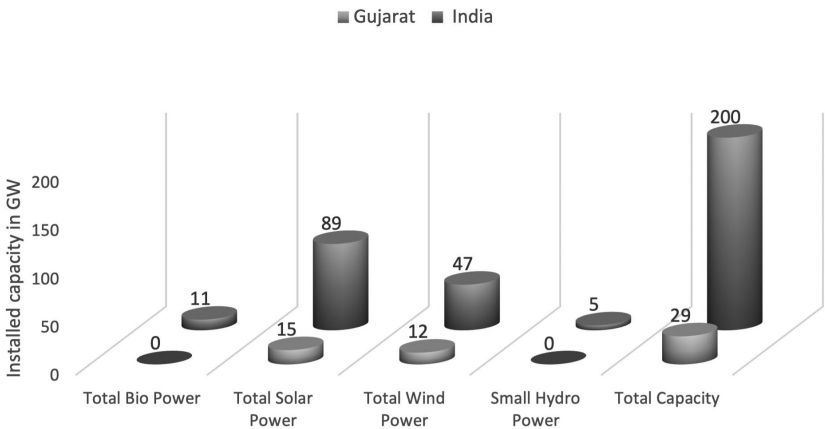


Figure 3.5 Source-wise installed RE capacity in India and Gujarat in MW (31.08.2024).

Source: Authors’ Computation (MNRE, 2024).

and solar power are the dominant sources of non-conventional energy in the state. Gujarat is also home to the 730 MW Charanka Solar Park, commissioned in 2012, and one of the first large-scale solar projects in the country. These statistics depict the favourable conditions for SE in the state leading to identification and exploitation of opportunities for increasing the market share for renewables.

Analysing the composition of the total installed energy capacity mix, renewable energy sources (RES) contribute a significant 51 percent, with coal and gas (fossil) accounting to a total of 42 percent of the total capacity (Figure 3.6). Hence, in terms of electricity infrastructure, Gujarat is already on the path to greening its grid, while supply integration and storage concerns may remain. The Gujarat Renewable Energy Development Agency (GEDA) is the state nodal agency that promotes RE adoption and market creation in accordance with the national decarbonisation mandates, hence contributing to an entrepreneurial and innovation ecosystem development in this sector. In response to national (landscape) guidelines for RE adoption, GEDA has implemented several policies to promote both decentralised off-grid and grid-connected RE systems to ensure energy security and decarbonisation of lighting, cooking, and productive energy needs in both rural and urban regions. The Gujarat Wind-Solar Hybrid Power Policy, 2018, for instance, supports wind-solar hybrid projects in the state and incentivises storage technologies. In addition to waiving off additional tariffs on transmission capacity for hybridising existing wind or solar plants, this policy also offers state support for R&D and standardisation. The recent Gujarat RE policy, 2023 is aimed at simplifying the framework for RE project development in the state and attract private capital in the sector<sup>7</sup>. In line with national mandate, several financial and fiscal incentives including tax holidays, subsidies, viability gap funding, and exemption from electricity duties are in place at the state (regime) level. Land being recognised as a key input for RE capacity development, the Gujarat government has specific incentives such as allocating government waste land at concessional rates for RE projects (Ghosh et al., 2023).

These present significant opportunities for sustainability-oriented entrepreneurs to tap into the emerging market opportunities and serve as both demand-pull and supply-push agents (Onoshakpor & Ogundana, 2024). Given that the total installed energy capacity in the state is majorly owned by the private sector (76 percent), the role of SE in diffusion and adoption of RE innovations emerges as paramount (Figure 3.6). Sustainability-oriented entrepreneurs can act as demand-pull agents by demonstrating the feasibility and profitability of RE innovations and technologies, encouraging similar businesses, investors, and consumers to adopt these solutions. The potential of SE to reduce uncertainties through innovative business models and market creation strategies, given that the national and sub-national policies also support RE adoption can spur widespread adoption of RE technologies, as other businesses follow suit (Tryndina et al., 2022).

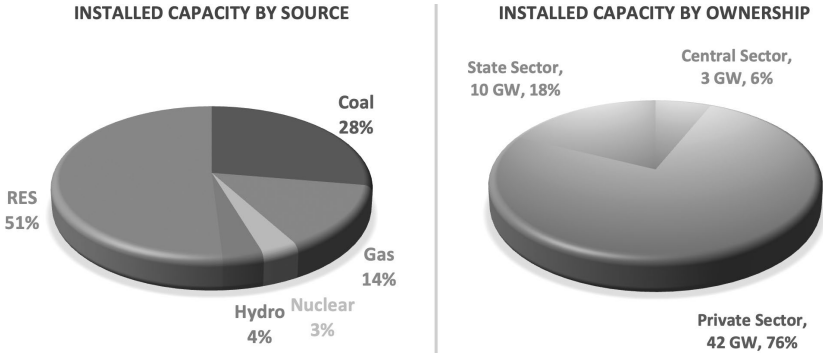


Figure 3.6 Source-wise and ownership-wise installed energy capacity in Gujarat (August 2024).

Source: Author’s Computation (Central Electricity Authority, 2024; <https://cea.nic.in/dashboard/?lang=en>).

As regards the supply side, SE pushes the boundaries of technological innovations through scaling supply chains and introducing product innovations. These innovations are aimed at increasing efficiency and cost reduction to make RE technologies economically viable for both consumers and producers. Hence, through their dual function as demand-pull and supply-push agents SE generates feedback loops where greater adoption of RE drives further advancements and profitability.

Hence, businesses operating in the RE industry can be understood as niches that adopt and diffuse RE innovations – both product and process, leveraging the windows of opportunities created by national and sub-national policy processes (landscape conditions) to mainstream RE technologies in the existing fossil-dependent regime. To understand how these sustainability-oriented niches emerge, organise, and then become potent enough to destabilise existing regimes, it is important to uncover the individual and firm-level characteristics of sustainability-oriented entrepreneurs in Gujarat. The next section thus, analyses both secondary and primary data on RE entrepreneurial ventures operating across six districts in the state of Gujarat to surface their characteristics.

**3.3.3 Understanding sustainable entrepreneurial niches in Gujarat**

SE emerges as an important catalyst for driving RE markets through product and process innovations, given the push from landscape and regime conditions. To surface the intrinsic conditions that shape SE niches in Gujarat, it is important to look at the individual- as well as firm-level characteristics that shape entrepreneurial behaviour and success or failure in the RE industry. In

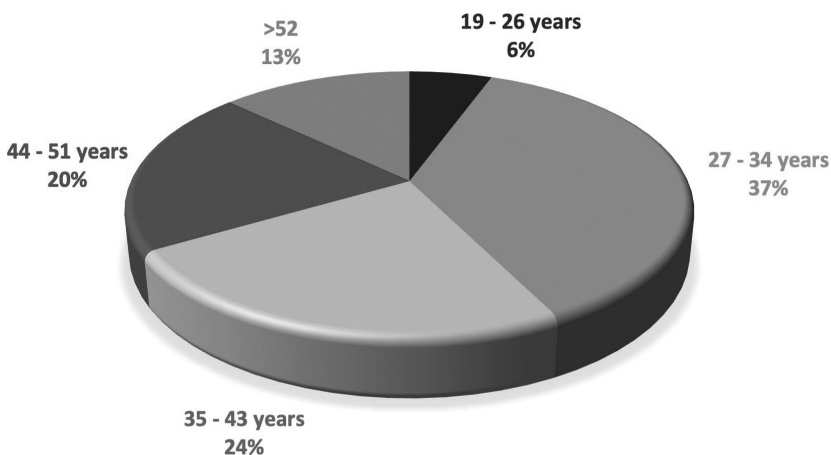
doing so, we analyse empirical insights from 54 RE entrepreneurs located across six districts of Gujarat, namely – Surat, Gandhinagar, Ahmedabad, Rajkot, Anand, and Vadodara. Individual characteristics that might impact entrepreneurial behaviour towards sustainability include age group, education, family occupation, and social status. While firm-level characteristics include type of innovation focus, ownership structure, age of firm, firm size (number of employees), type of product or service provisioning, nature of partnership, source of equipment and product design, and type of consumer. Data on these indicators was collected in a phased manner, through a structured interview tool and follow-up semi-formal interviews were conducted based on the observed trends that needed clarification.

### 3.3.3.1 *Individual characteristics of entrepreneurs*

In this study conducted in Gujarat, a survey of 54 entrepreneurs indicates that the largest proportion (37 percent) falls within the age group of 27 to 34 years. The age of respondents ranges from 23 to 59 years, with a mean age of 38 years. Notably, a majority of entrepreneurs in this sector (67 percent) are under the age of 43, indicating a relatively younger demographic.

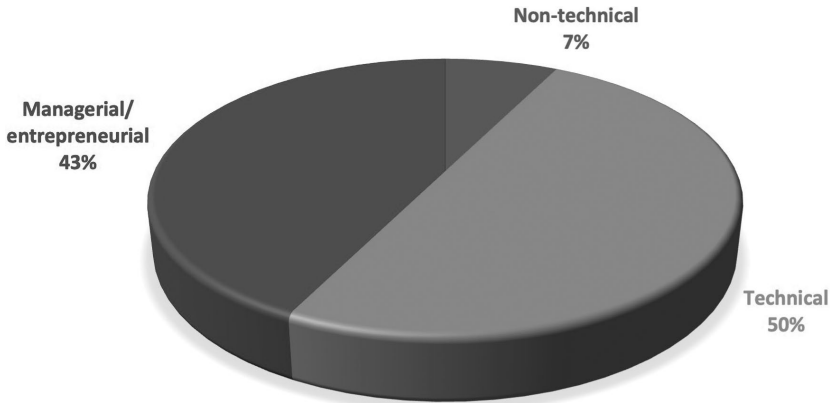
These findings suggest that the RE sector in Gujarat is characterised by a significant presence of younger entrepreneurs, which may have implications for the sector’s development needs and adaptability (Figure 3.7).

Figure 3.8 illustrates the educational profile of RE entrepreneurs. Among the 54 entrepreneurs surveyed, 50 percent possess technical training or educational qualifications in engineering or related fields, while 43 percent have



*Figure 3.7* Age-wise distribution of entrepreneurs.

*Source:* Primary Survey, 2019.



*Figure 3.8* Educational qualification of respondents.

*Source:* Primary Survey, 2019.

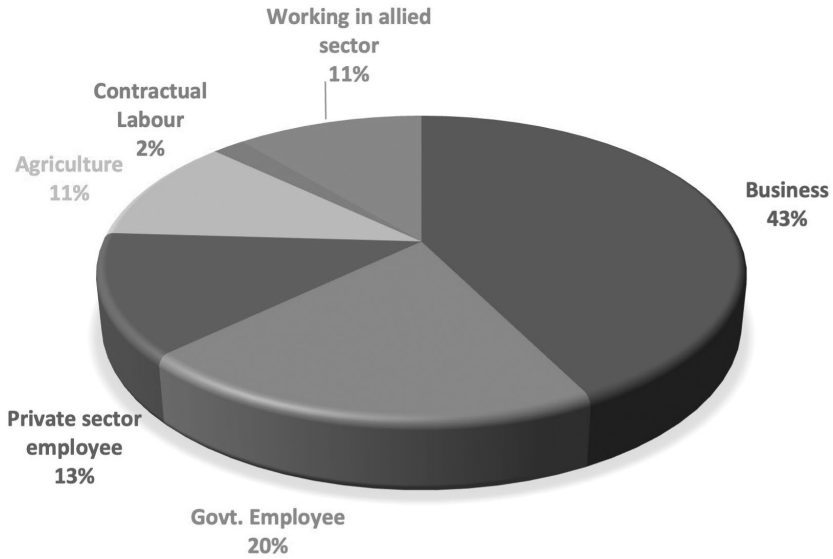
degrees in management or entrepreneurship. Only 7 percent of the respondents have non-technical educational backgrounds, such as in arts or commerce.

These findings suggest that having specialised skills and knowledge is important for success in the RE sector. Many of the surveyed entrepreneurs have technical or managerial backgrounds, which reportedly help them navigate the challenges of this industry. The need for technical expertise and strong management skills is particularly relevant when dealing with complex renewable technologies like solar, wind, or bioenergy systems. This may explain why most of the entrepreneurs in this sector have training in either technical fields or management. These trends have important implications for SE, as they indicate that fostering technical and managerial skills may be key to supporting the growth and resilience of such ventures.

With respect to family occupation, a significant portion – 43 percent – come from business families. Among these, 11 percent reported that their families are involved in power sector-related businesses, such as the power or electronics sectors. In total, 54 percent of the entrepreneurs surveyed come from a business oriented family background (Figure 3.9).

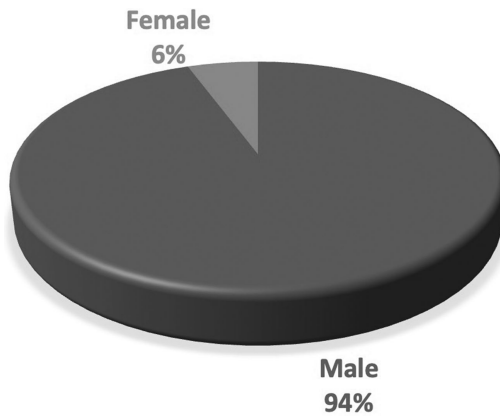
These findings suggest that having business as family occupational background may provide positive reinforcement for the development of entrepreneurial skills and attitudes. This is consistent with existing literature, which indicates that family occupation and background can significantly influence the formation of entrepreneurial attitudes (Agarwal & Upadhyay, 2009).

Among the total respondents, 94 percent are male, while only 6 percent (three respondents) are female entrepreneurs, highlighting the significant gender disparity in the renewable energy (RE) sector (Figure 3.10). Insights gathered from interviews suggest that this underrepresentation of women may be influenced by several factors, including the preference for



*Figure 3.9* Family occupation of respondents.

*Source:* Primary Survey, 2019.



*Figure 3.10* Gender-wise distribution of respondents.

*Source:* Primary Survey, 2019.

work-life balance and the challenging nature of on-site working conditions, such as climbing heights and exposure to harsh weather conditions.

Analysis of the social status of the surveyed RE entrepreneurs reveals that 74 percent belong to the General category, 19 percent are from Other Backward Classes, and 7 percent belong to the Scheduled Caste category.

### 3.3.3.2 *Organisational characteristics of RE ventures operated by respondents*

We now discuss the organisational characteristics of RE ventures operated by the 54 respondents. These characteristics include age of the venture, the type of product or services offered, firm size, ownership structure, and type of innovation engaged in.

Figure 3.11 demonstrates the age-wise distribution of RE ventures across six districts of Gujarat. These firms have been classified into three categories: infant firms (i.e.  $\leq 5$  years), young firms (i.e. five to nine years), and mature firms (i.e.  $\geq 10$  years). The analysis indicates that a majority are either young or infant firms, while mature firms represent a smaller proportion. Spatial analysis shows that most RE firms are concentrated in Ahmedabad and Gandhinagar. Specifically, 85 percent of these firms have been in operation for less than ten years, illustrating the emergent nature of the RE sector in this region. The observed spatial concentration can be linked to the strategic roles of Ahmedabad and Gandhinagar as the financial and administrative hubs of Gujarat, as well as their proximity to the Gujarat Energy Development Agency (GEDA), which acts as a key facilitator for renewable projects. Moreover, policy initiatives favouring the solar photovoltaic (PV) industry have shaped a market environment that allows opportunities to new entrants.

The 54 firms surveyed are engaged in engineering, procurement, and construction (EPC); operations and management (O&M) services; and manufacturing and selling RE products, including solar PV, solar thermal, biomass gasifiers, and wind energy equipment. Most of these firms are service providers, followed by solar PV manufacturers (Figure 3.12). Notably, service providers are concentrated in Ahmedabad and Gandhinagar, leveraging proximity to administrative and financial centres as discussed above. Solar PV manufacturers are mainly located in Ahmedabad, Surat, and Gandhinagar, while firms involved in both solar PV and wind systems cluster in Ahmedabad (Primary Survey, 2019).

Such spatial distribution highlights the importance of proximity to administrative and financial centres for growth in the sector. Specifically, the concentration of firms in Ahmedabad and Gandhinagar was corresponded to strategic location being considered crucial for overcoming industry challenges and achieving sustained growth. The prevalence of service-oriented firms may indicate that current market conditions favour EPC and O&M services, and since manufacture and sale is a capital incentive segment, it is often not suitable for smaller ventures. (Figure 3.12).

The discontinuation of generation-based incentives for wind power from 1 April 2018 led to reduced demand, making the sector less appealing for entrepreneurs (WISE, 2017). Following the Paris Agreement of 2015, the

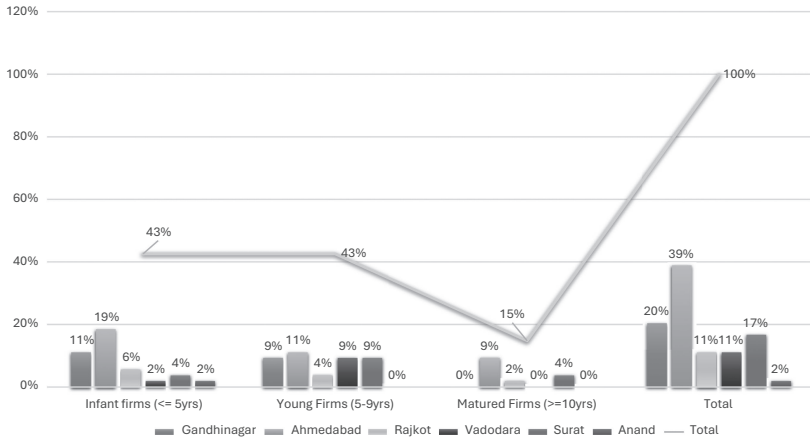


Figure 3.11 Age-wise spatial distribution of RE firms.

Source: Primary Survey, 2019.

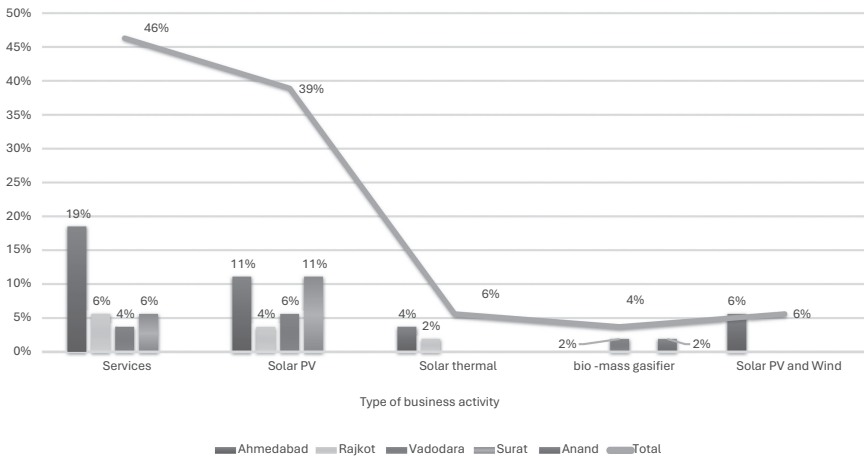


Figure 3.12 Type of business activity (service/manufacturing) engaged in across product segments and location.

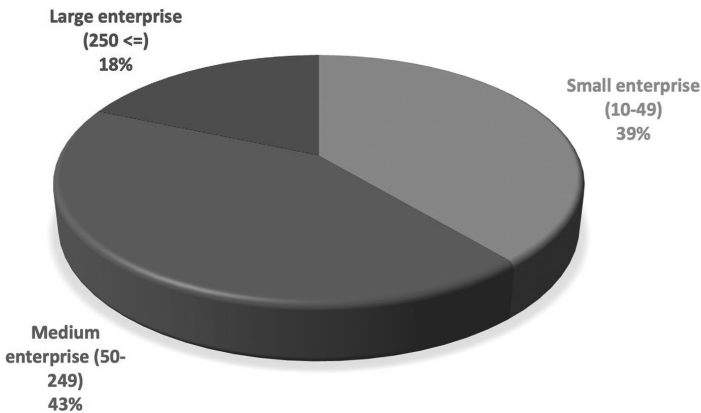
Source: Primary Survey, 2019.

RE target was set at 175 GW by 2022, with wind power targeted at 60 GW – a target that was arguably conservative, given the sector’s installed capacity of 25 GW by 2015–2016. The abrupt shift in policy towards favouring solar PV resulted in a withdrawal of support for wind energy, and annual capacity additions of 4 to 5 GW were not being met since 2017 (Haldar, 2021a). This shift illustrates the importance of stable policy frameworks for

balanced growth across RE sectors. Reduced support for wind energy has prioritised solar PV, hindering a more diversified energy mix. For entrepreneurs, it demonstrates the need for strategic alignment with policy changes and highlights the risks associated with policy uncertainty.

Figure 3.13 presents an analysis of firm size based on the number of employees, categorising firms as small (10 to 49 employees), medium (50 to 249 employees), and large (250 or more employees), following the OECD classification (OECD, 2017). Majority of RE firms among the sample, fall into the medium enterprise category, followed by small enterprises. Firm sizes range from 12 to 1,708 employees, with a mean employee size of 184 and a median of 67 (Figure 3.13). Thus, 82 percent of the sample qualify as SMEs, demonstrating that the RE sector in Gujarat is predominantly in the process of capital accumulation and market consolidation, with the majority of the firms navigating initial growth phases.

In terms of the ownership structure of the 54 ventures studied, majority are either Sole Proprietorships or Private Limited companies, whereas Public Limited companies, LLPs, and cooperatives represent a smaller proportion (Figure 3.14). Regarding partnership type, 35 percent of firms are family-based, while 33 percent operate without any partnership arrangement. Partnerships among extended occupational networks make up 17 percent, and only 15 percent involve community members. The prevalence of Sole Proprietorships and Private Limited ownership structures aligns with literature on emerging sectors, which suggests that entrepreneurs tend to favour ownership models that offer control and flexibility during early growth stages (Carney, 2005). Similarly, the dominance of family-based partnerships is consistent with studies emphasising trust and resource-sharing within familial networks as critical to entrepreneurial ventures in nascent industries (Licht & Siegel, 2006).



*Figure 3.13* Firm size based on number of employees.

*Source:* Primary Survey, 2019.

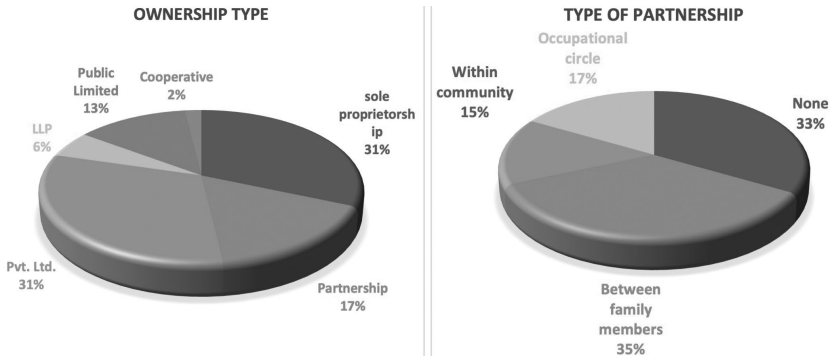


Figure 3.14 Ownership structure of firms.

Source: Primary Survey, 2019.

The sample indicates that majority of the firms focus on process innovations (24 percent) – such as organisational changes, managerial reforms, and production upgrades, or do not innovate in any form (24 percent) (Figure 3.15). Notably, 37 percent of the firms surveyed engage in product innovation, but often prioritise design elements, like solar trees and aesthetic solar lights, rather than improving solar panel efficiency or developing new products for diverse energy needs (Halder, 2021b). This focus on design over technical advancements was reportedly attributed to significant barriers including high R&D costs, insufficient policy support, and a lack of advanced technical skills. As the RE market is still emerging, there is a perception that investing in advanced technologies may not yield sufficient returns due to limited demand.

These trends illustrate a sector where cost constraints and policy environments drive firms towards incremental, accessible innovation instead of transformative advances. The alignment between business activities and innovation types further supports this narrative; manufacturing firms, driven by necessity, tend to invest in product development, whereas service providers, limited by expertise and financial capacity, focus on modest process improvements or avoid innovation altogether (Halder, 2021a). This suggests that practical constraints currently outweigh the potential for radical innovation.

The predominance of service-oriented firms in system integration and trading, with minimal innovation activity (mostly process), contrasts with manufacturing firms that are more likely to pursue product innovation. This indicates that manufacturing firms have both the imperative and resources for product development, whereas service firms often lack the means to innovate (Figure 3.15).

The policy environment exacerbates these issues. A focus on subsidies and tax incentives rather than direct R&D support has led firms to prioritise

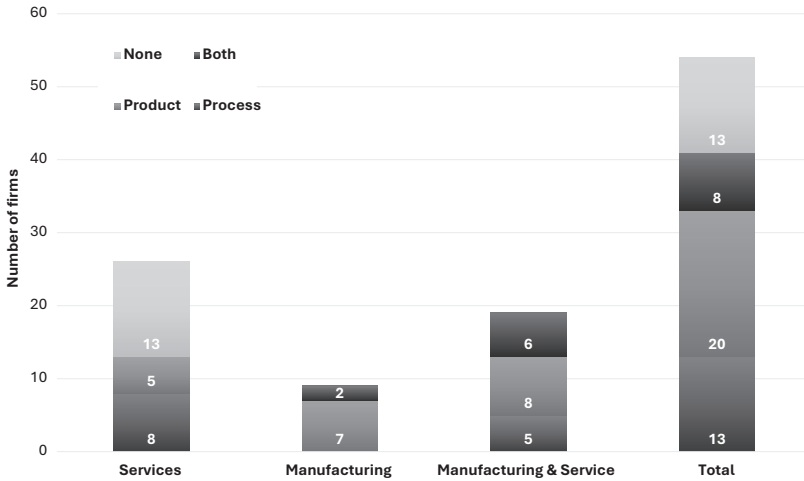


Figure 3.15 Type of innovation across type of business activity.

Source: Primary Survey, 2019.

short-term operational improvements over long-term product innovation. As service provision dominates the sector, opportunities for transformative innovations are limited (Haldar, 2021a). Addressing this gap calls for targeted R&D incentives to encourage innovation across the sector, fostering a diverse and resilient RE ecosystem. Recent national policies address some of these gaps – like the production-linked incentives (PLI) to achieve GW scale manufacturing capacity in high-efficiency solar PV modules. This scheme has an outlay of around 3 billion USD aimed at creating an ecosystem for high-efficiency solar PV manufacturing – thus reducing India’s import dependence for RE technologies (MNRE, 2022).

In the RE sector, diversification into allied industries like power electronics, smart home systems, telecommunication, textiles, and consumer goods is common. For MSMEs, diversification is vital to counter low-profit margins and high competition, while larger firms leverage their capacity for comprehensive risk management. Sixty-seven percent of small and 65 percent of medium enterprises have diversified vertically or horizontally in the current sample, compared to all large enterprises – highlighting the strategic capacity of larger firms (Figure 3.16). Given the low profitability in RE, driven by competitive pressures, diversification acts as a critical buffer, ensuring steady capital flow and financial stability. Larger firms see diversification as an opportunity to expand market reach, while for MSMEs, it is a tool for survival. Hence, diversification in the RE sector is not just a growth strategy, but is fundamental for stability and resilience in a rapidly changing industry (Haldar, 2021a).

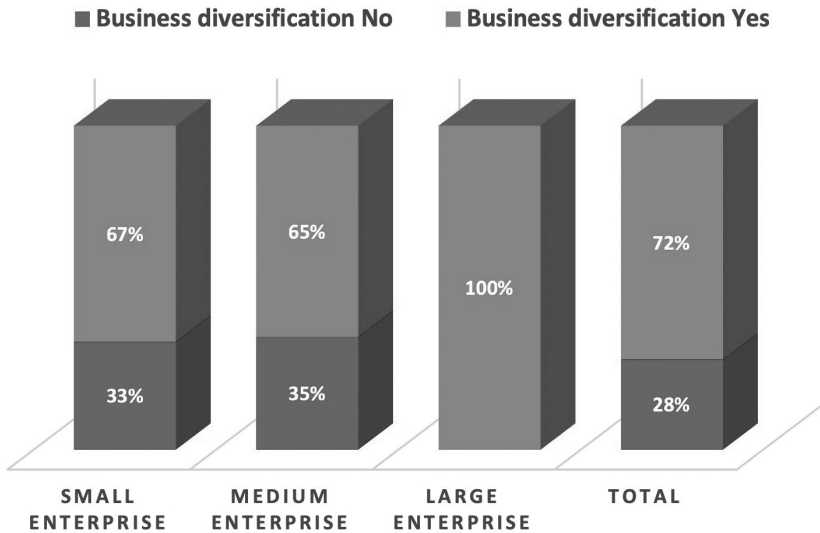


Figure 3.16 Business diversification across firm size.

Source: Primary Survey, 2019.

The financial performance of RE firms surveyed in Gujarat reflects a landscape characterised by uneven profitability. The 54 firms’ profits have been computed through primary responses. Profits per unit sale in Kilowatt (KW) have been derived using the annual turnover (in USD) and annual sales (no. of KWs). The profits have then been categorised into low (< USD 48 per KW), moderate (USD 48 to 95 per KW), and high profits (> USD 95 per kW).

The analysis of profits per unit sale (KW) from these 54 firms reveals significant disparities: while the mean profit stands at USD 270, the mode is notably lower at USD 60. The bottom 20 percent of firms earn profits below USD 13 per unit sale, whereas the top 20 percent exceed USD 105 per unit sale (Table 3.1).

This disparity highlights the competitive nature of the market, where only a small proportion of firms achieve significant returns. The modest average profit margins reflect the pressures of competitive pricing and limited market scalability, suggesting that financial sustainability remains a major challenge for many RE firms. For these firms, navigating profitability requires strategic differentiation and efficiency improvements to mitigate the pressures of an infrastructurally constrained yet highly competitive sector.

As discussed above regarding the policy and institutional landscape for RE, subsidies and tax exemptions are the dominant instrument used to incentivise SE in this sector. However, it is notable that almost half of the entrepreneurs interviewed do not engage in any form of innovation or

*Table 3.1 Profits per unit sale in USD (USD/KW sale)*

<i>Mean</i>		270
<b>Mode</b>		60
<b>Percentiles</b>	20	13
	80	105

*Source:* Primary Survey, 2019

are limited to only process innovation. This highlights the need for policy support to boost R&D investment in the sector to increase efficiency and manufacturing of RE equipment. This is important as evidence suggests a strong positive relationship between profitability and R&D expenditure (Pindado et al., 2010). Although there is also some evidence that suggests that this positive relationship is only observed if the enterprise has strongly established itself in the sector, as opposed to R&D investments eroding away profits for emerging firms in fast-growing markets (Schoeffler, 1978). So, to uncover how the niche is being shaped for SE in the RE sector of Gujarat, it is important to look at the relationship between profitability and R&D expenditure (Figure 3.17) versus the firm's registration as MNRE/GEDA channel partners – that get benefited from subsidies and tax exemptions (Figure 3.18).

Figure 3.17 illustrates the relationship between R&D expenditure and firm profitability among the surveyed firms, and also estimates the significance of the results and strength of correlation. The analysis reveals a clear trend: firms investing more than 3 percent of their total expenditure on R&D are highly profitable, while those with moderate profits tend to invest between 1 and 3 percent. Conversely, firms with less than 1 percent R&D expenditure are predominantly low-profit entities. It is interesting to observe that many service providers, who largely do not invest in R&D, still achieve moderate to high profitability – likely due to the nature of their activities that do not require intensive R&D investment.

The statistical results solidify the importance of R&D: the Fisher's exact test p-value of 0.030, confirms a statistically significant relationship between R&D investment and profitability at the 5 percent level. Moreover, the Cramer's V value of 0.351 indicates a moderately strong association between these variables, demonstrating that R&D investment is a critical differentiator for achieving higher profitability.

Hence, R&D is a key driver of firm growth and competitive advantage – (Ehie & Olibe, 2010; Pindado et al., 2010) allowing firms to enhance production efficiency, lower costs, and innovate, thereby positioning themselves more competitively in the market. This data also depicts the heterogeneous nature of the RE sector. Manufacturing firms, which rely on R&D to drive

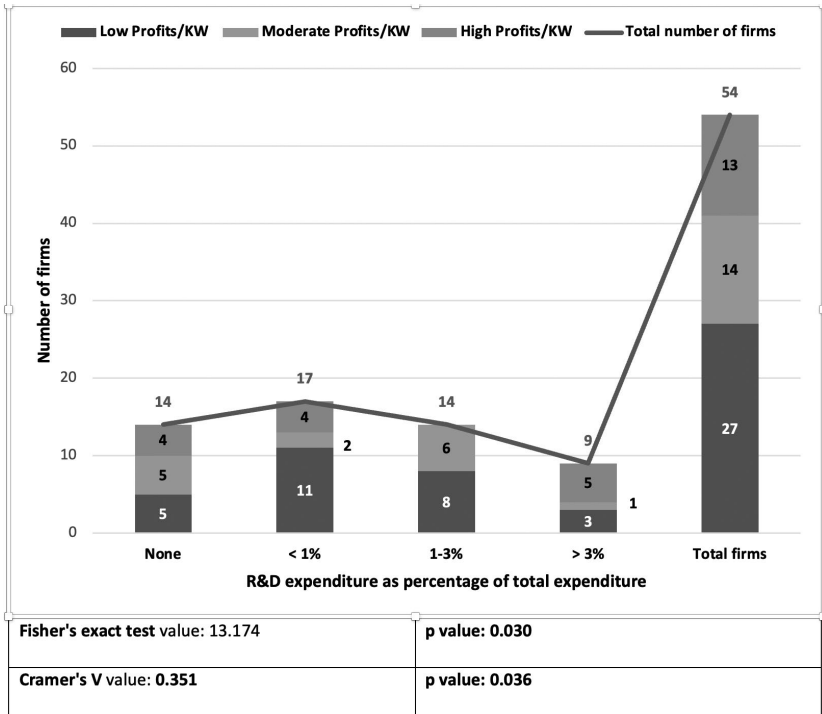


Figure 3.17 Profit distribution across R&D expenditure of firms as proportion of total expenditure.

Source: Primary Survey, 2019.

innovation, tend to experience growth through technological advancements, while service providers often achieve profitability by focusing on operational efficiency and cost control rather than radical product innovation (Haldar, 2021b). While R&D is vital for some firms, others succeed through strategic differentiation and efficient resource allocation. The relationship between R&D investment and profitability is therefore complex and nuanced, influenced by the type of firm and its business strategy.

To understand the relationship (significance and strength of correlation) between direct and indirect subsidies and profitability of RE businesses, we analyse the sample with respect to their status of registration as a channel partner with the national (MNRE) or state nodal agency (GEDA) for renewables (Figure 3.18). Being registered as a channel partner allows these businesses to access benefits such as state and central government subsidies and tax incentives while being compliant with regulations.

Observations from primary data indicate that firms not registered as MNRE/GEDA channel partners are predominantly low-profit makers per

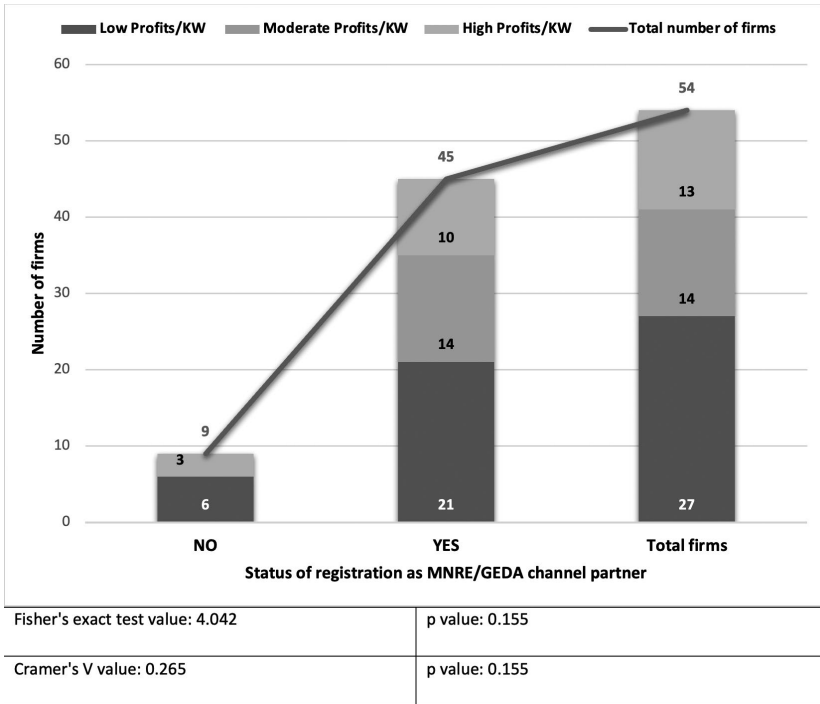


Figure 3.18 Profit distribution across status of registration as MNRE/GEDA channel partner.

Source: Primary Survey, 2019

KW sale, while a higher proportion of MNRE/GEDA channel partners achieve moderate to high profits. Hence, the financial performance of channel partners is stronger compared to non-registered ones. However, the statistical analysis reveals that the relationship between channel partner registration with MNRE/GEDA and profitability per KW sale is not significant at the 5 percent level, as evidenced by a Fisher's exact test p-value of 0.155 (Figure 3.18). The Cramer's V value further indicates that the association is weak. Implying that access to direct or indirect financial subsidies, typically available to channel partners, does not necessarily translate into higher profitability. This challenges the assumption that formal registration and associated benefits inherently enhance financial outcomes in the RE sector. The results are consistent with broader literature suggesting that while policy support can aid operational stability, it does not guarantee enhanced profitability without effective utilisation of resources and strategic market positioning (Pergelova & Angulo-Ruiz, 2014).

When comparing the relationship between subsidies and R&D expenditure, it becomes evident that while policy support through financial instruments creates a favourable environment for SE, it does not have a significant or statistically established link with profitability (Halder, 2021a). In contrast, firms' level of expenditure on R&D shows a statistically significant correlation with profitability, emphasising that internal investment in innovation is more directly tied to financial performance. This implies that, rather than relying solely on subsidies, firms need to strategically prioritise R&D to enhance their competitive advantage and achieve higher profitability, particularly in an evolving and competitive sector like RE.

### **3.4 Conclusion**

In this chapter, we explored the role of SE in driving the RE transition within the complex socio-political and economic context of Gujarat, India. By employing the multilevel perspective (MLP) framework, we analysed how SE, as a niche phenomenon, interacts with the broader regime and landscape to facilitate systemic change. This conceptual trope highlights that niches, like the RE ventures studied here, are critical spaces where innovations are developed and refined before they can challenge the existing regime.

The niche-level actors, represented by entrepreneurial RE firms, thrive on institutional support, R&D and innovation. Our analysis makes it evident that firms investing significantly in R&D are more likely to achieve higher profitability, surfacing the importance of technological advancement and process improvement within these niches. This contrasts with regime actors – largely fossil fuel-based incumbent actors – who maintain their influence through established infrastructure and entrenched interests. The RE firms that succeed are those that can balance the nurturing of niche innovations with a strategic alignment to shifting regime dynamics.

The landscape, characterised by broader socio-economic and political pressures, plays a dual role. Policies like subsidies and financial incentives have provided temporary buffers to RE entrepreneurs. However, our findings indicate that these regime-level supports do not exhibit a statistically significant effect on profitability, suggesting that subsidies alone are insufficient to guarantee long-term success. Instead, landscape-level shifts – such as the policy volatility following the Paris Agreement and the sudden pivot towards solar PV over wind – have highlighted the vulnerability of niches to abrupt changes in regime priorities. For entrepreneurial niches to thrive, a stable and predictable policy landscape is essential.

Our empirics also emphasises the differentiated pathways of value creation within the RE niche. Manufacturing firms tend to drive change through technological innovation, leveraging R&D to push the boundaries of what

is possible within the niche. In contrast, service-oriented firms achieve profitability through operational efficiency (process innovation) rather than new technological breakthroughs. These differentiated strategies illustrate that successful niche actors can either (radically) innovate technologically or optimise operationally, depending on the opportunities presented by both regime structures and landscape shifts. The transition from niche to regime dominance towards RE depends on a careful interplay of policy support, market readiness, and technological innovation. Sustainable entrepreneurs are vital in catalysing this transition, but success requires a comprehensive approach that balances R&D, market adaptability, and resilience to landscape-level pressures. The journey towards a sustainable energy regime will not only rely on the development of niche innovations but also on a stable landscape and supportive regime that collectively foster a conducive environment for transformation.

With this backdrop, we conceptualise SE as a driver of energy transition while navigating landscape and regime dynamics. In the next chapter, we discuss the evolution of policy and regulatory landscape for RE technologies in India before identifying specific challenges and opportunities for RE entrepreneurs in Gujarat moving ahead. Challenges and opportunities for SE comprise regime and landscape-level interactions with incumbents and destabilising processes in the existing fossil dominant market regime. It is therefore important to explore how national- and (Gujarat) state-level policies create windows of opportunity for the market uptake of RE gradually over longer timeframes.

## Notes

- 1 Ministry of Environment, Forest and Climate Change. (2023, December 18). India achieves two targets of nationally determined contribution well ahead of the time. Press Information Bureau. Retrieved August 6, 2024, from <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987752#:~:text=In%20August%202022%2C%20India%20updated,enhanced%20to%2050%25%20by%202030.>
- 2 Elets e-gov. (2024, January 25). Gujarat is Actively Exploring and Prioritizing Renewable Energy Sources. *Elets News Network*. <https://egov.eletsonline.com/2024/01/gujarat-is-actively-exploring-and-prioritizing-renewable-energy-sources/#:~:text=Out%20of%20total%20installed%20power,of%2030GW%20by%20December%202026.>
- 3 Press Information Bureau, MoEFCC. (2023, December 18). India achieves two targets of Nationally Determined Contribution well ahead of the time. <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987752>.
- 4 Press Information Bureau, MNRE (2011, December 16). Generation Based Incentive Scheme. <https://pib.gov.in/newsite/PrintRelease.aspx?relid=78829>.
- 5 Ministry of New and Renewable Energy. (n.d.). Production Linked Incentive (PLI) Scheme: National Programme on High Efficiency Solar PV Modules.

Retrieved September 19, 2024, from <https://mnre.gov.in/production-linked-incentive-pli/>.

6 <https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2024/09/20240910506609784.pdf>.

7 Energy and Petrochemicals Department. (2023). Gujarat renewable energy policy 2023. Government of Gujarat. <https://cdn.vibrantgujarat.com/event/document/1698657395807-Gujarat-Renewable-Energy-Policy.pdf>.

# 4 Evolution of policy landscape for renewables

## National and state interventions

### 4.1 Introduction

Over the past three decades, India has experienced a systematic shift in its energy policy, transitioning from a reliance on conventional fossil fuels towards an expanding renewable energy (RE) landscape, with recent ambitious decarbonisation goals of achieving 500 GW RE installed capacity by 2030 (MoP, 2025). Interventions for this transformation emerged early on in the 1990s, when the Ministry of Non-Conventional Energy Sources (MNES) was established to promote renewable technologies at the national level. Since then, an evolving set of government-led instruments including feed-in tariffs, fiscal incentives, Renewable Purchase Obligations (RPOs), and dedicated funding agencies has progressively shaped India's RE trajectory.

Alignment with global climate imperatives such as the Kyoto Protocol, 1997 and the Paris Agreement, 2015 provided momentum for market integration of clean energy technologies. Successive regulatory measures at both national and state levels – such as net-metering provisions, streamlined auction processes, tax holidays, and concessional financing, bolstered market confidence and catalysed entrepreneurial ventures in solar, wind, biomass, and small hydropower across India. In recent years, when the discourse on the need for urgent climate action has gained global consensus, policy developments are emerging at an accelerated pace, reflecting India's reinforced commitment to meet ambitious decarbonisation targets. Initiatives like the Production Linked Incentive (PLI) scheme for high-efficiency solar modules and the National Hydrogen Mission, launched in 2021, demonstrate a strategic pivot towards domestic manufacturing and the exploration of new energy frontiers. Meanwhile, updated guidelines from national RE entities such as the Solar Energy Corporation of India (SECI), coupled with strengthened commitments to augment non-conventional energy capacity in the near term (50 percent cumulative electric power installed capacity from non-fossil fuel-based energy by 2030) and long term (2070-net zero commitments at the national level), have continued to create new market opportunities.

Against this backdrop, sustainability-oriented entrepreneurs play a critical role in translating policy vision into tangible outcomes, capitalising on policy incentives, competitive pricing, and technological innovations to drive expansion of RE solutions. By tracing the historic transformation in policy and regulation that paves the way for entrepreneurs to advance a renewable centred energy regime, through this chapter we explore the catalysts driving India's clean energy ambitions from rhetoric to reality. We also spotlight the emerging pathways – some incremental, others potentially game-changing, that stand to reconfigure the nation's energy future. As Gujarat is at the core of our empirical enquiry, we also discuss how national RE priorities and policies trickle down and shape the RE ecosystem at the subnational level.

#### **4.2 Transition policy foundations: pre-1990s liberalisation scenario**

India's energy landscape has been consistently evolving post-independence in 1947, with shifting national priorities – from meeting energy needs for infrastructure and development, to promoting competitiveness for energy efficiency, to clean energy as a lever for economic development. From 1947 to the early 1970s, India was struggling with balancing electricity supply to meet the increasing demand for electricity as the primary input for infrastructure development – which was considered central to India's economic growth. Key governance and planning institutions including the Planning commission, Central Electricity Authority (CEA), and the Energy Survey of India were established during this phase. The role of Planning Commission of India was paramount in formulating policies and long-term visions related to energy at the nationwide scale. CEA was established along with the Planning commission in 1950, to coordinate the development, implementation, and monitoring progress of uniform national electricity policies. The State Electricity Boards (SEBs) were instituted by the CEA to serve as nodal electricity agencies at state level. Notably, electricity is a concurrent subject in India – meaning both national and state governments possess legislative rights over generation, transmission, and distribution of electricity. This initial phase until 1970 in the history of India's energy policy is marked by attempts to achieve supply adequacy while being heavily reliant on coal, oil, and gas. This period saw expansion of the oil and natural gas sector with the government of India recognising opportunities for exploiting economies of scale. The institution of Indian Oil Corporation and the Oil and Natural Gas Commission advanced efforts towards marketing and refining of oil and its derivative products. Thus, post-independence to the early 1970s the national government's focus was on regulating supply of primary energy with visions to decentralise the electricity sector so as to effectively meet rapidly growing demand.

In the 1970s, the global oil shock crisis triggered a shift in national energy policy focus on energy conservation and efficiency (Ferguson et al., 2011). Regulation of the coal-mining industry and reducing petroleum consumption were key policy thrust areas during this phase. Hence, the early 1970s saw nationalisation of the coal industry and establishment of Coal India Limited (CIL) in 1975 to undertake design and planning of the coal-mining segment. The CIL is now the largest coal producers in India and operates under the administrative ownership of the Ministry of Coal, Government of India. CIL, along with the National Thermal Power Corporation (NTPC) established in the same year, was instrumental to the national priorities regarding ensuring energy security, augmenting overall efficiency and safety of coal production, and promoting planned development of the power sector (Bardhan et al., 2019). Although there were efforts to regulate and promote energy conservation in the ‘fossil dominant’ regime during this period, no concrete directives were introduced to replace fossils with renewable energy (RE) sources. The Planning Commission of India was particularly committed to ensuring access for households and industries to cleaner forms of energy like Liquid Petroleum Gas. However, this did not particularly refer to non-conventional sources.

The decade after the 1970s marked a massive upward shift in energy demand owing to emerging businesses and industries in the country. In response, it was the first time that energy-saving targets were defined in the 1980s. Energy security still remaining the core of regulation, and policy-targeted interventions were being made towards augmenting capacity, diversification, and streamlining of energy supply. The Advisory Board on Energy, established in 1983 laid down an integrated energy policy at the national level. Acknowledging the burden of expensive coal and oil imports to meet energy needs of the nation, this integrated national policy highlighted the potential of non-conventional energy – including renewables as a viable substitute for fossil fuel imports. This stimulated the establishment of the Nuclear Power Corporation of India in 1987 marking the dawn of non-conventional energy in India’s energy transition trajectory. All forms of energy policy agencies and departments were brought under the purview of the Ministry of Energy, barring the Department of Atomic Energy.

### **4.3 Liberalisation and modernisation of energy sector: 1990s to early 2000s**

With liberalisation of the Indian economy, the 1990s also witnessed a period of reform in the nation’s energy sector. The Planning Commission introduced reforms to deregulate, privatise, and unbundle the power sector. This also meant opening up the energy sector to foreign investments. India’s energy infrastructure had been by then historically susceptible to inefficiencies, and

high transmission and distribution (T&D) losses (Gandhi et al., 2022). Until the early 1990s, the sector was dealing with severe capacity and financial constraints. The losses from electricity supply amounted to as high as 0.7 percent of India's Gross Domestic Product (GDP) at that time. Poor fiscal health of the sector was reinforced by technical challenges such as T&D losses of approximately 23 percent, and high inefficiencies in generation with plant load factor at merely 54 percent (Bardhan et al., 2019). Energy deficits were also substantial at approximately 19 percent (Khurana & Banerjee, 2014). Some of these issues persist now in the 21st century in terms of access, affordability, and reliability concerns (Halder et al., 2023). In this regard, impetus was on modernising the energy sector, with focus on demand side reforms. Energy conservation bill that laid the foundation for establishment of the Bureau of Energy Efficiency (BEE) in 2001 had clear mandates on promoting energy conservation and enhancing efficiency of energy supply in India. This period also marked the shift in policy focus on environmental sustainability, reflecting in emergence of institutions and interventions to integrate non-conventional sources in the energy supply mix. The MNES was set up in 1992 to facilitate uptake of RE in the country. MNES was later renamed as the Ministry of New and Renewable Energy (MNRE) in 2006 – as we know it now (Bardhan et al., 2019).

Private-sector participation was deemed crucial to reform the power sector towards efficiency and competitiveness, and especially to draw investments. Through the amendment to the Electricity Supply Act, 1991, the power sector was able to attract private investments including foreign capital. Long-term power purchase agreements (PPAs) and supply contracts were important instruments to ensure long-term supply stability. However, the distribution segment was constantly performing poorly, being highly entrenched within state politics (Dubash & Rajan, 2001). So, there was realisation of the need to unbundle the power sector and dissolve public monopoly over the energy sector during this phase. The Regulatory Commission Act was enacted in 1998, which brought about regulatory consistency in the nation's power sector. The Central Electricity Regulatory Commission (CERC) was also instituted under this act. The unbundling of SEBs into separate distribution, generation, and transmission segments (or companies) by CERC was a regulatory reform that shaped the future of the power sector in India. As a result, by the 1990s and the early 2000s the gross power generation grew ninefold in comparison to the 1970s. Almost 61 percent of the energy was being generated through coal-based thermal power plants. Hydro electricity, nuclear, gas, and oil were other sources of power in the nation's total energy mix. Regulatory interventions such as the Aggregate Power Development and Reforms Program (APDRP) launched in 2002 were specifically aimed at drawing private investments in the distribution sector. However, it was not as successful, and high levels of

Aggregate Technical and Commercial (AT&C) losses were indicative of the challenges in achieving a modern and efficient energy grid infrastructure. An incentive-based system was then proposed through the Restructured APDRP in 2003. These policy and regulatory reforms formed the basis of the Electricity Act (EA) 2003, which marked the dawn of a more competitive, liberal, and progressive power sector in India.

The EA 2003 offered a market oriented approach to augment accountability, commercial viability, and efficiency in the power sector (Joseph, 2010). Delicensing of thermal power generation, incentivising rural electrification and RE generation, institutionalisation of independent regulatory commissions, multiyear tariff system, and introduction of licensed power trading were some important strategies in this direction. One of the most effective measures to promote competition was the provision of open access in the transmission and distribution segment. This implies that generation companies (Gencos) can directly sell power to the highest bidder, while consumers can purchase power from the most price competitive and efficient Discoms (Garg et al., 2022). Other policy interventions that were directed towards grid efficiency and modernisation were the National Electricity Policy in 2005, The National Tariff Policy in 2006, and Integrated Energy Policy in 2006. Interstate transmission was regulated through these policies which offered avenues for maintaining a stable and reliable power supply across states, promoting competition, and minimising AT&C losses. The Indian Energy Exchange and Power Exchange India Limited were established in 2008 to further energy security in the nation.

Thus, ensuring stability and sufficiency of supply at affordable prices while balancing environmental sustainability was gaining momentum in the design of energy policy in the post-liberalisation era (Shanmugam & Kulshreshtha, 2005). Although private-sector participation, plant renovation, and modernisation, along with new capacity installation, were the focus of policy, the distribution sector remained the cause of concern owing to its inefficiencies and politically entrenched nature. Even in the 21st century, risks of stranded assets - as most of the thermal power plants are not close to the end of their life cycles remain a major bottleneck for RE transitions in India. Similarly poor fiscal health of Distribution companies (Discoms) has emerged as a sticky challenge that is yet to be resolved despite decades of reforms in the national energy landscape (Srinivasan et al., 2023).

#### **4.4 Energy discursive shifts towards climate change mitigation: late 2000s to 2015**

The Indian energy policy recognised the importance of shifting towards non-conventional energy sources early on during the 1990s – when the MNES was established. Indian Renewable Energy Development Agency (IREDA), India's first non-banking financial institution (NBFC), was also

established in 1989 – with an objective to offer financial assistance for RE projects and projects related to energy efficiency and conservation. The oil shocks of the 1970s also played an important role in steering the debate towards the need to augment RE capacity to ensure energy security (Bardhan et al., 2019). Thus, it makes sense to say that India's commitment to RE adoption has been historically influenced by global discourse on climate change and geopolitical situations. We now analyse how key global events starting from the Kyoto Protocol (adopted in December 1997 and entered into force in February 2005),<sup>1</sup> has defined the energy policy trajectory of India, hence creating opportunities for market uptake and entrepreneurship in the sector.

India's early stance on climate emission reduction echoed the logic of 'common but differentiated responsibility' – i.e., the industrialised nations often in the Global North should reduce emissions and allow for developing economies in the Global South to continue use of fossil fuels so as not to compromise on their development needs (Bardhan et al., 2019). This also attributes to the abundance of relatively cheaper coal reserves and fossil dependent infrastructure in the Indian context, which created significant lock-ins with fossil energy. Rapid urbanisation, economic growth and industrialisation was increasing energy demand, accompanied by the wave of liberalisation where majority of private investments in energy sector went to coal, oil, and natural gas. In light of these lock-ins and path dependencies, when the Kyoto Protocol – Conference of Parties (COP) 3 was adopted in 1997, India acceded to it. However, India did not agree to obligations towards emission reduction. Despite this, concrete measures to conserve and increase efficiency were taken through establishment of the Bureau of Energy Efficiency (BEE) and the Energy Conservation Act, 2001. The Integrated Energy Policy, 2006 was an important milestone in India's energy transition trajectory. In addition to meeting energy demand through technical efficiency, and economic viability, this policy laid the groundwork for integration of RE sources in energy provisioning. Thus, measures to phase out fossil fuel subsidies, incentives for RE production, and FiT laws were proposed (IEA, 2021b). By February 2005, when the Kyoto Protocol entered into force in COP-7, India played central role in its codification highlighting that sustainable development is very much interlinked to climate change mitigation and adaptation. It also argued that developing economies are more vulnerable to climate impacts and hence need resources and strategies to boost preparedness.

As global discourse on climate change intensified, the national energy landscape shifted towards balancing decarbonisation goals with energy security. This motivated the establishment of the Prime Minister's Council on Climate Change (PMCCC) in 2008. This council coordinated the national strategy for assessment, adaptation, and mitigation of climate change. The National Action Plan on Climate Change (NAPCC) launched by the

PMCCC in 2008 that outlines India's climate action strategy also had the need for balancing economic, social, and environmental goals at its core. It stressed that maintaining high growth rates is crucial for raising living standards of the people, while reducing their vulnerability to climate impacts. To achieve this, eight interrelated 'national missions' were formulated with a focus on enhancing understanding of climate change risks, adaptation and mitigation, natural resource conservation, and energy efficiency. Out of these eight missions, two were directly focused on reforming the energy sector in India by improving efficiency and increasing RE capacity – (1) National Solar Mission and (2) National Mission on Enhanced Energy Efficiency.

The Jawaharlal Nehru National Solar Mission (JNNSM) marks the epoch in proliferation of RE capacity in India. Launched in January 2010, this mission cemented the national government's commitment to establish India as a frontrunner in the global energy transition landscape. This was guided by an initial mandate of achieving 20 GW of installed solar capacity by 2022 which was revised to 100 GW in 2015, and then 175 GW by 2022 (Prakash et al., 2022). The Jawaharlal Nehru National Solar Mission (JNNSM) marks an epoch in India's RE trajectory by introducing a targeted implementation roadmap and a supportive regulatory architecture for a diverse range of solar technologies and uses – spanning off-grid and decentralised systems to grid-connected utility-scale and PV rooftop installations. Beyond setting ambitious capacity targets in Phase I (10 GW solar power capacity by 2014), the JNNSM laid out a comprehensive policy and regulatory framework that recognised the centrality of industrial policy, robust R&D, and skill development in building a thriving solar sector (Figure 4.1). These pillars, in turn, have also opened up new spaces for sustainable entrepreneurship (SE) by lowering barriers to market entry, incentivising technological innovation, and fostering collaborative platforms.

Crucially, the mission called for a dedicated governance structure to facilitate RE integration and to identify diversified funding channels, reducing financial risk for early-stage ventures and scaling startups. Such measures are especially vital in a federal context where electricity is a concurrent subject, empowering both the central and state governments to legislate and implement energy policies. Following the broad directives of the JNNSM, several states including Madhya Pradesh, Odisha, Andhra Pradesh, Rajasthan, and Uttar Pradesh launched their solar policies in 2013 (Kshitij & Mandal, 2022). These state-level guidelines, while aligned with national targets, also made room for entrepreneurial ecosystems attuned to local resource endowments and market conditions.

The Clean Energy Cess, 2010 is an important instrument used to disincentivise coal dependence in India. This cess was levied at a rate of 50 INR per tonne of coal consumed in a region. This cess contributed to the National Clean Energy Fund (NCEF) to support sustainable energy production and consumption. However, NCEF has been critiqued for diverging finances to other development needs rather than specifically being

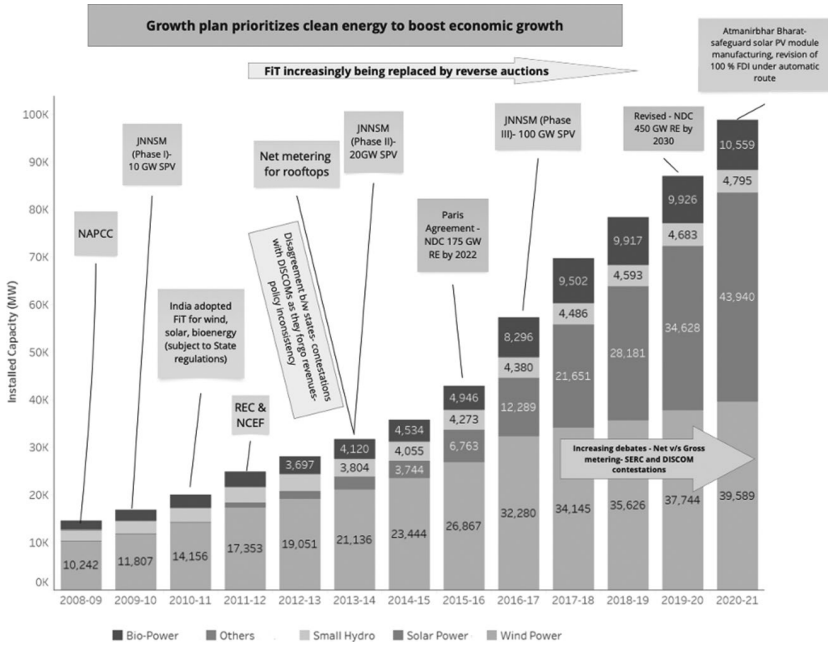


Figure 4.1 India’s RE installed capacity growth with respect to policy evolution.

Source: Author’s Composition Based on MNRE Data and Policy Reports.

targeted at RE integration and uptake (Haldar, 2021a). In 2011, India adopted Renewable Purchase Obligations (RPOs) and Renewable Energy Certificates (RECs) as key regulatory mechanisms to accelerate renewable energy adoption. RPOs require electricity distributors to procure a specified portion of their supply from renewable sources, thereby creating stable demand. RECs, in parallel, establish a market-based trading mechanism to offset interstate disparities in renewable energy generation capacity and pricing. Together, these instruments provide predictable market conditions, reducing investment risks, and promoting opportunities for sustainable entrepreneurship in India’s RE sector (Figure 4.1). In the same year, recognising the importance of financial incentives to boost distributed RE generation, India introduced Generation Based Incentives (GBIs) for small-scale solar projects connected to distribution grids (below 33 kV). GBIs addressed the considerable gap between the higher tariff fixed by the CERC for solar power (Rs. 17.91 per kWh in 2010–2011) and a lower reference tariff (Rs. 5.5 per kWh), thus lowering the market entry barriers faced by new ventures. By directly enhancing the economic viability of smaller entrepreneurial projects, GBIs not only supported distributed energy generation but also signalled the government’s strategic intent to decentralise RE markets, stimulate local innovation, and broaden entrepreneurial participation beyond large industrial actors.

Recognising that decentralised RE alone could not achieve India's ambitious decarbonisation and energy security goals, the government also turned towards large-scale renewable infrastructure to capture economies of scale. Mega-scale renewable projects became strategically important for attracting significant private investment, including foreign direct investment (FDI), thus expanding the entrepreneurial ecosystem and mobilising capital at a larger scale. Consequently, in 2014, the Ministry of New and Renewable Energy (MNRE) mandated the establishment of at least 25 large-scale and Ultra Mega Solar Power Projects, aiming for over 20 GW of installed capacity within a five-year period. This policy initiative not only reflected India's commitment to rapidly scaling RE but also indicated a clear shift towards enabling substantial private-sector participation to realise broader development and climate objectives.

#### **4.5 Scaling ambitions and deepening markets: post-Paris (2015-present)**

The 2015 Paris Agreement marked a watershed moment for India's RE ambitions, sparking a new era of accelerated policy action and entrepreneurial dynamism. Shifting gears from cautious expansion to bold market-driven growth, India set audacious targets – including scaling renewable capacity to 175 GW by 2022 and later ramping up ambitions to an unprecedented 500 GW of non-fossil capacity by 2030 (Haldar et al., 2023). This period saw fierce competitive auctions dramatically slash solar tariffs, innovative financial instruments attract global capital, and strategic initiatives like the Production Linked Incentive (PLI) scheme reshape domestic industrial landscapes – fundamentally repositioning India as a vibrant hub for RE entrepreneurship and investment.

Key national mechanisms introduced since 2015 illustrate India's broader vision towards deepening market frameworks, strategically positioning entrepreneurship as a catalyst for low-carbon transformation clearly. The JNNSM Phase II (2012–2017) aimed at proliferating solar power generation (20 GW capacity by 2017) by facilitating and incentivising participation of least cost developers for solar projects (Figure 4.1). Auction mechanisms were deployed nationwide to attract private participants and ensure RE production at affordable rates. Focused R&D initiatives through mandatory domestic content requirement (DCR) clause aimed at strengthening local manufacturing capacity under the Phase II. The DCR clause mandated that all investors must use locally manufactured solar modules and procure 30 percent of their overall inputs from local sources. However, the DCR clause drew criticism from the international community including the United States who challenged it in the World Trade Organisation (WTO) on grounds that India's DCR clause was protectionist and discriminated

against imports. The WTO panel – dispute settlement body, ruled against the DCR clause, leading to a considerable setback in India’s transition story through building up manufacturing capacity (Tagotra, 2017).

The National Smart Grid Mission (2015), aligned explicitly with India’s Paris commitment of achieving 40 percent renewable electricity capacity by 2030. It actively widened market opportunities for entrepreneurs developing innovative solutions in grid modernisation and renewable integration. Recognising the importance of domestic industrial capacity to sustainable market deepening, the government substantially expanded its PLI scheme from an initial USD 0.6 million in 2021 to USD 2.62 million in 2022, targeting domestic solar manufacturing capabilities of up to 54.5 GW. By significantly lowering the barriers to manufacturing and fostering entrepreneurial competitiveness, this policy sought not only self-reliance but also global positioning within the RE market.

Complementing this industrial policy push, targeted financial mechanisms were deployed to stimulate entrepreneurial activity in both utility-scale and distributed RE segments. For instance, a Central Financial Assistance (CFA) of up to USD 33,450 per solar park, coupled with USD 26,700 per MW installed capacity, or 30 percent of total project costs, incentivised private-sector involvement in the creation of at least 25 mega solar parks, each with 500 MW or more, totalling 40 GW by March 2024. The rooftop solar segment emerged as a critical entrepreneurial opportunity, particularly with generous subsidies of 20 to 40 percent CFA for residential rooftop installations, while ensuring that commercial and industrial sectors achieve incentives on 10 percent of their base installed capacity through rooftop solar solutions.

Government departments themselves were recognised as key actors – or ‘prosumers’– under the Central Public Sector Undertaking Scheme, aiming to set up 12 GW of grid-connected solar PV plants by 2022–2023. For this, Viability Gap Funding (VGF) of up to USD 73,500 per MW was sanctioned (Singh et al., 2023). Strategically addressing persistent urban challenges around energy reliability and security, solar power, especially rooftop installations, was recognised not merely as a technology solution, but also as a market-driven entrepreneurial response.

Despite existing structural barriers, India’s wind energy sector presents unique opportunities for sustainable entrepreneurship, notably through firms like Suzlon and Inox Wind, which have positioned the country as an emerging hub for wind technology innovation and diffusion, particularly targeting domestic and Global South markets (Lewis, 2007). Recognising both the constraints and potential of the domestic wind industry, India’s MNRE launched the National Offshore Wind Energy Policy in September 2015 under the broader NAPCC. The policy explicitly sought to promote domestic technology indigenisation, catalyse private-sector investments in

R&D, and nurture skill development within the sector (MNRE, 2015). Framed against the backdrop of India's ambitious target of achieving 60 GW of installed wind capacity by 2022, the policy demonstrated India's broader strategic vision of integrating climate objectives with industrial development and entrepreneurial growth.

To incentivise SE in wind power, the government had deployed market-stabilising instruments, notably GBI rewarding wind developers per unit of generated energy, alongside generous tax incentives such as accelerated depreciation allowances of up to 80 percent. However, the planned phase out of the GBI by March 2017 and reduction of accelerated depreciation to 40 percent sparked concerns among wind power developers and entrepreneurs, who viewed these mechanisms as critical for reducing investment risks and ensuring market predictability (Halder, 2021). The policy uncertainty around these instruments posed potential threats to the sustained growth of India's wind energy market, advocating the importance of stable, forward-looking policies capable of simultaneously addressing technology transfer barriers, deepening domestic manufacturing capabilities, and supporting entrepreneurship within India's rapidly evolving wind energy landscape (Halder, 2022; Halder & Tripathi, 2023).

Hence, energy policy at the national level is formulated in response to global conditions and discourse on climate policy. The national policy offers directionality to state level policy to support SE, regulate, and create infrastructure to integrate and augment RE capacity. Figure 4.2 offers an overview of the major epochs in India's energy transition trajectory in all the three phases discussed above. Although there are often complexity and policy shifts at the national-level, state-level governance emerges as pivotal for driving RE transitions, offering stability and proactive market-shaping measures critical for entrepreneurial growth. Gujarat, in particular, has consistently demonstrated pioneering leadership by proactively formulating and implementing energy transition policies ahead of national trends. The state's early adoption of the Gujarat Solar Policy in 2009, even prior to India's National Solar Mission, clearly illustrates its visionary stance. Moreover, strategic infrastructure projects like the 790 MW Charanka Solar Park (DNA India, 2018) – among Asia's largest solar installations at the time – reinforced Gujarat's role as a frontrunner, signalling to investors, innovators, and entrepreneurs alike, regarding the state's robust institutional commitment and regulatory foresight. The following section undertakes a deep-dive exploration into Gujarat's policy landscape, highlighting precisely how Gujarat's proactive energy policy instruments, regulatory innovations, and market interventions have created an enabling environment, positioning the state as a benchmark for India's RE transition and a dynamic hub for SE.

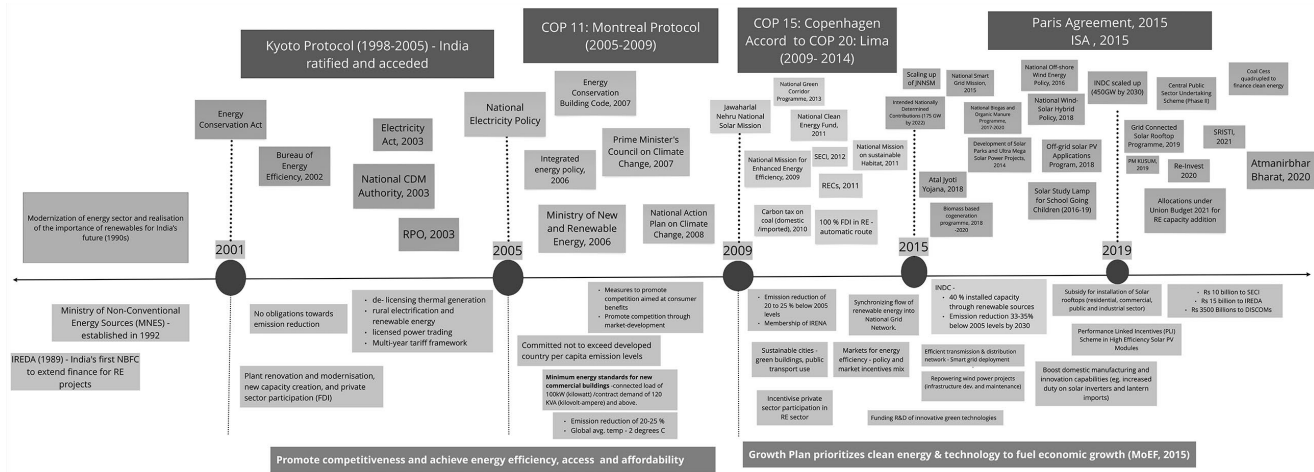


Figure 4.2 India's RE policy roadmap post-liberalisation (1990s) to present.

Source: Author's Composition.

#### 4.6 Gujarat's transition policy landscape: from early leadership to strategic adaptation and market expansion

The RE policy landscape in Gujarat has evolved progressively, shaped by a mix of pioneering ambition, changing market dynamics, and broader national climate goals. This evolutionary trajectory began prominently with the *Gujarat Solar Policy of 2009*, a groundbreaking initiative that positioned the state as an early mover in India's solar energy sector even before the JNNSM was launched (Energy and Petrochemicals Department, 2009). With a population of 60.4 million (Census, 2011) and a land area of 196,024 sq. kms, Gujarat is susceptible to climate risks including precipitation and temperature extremes, along with sea level rise. These climate-related risks impact the state on multiple fronts – agriculture, economy, water resources, and infrastructure. Certain population groups including coastal population, low-income groups, women, elderly and children are relatively vulnerable to these impacts. One of the most industrialised states in India, Gujarat leads the petrochemical, chemical, and crude oil refining industries. 25 percent of the total emissions in the state can be attributed to its power generation industry. Hence, the state realised the need to disrupt fossil dependent development pathways early on and took a proactive stance to renewable led path creation through policy and regulatory steering. This was supported by the state's significant solar potential (over 300 days of sunlight per year), and favourable wind conditions along with an expansive coastline of 1,600 kms (Ghose et al., 2022). Thus, starting from the 2009 Solar Policy, Gujarat committed to attracting private-sector investment through streamlined regulatory processes, favourable feed-in tariffs, and the creation of dedicated large-scale solar parks (Energy and Petrochemicals Department, 2009). This policy not only demonstrated political foresight but established institutional frameworks critical for investor confidence and entrepreneurial engagement.

Building on this momentum, Gujarat revised its *Solar Policy in 2015*, aligning more explicitly with India's emerging national commitments post-Paris Agreement. The revised policy emphasised rooftop solar deployment, decentralised generation, and introduced clearer regulatory instruments like net-metering to enhance consumer participation (Energy and Petrochemicals Department, 2015). By actively encouraging rooftop solar installations and providing financial incentives, Gujarat sought to democratise RE access and stimulate local entrepreneurial opportunities, thus diversifying its solar energy ecosystem.

In Gujarat, the agricultural sector contributed to 18 percent of the total GHG emissions statewide (Garg et al., 2024). However, agriculture is a key economic sector in the state. Hence, the government's *Suryashakti Kisan Yojana (SKY)* was launched in 2018 with an objective to ensure economic

growth for the agricultural sector through the use of solar energy powered irrigation and farming systems, e.g. solar pumps. Under this scheme, farmers can generate their own power through solar panel installations on their farmland for captive consumption and sell the excess to the government via the electricity grid. Thus, having grid connectivity was a crucial requirement to benefit from the SKY program. 60 percent of the cost of solar panels is to be financed through the state and central governments, while 35 percent of the cost would be covered through loans at an interest rate of 4.5 to 6 percent. So, the farmers need to bear an upfront cost of 5 percent. The scheme was launched for a duration of 25 years in two phases (7 years and 18 years) and was set to benefit 12,400 farmers across 33 districts in Gujarat (GPRD & GUVNL, 2019).

In addition to solar energy, wind energy has historically been recognised as a vital component of Gujarat's RE potential. The state hosts 35 GW of wind energy potential alone (Energy and Petrochemicals Department, 2016). *The Gujarat Wind Power Policy 2016* reflected this recognition, setting out to expand the state's RE mix while also fostering private-sector participation. At a time when solar was gaining momentum, this policy signalled that wind energy remained a strategic priority, particularly for regions within the state with high wind potential.

To encourage investment, the policy offered a range of financial and operational incentives. These included exemptions from electricity duty, eligibility for RECs, and banking of generated electricity – provisions particularly important for independent power producers. Further, the policy allowed for third-party sale and captive use without restriction, enabling developers to explore flexible business models. Transmission and wheeling charges were also waived off under its provisions for certain project categories, thereby lowering operational costs and improving the bankability of projects (Energy and Petrochemicals Department, 2016).

From an entrepreneurial perspective, these mechanisms were designed to create space for both large firms and smaller, locally rooted enterprises. However, while the policy laid out a supportive framework, its effectiveness was limited by broader structural constraints. Land acquisition remained a persistent challenge, especially in coastal and high wind potential zones (Madhanagopal et al., 2022). Also, while the policy emphasised infrastructure readiness, actual grid capacity and evacuation infrastructure did not always match policy ambitions, creating bottlenecks for timely project commissioning (Abhishek & Goel, 2021). These limitations have been observed in several project sites globally, where delays in transmission infrastructure undermined investor confidence and increased the cost of capital for wind developers (e.g. Gregory & Sovacool, 2019).

Nevertheless, the Gujarat Wind Power Policy 2016 marked a significant step in broadening the state's RE landscape. It illustrated how state-level

policy can act as a catalyst for market creation and SE and also pointed towards the importance of aligning implementation capacities with policy ambition in order to realise its full transformative potential.

With an explicit push for building up wind energy capacity in the state, there were also emerging challenges in implementation and operation. Gujarat hence launched its *Repowering of the Wind Projects Policy 2018* to address issues related to underutilisation of wind energy resources owing to aging turbines of capacities equal to or under 1 MW (Energy and Petrochemicals Department, 2018a). These older installations, prevalent in prime wind zones, were operating inefficiently, leading to suboptimal energy production. The policy aimed to replace these outdated turbines with modern, higher-capacity models to enhance energy output without requiring additional land acquisition – a significant advantage in a state where land availability was already posing challenges.

From a political economy perspective, the Gujarat Wind Power Repowering Policy 2018 reflects a strategic shift – it addressed the inefficiencies of legacy wind installations while unlocking higher generation potential in the face of land resource constraints. The policy was introduced in response to the proliferation of sub-MW turbines – many installed before 2005 and occupying high wind zones but generating at capacity utilisation factors as low as 10 to 14 percent. These inefficient assets, while technically operational, pointed towards a significant misallocation of valuable renewable resources. The 2018 policy sought to correct this by offering targeted incentives to encourage the replacement of old turbines with newer, higher-capacity models. It offered GBIs, exemptions from electricity duty for five years, and guaranteed eligibility for RECs, thereby increasing financial viability for private developers repowering existing sites (Energy and Petrochemicals Department, 2018a).

Critically, the policy also introduced a preferential FiT for repowered projects. This was set 10 percent higher than tariffs for new projects to reflect the additional capital burden and operational complexities of decommissioning old units. It explicitly allowed developers to retain existing infrastructure and land rights, acknowledging the logistics related hurdles of repowering on fragmented landholdings. These provisions were designed not only to attract large investors but also to make repowering viable for smaller, early-stage entrepreneurs who originally developed these projects and now faced technology lock-in and declining returns. This need to achieve balance between enabling new investment and protecting first-generation developers speaks to Gujarat's attempt to smoothen the political economy frictions of structural transition within a liberalised energy sector.

However, the policy's ambitions were hindered by persistent implementation challenges. Though repowering was meant to avoid new land acquisition, coordination between turbine owners, landholders, and Discoms

proved difficult – especially in sites with fragmented ownership or outdated power evacuation infrastructure (Norman et al., 2024). The policy assumed that grid capacity would scale in parallel, but actual investment in transmission lagged behind. As a result, project execution timelines stretched, and investors, particularly smaller ones, faced increased costs and regulatory uncertainty (CEA, 2023). These dynamics reveal a broader tension in India’s energy transition – while policy designs may promote technological upgrading and efficient resource use, their success depends on ground-level institutional readiness and cross-sectoral coordination.

Moving further ahead, the *Gujarat Wind-Solar Hybrid Policy-2018* was launched with the intention to scale up wind and solar hybrid power project installations while minimising variability often associated with RE technologies (Bird et al., 2013). Land mobilisation has historically emerged as a key deterrent for RE projects in India (Halder et al., 2024; Levien, 2012) and other parts of the world alike (Temper et al., 2020). Against this backdrop the Wind-Solar Hybrid policy was designed to optimise infrastructure use including transmission systems and land in the state. Provisions were made under this policy to promote large grid-connected solar and wind hybrid systems through support for new methods, technologies, and solutions. These solutions would also focus on wind-solar hybrid integration with emerging technologies including energy storage systems. With an operative period of five years, this policy covered – (a) conversion of under construction or existing solar or wind power plants into hybrid projects, (b) new wind-solar hybrid projects. The state nodal agency GEDA was responsible for assisting private project developers and the Government of Gujarat would facilitate energy storage technology for these projects. All the projects developed during the operative period of the wind-solar hybrid policy would be eligible for incentives and benefits available under this policy for a long-term period of 25 years from the date of commissioning (Energy and Petrochemicals Department, 2018b).

The residential segment was an important mover of Gujarat’s RE ambitions. So, the state rolled out the *Surya Urja Rooftop Yojana* in 2019–2020 to prioritise large-scale solar rooftop PV systems among the private residential households. This came in compliance with the state’s solar energy targets of around 8 GW by 2021–2022, out of which 3.2 GW was to be achieved through the rooftop segment. The rooftop segment was identified as key in the state’s transition trajectory, as it does not entail land-use change, and energy is majorly consumed where it is generated – avoiding AT&C related losses. The scheme also known as SURYA-GUJARAT, was set up with a mandate to benefit 200,000 consumers in the year 2019–2020 and cumulatively 800,000 consumers by the end of 2021–2022. A subsidy of 20 percent was made available for rooftops above 3 KW and up to 10 KW, installed by residential households. While any consumer installing between

1 KW and 3 KW solar PV rooftop systems were offered a subsidy of 40 percent on the final cost of installation (Energy and Petrochemicals Department, 2019b). This also created avenues for smaller EPC service providers by generating demand in the residential sector.

Recognising the importance of diversifying beyond residential rooftops and utility-scale solar parks, the Gujarat government identified a strategic opportunity in promoting small-scale, distributed solar photovoltaic (PV) systems. In response, the state introduced the *Policy for Development of Small-Scale Distributed Solar Projects-2019*, aimed explicitly at facilitating solar installations ranging between 0.5 MW and 4 MW capacity within the existing distribution networks of state licensees. The policy, while operationally effective for five years, assured developers of sustained incentives and policy stability by guaranteeing eligibility for a full 25-year Power Purchase Agreement (PPA) term for all projects commissioned during the operative window (Energy and Petrochemicals Department, 2019a). This targeted approach not only addressed critical gaps in Gujarat's RE deployment but also reflected a nuanced understanding of the state's socio-economic landscape. By focusing on dispersed, uncultivable, or barren land parcels, Gujarat aimed at minimising land-use conflicts and negative environmental impacts commonly associated with large-scale projects. Moreover, this policy demonstrated an intentional departure from the competitive bidding paradigm that tends to favour larger, better-capitalised firms. Instead, it provided transparent and predictable tariff visibility, significantly lowering entry barriers for smaller, local developers who typically lack the resources to engage in complex bidding processes.

From the broader perspective of Indian energy politics and sustainable development, such state-level interventions are crucial. They decentralise governance in energy transitions, create employment opportunities at local scales, and contribute meaningfully to skill development in regions often excluded from the economic benefits of national level energy transition dynamics. Gujarat's initiative, therefore, complemented national strategic objectives encapsulated in the 'Make in India' initiative, fostering local manufacturing capabilities and domestic innovation ecosystems. This alignment alludes to the essential interplay between subnational policy innovation and national economic strategies, reinforcing the state's pivotal role in India's broader energy and climate agenda.

This was followed by a new iteration of the *Gujarat Solar Power Policy 2021*. It outlines a robust strategic framework designed to stimulate SE and enhance solar energy adoption across the state. A key strength of this policy is its flexibility – it allowed solar projects of all sizes, from small setups starting at 1 KW (suitable for homes or small businesses) up to large projects of 1 MW (appropriate for bigger businesses or industrial operations). By accommodating projects of different scales, the policy makes it easier for both small entrepreneurs and established companies to get involved in the solar power market.

An important feature of this policy is the ‘banking’ provision. Simply put, banking lets solar energy producers store extra electricity they generate for later use. For smaller users, households and small businesses, known as low-tension (LT) consumers, extra energy could be banked on a monthly basis, making it easier to manage surplus electricity. Larger businesses, high-tension (HT) consumers, had to manage their surplus electricity daily. This policy assigned a modest compensation for Discoms for their grid services (i.e. INR 1.50 per unit for certain large users and INR 1.10 per unit specifically for solar energy consumed), ensuring that the companies supplying electricity remain financially healthy while keeping the system fair for everyone (Energy and Petrochemicals Department, 2020).

The policy also offered special support for small and medium-sized businesses (MSMEs) by guaranteeing a fixed price of INR 2.25 per unit for any surplus solar energy they generate over the first five years, instilling investor confidence in solar power. For larger businesses, the policy covers 75 percent of the recent competitive market rate for surplus energy (Energy and Petrochemicals Department, 2020). This balanced approach aimed to attract private investment across the board, creating a supportive environment for all types of solar energy projects. Hence, the Gujarat Solar Power Policy 2021 played a significant role in encouraging widespread use of solar energy, supporting entrepreneurship, and promoting economic growth.

The most recent, *Gujarat Renewable Energy Policy 2023* marks a significant institutional shift in how the state envisions the next phase of its energy transition. Moving beyond the fragmented and technology-specific frameworks of earlier policies, Gujarat recognised the interconnected nature of renewable technologies and unveiled a comprehensive policy that brings together solar, wind, hybrid systems, storage solutions, and emerging areas such as green hydrogen under a single regulatory umbrella. The 2023 policy sets an ambitious target of achieving 50 percent of the state’s cumulative electric power installed capacity through non-fossil sources by 2030. The operative period of this policy is five years from the date of its notification, i.e. until 18 August 2028, providing a medium-term horizon for investment planning, regulatory certainty, and phased infrastructure development (Energy and Petrochemicals Department, 2023).

From a broader political economy perspective, this policy signals a shift from incrementalism towards systemic transformation. With explicit targets and streamlined procedures for land acquisition, it seeks to mitigate one of the most persistent implementation bottlenecks in RE deployment. It also integrates clarity in tariff determination, notably allowing MSMEs to develop projects up to 4 MW with pre-fixed PPA tariffs linked to past competitive bidding, thereby lowering financial uncertainty for small-scale entrepreneurs. It also introduces zero banking charges for residential consumers, encourages hybrid and floating solar models, and facilitates green hydrogen production through clearly designated regulatory pathways (Energy and Petrochemicals Department, 2023).

Importantly, the policy places much needed emphasis on job creation, local manufacturing capacity, and the expansion of a clean-tech startup ecosystem. By providing incentives for battery storage, skill development, and green manufacturing clusters, the state is embedding industrial policy objectives within its RE strategy. This approach broadens the scope of the energy transition from a technical to a developmental agenda. It reflects a maturing policy logic that views RE as not only a tool for decarbonisation, but also as a vehicle for regional and local economic transformation and entrepreneurship. However, the ambition of the policy might be restricted by enduring constraints. While the single-window clearance mechanism and proactive nodal agencies are presented as solutions, past experience indicates that institutional coordination remains uneven horizontally as well as vertically. The policy's success in practice will depend on grid augmentation, evacuation infrastructure, and the resolution of social and administrative challenges associated with land access. More so, effective implementation of repowering provisions and the monitoring of time-bound infrastructure disclosure (Energy and Petrochemicals Department, 2023) will be key to translating policy ambition into real-world outcomes.

Overall, the recent Gujarat Renewable Energy Policy represents the state's most integrated and forward-looking energy policy to date. It consolidates prior lessons while setting out a future-oriented roadmap, making a strong case for the role of subnational leadership in India's clean energy transition. Its ability to balance scale with inclusion, and investment with institutional depth, will ultimately determine its impact on SE and energy governance more broadly.

Through these sequential policy advancements, from pioneering solar-specific strategies to an integrated renewable framework, Gujarat has continuously adapted to shifting technological, economic, and political realities. This evolutionary perspective points towards the state of Gujarat's significant role in the national energy transition, emphasising the dynamic interplay between policy ambition, entrepreneurial ecosystems, and practical governance challenges. The ongoing challenge that remains for Gujarat, is balancing rapid deployment of renewables with socio-economic inclusivity and environmental sustainability, ensuring that its transition pathways remain equitable and broadly beneficial.

#### **4.7 Conclusion**

India's RE transition is a complex process of institutional layering, policy experimentation, and political negotiation. As this chapter has demonstrated, the state of Gujarat offers a compelling vantage point from which to examine how national climate and energy targets are interpreted, recalibrated, and operationalised through subnational policy frameworks. Rather than viewing the energy transition as a linear extension of central mandates, the Gujarat

case foregrounds the contingent and negotiated nature of transition, as one shaped by local capacities, sectoral politics, and developmental imaginaries.

Successive policies, from the Gujarat Solar Policy of 2009 to the Wind Repowering Policy of 2018 and the consolidated Renewable Energy Policy of 2023 reflect a progression from discrete interventions to a more integrated vision of RE governance and planning. Over time, Gujarat has adopted not just ambitious capacity targets, but a suite of regulatory instruments intended to reduce market friction and induce entrepreneurial activity. Mechanisms such as pre-defined PPA tariffs, energy banking provisions, net metering, repowering incentives, and green hydrogen promotion are not merely technocratic tools, they are, in fact, imagined as instruments of institutional design that shape the nature and inclusivity in the energy transition processes.

These tools, however, function within a broader political economy context. While Gujarat has built institutional credibility through policy continuity and early mover status, structural constraints persist. Land acquisition remains politically sensitive and socially contentious. Transmission infrastructure and evacuation readiness frequently lag behind generation growth, particularly for smaller and distributed producers. Institutional coordination across nodal agencies, though improving, is uneven. As such, Gujarat's experience reveals not only the potential of subnational initiative but also alludes towards potential limitations of policy ambition when not matched by governance capacity.

At the heart of these dynamics lies the question of entrepreneurship – not merely as individual initiative, but as a socially and institutionally embedded practice. Policies signal opportunity, but it is the structure of those signals, i.e. clarity, stability, procedural accessibility, that determines who can respond. In this sense, SE is not a spontaneous outcome of energy markets, but a product of deliberate regulatory curation and infrastructural provisioning. Where institutions align to lower uncertainty, distribute risk, and enable experimentation, entrepreneurship flourishes; where they do not, opportunities remain confined to incumbents or well-capitalised actors.

In this chapter so far, we mapped the architecture of Gujarat's RE policy environment within the context of broader national transition policy and goals. The focus of the next chapter shifts from institutional form to lived experience: here we empirically interrogate how entrepreneurs engage with this evolving policy landscape. By examining which policy mechanisms are activated in practice, where friction arises, and how actors innovate or adapt, we seek to uncover the grounded realities of SE. In doing so, we illuminate the co-production of energy futures in a transforming Indian polity.

## **Note**

- 1 [https://unfccc.int/kyoto\\_protocol](https://unfccc.int/kyoto_protocol).

# 5 Opportunities and challenges to sustainable entrepreneurship

## Evidence from India's energy sector

### 5.1 Introduction

Sustainable entrepreneurship is increasingly seen as a critical lever for addressing pressing environmental challenges while advancing social welfare and economic growth. In the context of key sectors like RE, transport, waste management, sustainability-driven entrepreneurs are not just businessmen; they are key agents of change, capable of reshaping production and consumption behaviour. Understanding the opportunities and challenges faced by these entrepreneurs is crucial – not only to foster a conducive ecosystem for them but also to inform the broader transformation to sustainable energy systems by better tailoring policies, support mechanisms, and market structures. This is central to achieving national and subnational decarbonisation and development goals. This chapter, therefore, focuses on the complex journey of sustainability-oriented entrepreneurs in India, particularly in the state of Gujarat, which is a frontrunner among Indian states contributing significantly to the total RE mix. Here, based on empirical evidence collected through personal interviews with firm owners and managers, we examine the developmental trajectories of Micro, Small, and Medium Enterprises (MSMEs) as they initiate, expand, and adapt their RE ventures. This analysis provides insights into the strategic choices, adaptive processes, and challenges these enterprises encounter while striving to establish a foothold in this evolving sector.

Sustainable entrepreneurship (SE), as established in existing literature, is influenced by a myriad of extrinsic and intrinsic conditions. On the external front, the socio-economic landscape, regulatory frameworks, and market conditions all play pivotal roles, while internal drivers are tied to an entrepreneur's intrinsic motivations – ranging from profit-making to a genuine commitment to environmental change (Haldar & Tripathi, 2023; Linnanen, 2016; Walley & Taylor, 2002). The need to unravel both external and internal conditions is indicative of the complexity of SE as a concept and as a practical instrument for change. SE hence entails a balance between navigating systemic market failures – like public goods, externalities, and

imperfect information – and leveraging these same failures as opportunities for innovation (Dean & McMullen, 2007).

In Gujarat's RE sector, these dynamics come to life in a particularly illustrative manner. Entrepreneurs here are not only responding to regime and landscape-level regulatory pushes and evolving market demands, but they are also striving to overcome barriers like demand uncertainty, inadequate technological support, and the absence of financial backing. Adopting a discussion-oriented tonality in this chapter, we empirically explore how sustainability-driven entrepreneurs as niche actors (refer Chapter 2), operate within and against the forces of the established fossil dominant regime. The examination of both niche and regime-level processes, allows us to investigate how intrinsic characteristics, organisational structures, and market and regulatory conditions interact to enable or hinder sustainable entrepreneurial outcomes. Through this exploration, we uncover the broader implications for fostering SE across different sectors and regions, drawing attention to how market instruments and policy frameworks can be more effectively designed to facilitate the transition from conventional to RE systems.

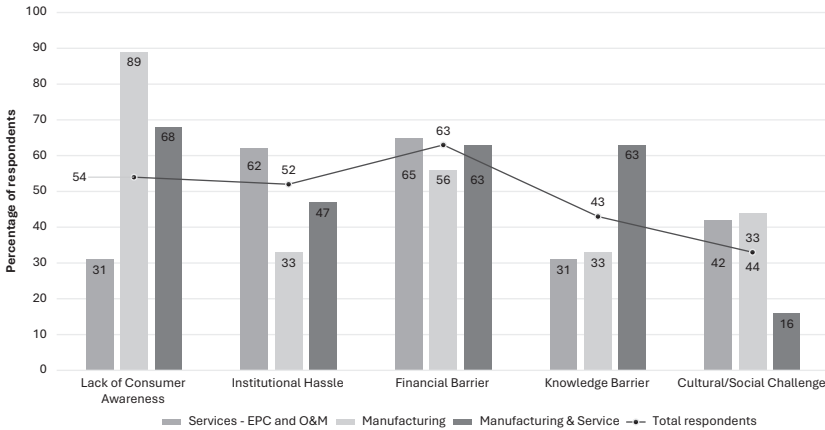
In this context, the next section starts with identifying major challenges faced by sustainability-driven entrepreneurs operating across six districts in Gujarat, specific to the RE sector. These challenges span from the early stages of establishment of the firm (early start-up phase) to the later stages when the entrepreneurs were grappling with strategies for scaling up (late start-up or leadership phase).

## **5.2 Challenges across entrepreneurial phases – establishment to scaling complexities**

Sustainability-oriented entrepreneurs often perceive challenges at their start-up phase differently in comparison to conventional entrepreneurs. SE driven by the need to address an ecological or social challenge is most likely to perceive the present institutional environment as challenging. This is reflected in their negative perception or scepticism of financial, institutional, market, and knowledge or information support structures (Hoogendoorn et al., 2019).

### *5.2.1 Challenges during early start-up phase*

Looking at the responses of 54 entrepreneurs from Gujarat, it becomes clear that overall financial challenges (63 percent), institutional bottlenecks (52 percent), and imperfect market conditions (54 percent) including lack of consumer awareness are perceived as major hindrances to firm growth at the early start-up stage – reported by over half of the respondents (Figure 5.1).



*Figure 5.1* Challenges faced at the early start-up stage as per type of business activity.

*Source:* Primary Survey, 2019.

It is interesting to explore these challenges based on the type of business activity the firms are engaged in – i.e. only service providers (engineering, procurement, and construction (EPC) and operations and management (O&M)), manufacturers, and those engaged in both service and manufacturing. Meaningful patterns can be noticed here. For instance, EPC and O&M providers predominantly face financial (65 percent) and institutional challenges (62 percent). This pattern indicates that service-oriented businesses being dependent on consistent funding streams and policy support are significantly sensitive to policy and regulatory uncertainty and complexity, and disruption of finance flows (Hoogendoorn et al., 2019). Service providers often lack the tangible assets that the manufacturers can leverage to secure funding. Especially in the lack of concrete production capacity and material outputs, investors are often uncertain of the returns, hence deterring them from investing in EPC and O&M-related activities (Haldar, 2021a). Similarly, for hybrid firms (manufacturing and service) challenges related to lack of finance are almost as pronounced (63 percent) as the service providers, having to balance securing capital for manufacturing as well as recruiting skilled workers for service provision. While 56 percent of the manufacturers report facing financing challenges during the start-up stage, they are relatively less exposed owing to clearer value propositions in terms of tangible outputs that can be marketed and scaled (Figure 5.1).

At the start-up stage, institutional hassles were reported by 52 percent of respondents. The pursuit of sustainability often implies challenging existing norms, institutions, and regulations (Dean & McMullen, 2007; Hockerts & Wüstenhagen, 2010). Thus, the complexities emerging from this

contestation and resistance from existing regime structures and institutions might increase the risk perception of sustainable entrepreneurs aiming to establish their venture. With respect to the type of business activity, the empirical evidence suggests that 62 percent of the service providers (EPC and O&M) report institutional and administrative challenges as a significant hurdle. Regulatory bureaucracy and complexity, and policy uncertainty disproportionately affect these entrepreneurs as they often lack adequate resources and networks to navigate intricate procedural and legal landscapes especially as they start out (Halder, 2021b). In comparison, only 33 percent of manufacturers report institutional challenges as a significant deterrent (Figure 5.1). This pattern implies that manufacturers are either better equipped to comply with regulations and navigate legislative procedures, or perhaps they benefit from a more simplified and supportive policy environment for production activities, as indicated by recent national initiatives like Make in India, and production-linked incentives, etc.

SE often emerges in imperfect markets characterised by lack of consumer awareness, information asymmetries, and inadequate infrastructure, etc. (Pinkse & Groot, 2015). This often shapes entrepreneurs' risk perceptions in relation to RE businesses. Our data on 54 entrepreneurs operating in Gujarat suggest that perhaps the most telling distinction in challenges across business types at the early start-up phase emerges with respect to consumer awareness or demand for RE products and services (Figure 5.1). Demand uncertainty due to lack of consumer awareness for RE products is reported by a staggering 89 percent of manufacturers in the early start-up stage. As manufacturers rely primarily on consumer demand for RE products, uncertainty of consumer demand not only risks low profitability, but also discourages further investments in innovation and scaling production capacity. In contrast, only 31 percent of service-oriented enterprises reported lack of consumer awareness to be a challenge during the early start-up stage. As service-oriented businesses offering EPC and O&M engage more directly with consumers, they are often able to inform potential consumers about the products or offer services to consumers who have already installed RE systems. Hence, lowering the concerns for lack of consumer awareness leading to lower demand (Halder, 2021a,b). Sixty-eight percent of the firms engaging in both service and manufacturing reported lack of consumer demand as a significant challenge, as during the early stages of establishment they struggled to generate consumer demand through engagement while also having to secure investments for building up manufacturing capacity.

Information or knowledge barriers present another layer of complexity, particularly for hybrid enterprises, where 63 percent of these entrepreneurs reported difficulties in leveraging necessary expertise and market or regulatory knowledge particularly during the early start-up stages (Figure 5.1). SE requires a wider range of skill sets and knowledge in comparison to

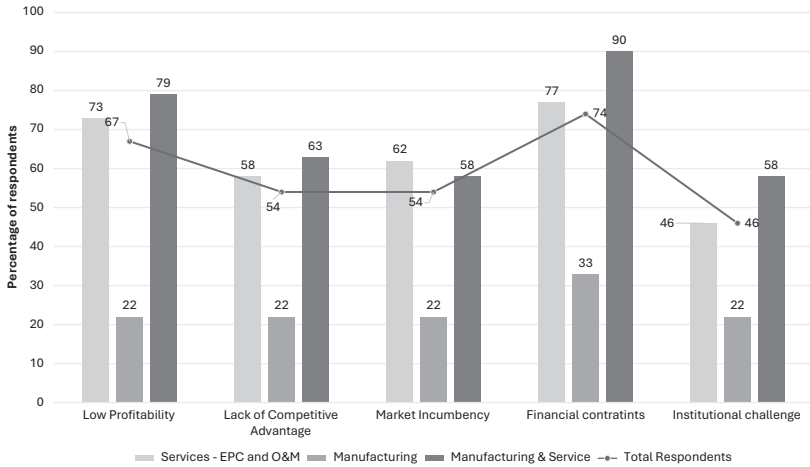
conventional businesses. Such entrepreneurs may perceive higher risks due to information asymmetry and a lack of skills. They also face challenges with inadequate technical knowledge on starting a sustainability-oriented business. This is especially true in a regime where existing information and resources are not tailored to meet their specific needs (Castka et al., 2004; Rizos et al., 2016). Thus, the need for sustainable entrepreneurial ventures to not only understand business principles, but also social and environmental issues, while having the capacity for stakeholder engagement, and policy advocacy makes the process of establishing a start-up seem more daunting (Marin et al., 2015). Specific to the RE sector which is a technocentric industry, managing both production and service provision requires a broader spectrum of knowledge – ranging from technical manufacturing skills to consumer-facing service skills. This complexity is compounded by the need to stay on track with evolving renewable technologies and market demands (Haldar & Tripathi, 2023).

Risk perceptions of entrepreneurs are also driven by the sociocultural contexts they operate in. Although the culture and history of Gujarat promote innovative and entrepreneurial aptitude, 33 percent of the RE entrepreneurs interviewed for this study reported cultural norms and consumer scepticism to be hindering the uptake of RE products and services. For instance, kite flying is integral to Gujarat's culture and social traditions. This is mostly practiced on the rooftops creating a trade-off in terms of giving up space for solar rooftop installation (Haldar, 2021a,b).

Interestingly, as businesses proceed from the early stages of start-up where the focus is on devising strategies for scaling, i.e. late start-up or scaling-up phases, they encounter a different constellation of challenges. Moving ahead, we analyse the challenges and risk perceptions of entrepreneurs in Gujarat with respect to making the move towards the growth trajectory in their RE businesses.

### *5.2.2 Challenges during scaling-up phases*

To uncover why certain firms might be performing relatively well while others struggle to grow, we analyse the challenges facing RE entrepreneurs in Gujarat by observing patterns of risk perception across different activities – service providers, manufacturers, and hybrid firms (both service and manufacturing). In-depth interviews with 54 entrepreneurs operating across six districts of Gujarat, reveal that low profitability, lack of competitive advantage, market incumbency, lack of finance, institutional hassles like bureaucracy and complex approval processes, technological challenge, uncertain demand, non-recovery of financial dues, unavailability of skilled labour, and raw material shortage are prominent challenges faced by RE ventures.



*Figure 5.2* Challenges faced at the scaling-up stage across type of business activity (A).

*Source:* Primary Survey, 2019.

Inadequate access to finance and low profitability are major challenges faced by RE entrepreneurs especially in developing economies. Our interviews reveal that 74 percent of the respondents perceive financial constraints as a major challenge during late start-up phases when they aim to scale up. While 67 percent of the respondents reported that low profitability was a significant hurdle (Figure 5.2). Financial challenges are more pronounced in developing economies particularly due to inadequate access to institutional finance, high costs associated with RE Technologies, and limited venture capital availability. Traditional banks often perceive RE projects as high-risk, further complicating funding prospects (Brunnschweiler, 2010). The underdeveloped market infrastructure and inconsistent policy environment also create uncertainty, shrinking funding possibilities for SE. A lack of coordinated financial support and high-cost barriers continue to hinder the expansion and long-term sustainability of sustainability-oriented sectors including RE (Gabriel, 2016; Lee et al., 2022). This is evidenced by 54 percent of the RE entrepreneurs surveyed reporting market incumbency and lack of competitive advantage as significant challenges during scaling up, followed by 46 percent of the respondents perceiving institutional bottlenecks as significant deterrent.

Low profitability is perhaps the most telling difference across business types. Among service providers, 73 percent report that low profitability is a significant challenge. This isn't particularly surprising given the sheer volume of competition they face. The barriers to entry for MSMEs have lowered significantly in recent years, as initiatives by GEDA and MNRE

sought to boost the RE sector by incentivising new players and lowering minimum thresholds for eligibility. While these measures have succeeded in creating a diverse marketplace, they've also fostered an environment where companies are competing fiercely on price, driving profit margins down. Firms that deal with EPC or O&M services find themselves caught in this downward price spiral with little room to manoeuvre financially (Haldar & Tripathi, 2023). In contrast, only 22 percent of manufacturers report low profitability as a key obstacle. Manufacturers have a fundamentally different financial structure; their business model allows for greater control over production costs and economies of scale. These firms often have strong networks and enter into long-term power purchase agreements (PPAs) that insulate them to some extent, from the competitive pricing pressures that service providers face. Hybrid firms, however, seem to bear the worst of both worlds – 79 percent of these respondents indicate that low profitability is an issue (Figure 5.2). The compounded demands of capital investment in manufacturing alongside the squeezed profit margins in services make profitability a serious and often overwhelming challenge for them.

Lack of competitive advantage is another pervasive challenge that based on business activity hybrid firms (both manufacturing and services) feel most acutely at the later stages of start-up when the entrepreneurs are strategising ways to scale up. Sixty-three percent of respondents engaged in both manufacturing and service provision reported that they struggle to maintain an edge. The combination of providing services and producing goods means they are competing across multiple dimensions, often against specialised firms that can offer more focused, competitive solutions. Service providers also report a significant issue here, with 58 percent stating that they lack a strong competitive advantage. The RE service sector is largely homogeneous; most providers are offering similar EPC and O&M services, which makes it hard to stand out except on cost competitiveness, again tying back to the problem of shrinking profitability. In contrast, manufacturers fare better, with only 22 percent citing lack of competitive advantage as a major concern (Figure 5.2). These firms have more room to differentiate, either through product quality, product innovation, or unique customer relationships.

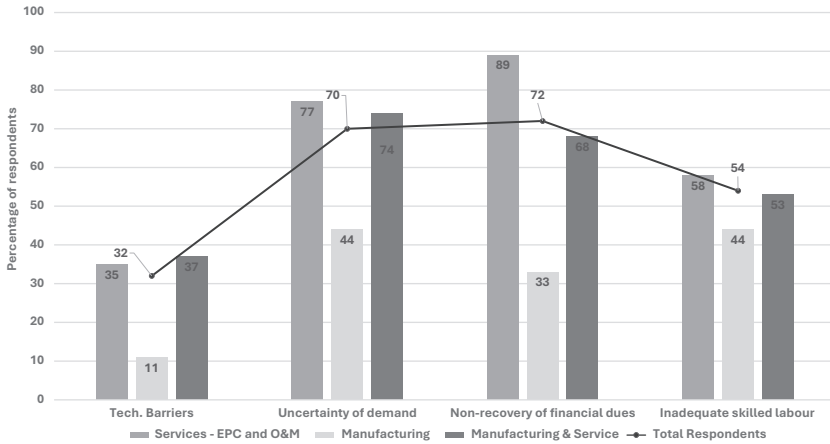
Market incumbency presents yet another layer of challenge, particularly for younger service-oriented firms. Here, 62 percent of service providers interviewed report that they struggle with market incumbency, which manifests in the form of established players creating barriers to entry through, predatory pricing, or simply already enjoying a larger share of customer loyalty. Established manufacturers – who are effectively growing into the role of incumbents having secured significant growth – are much less impacted, with only 22 percent citing incumbency as an issue. For these established players, being the incumbents means wielding significant influence over supply

chains and market norms. Hybrid firms, with 58 percent respondents reporting issues related to incumbency, again seem to be stuck between dynamics, trying to carve out a space that is competitive against both established manufacturers and a saturated service market (Haldar, 2021a; Haldar & Tripathi, 2023).

Financial market failures as discussed above, pose one of the most significant challenges for almost three-fourth of total respondents. Younger service-oriented firms feel this acutely, with 77 percent indicating that access to finance is a major barrier. Unlike manufacturers, which can offer physical collateral or have financial histories that make them more appealing to lenders, service providers struggle to present the kind of assurances banks and investors require. Ninety percent of the hybrid firms reported financial barriers, hence facing the steepest challenges of all. Trying to support both a manufacturing line and service operations necessitates substantial public, institutional, or private capital, which they often have limited access to. Manufacturers, though not immune, are better positioned, with 33 percent reporting risks related to financial market failures, pointing again to the advantages conferred by certain degree of maturity and stability in business (Figure 5.2).

Institutional challenges, such as bureaucracy, certification complexities, and lengthy tendering procedures, were cited by almost half of the total 54 firms surveyed. The percentage is highest among hybrid firms (58 percent) and service providers (46 percent). Service providers, often younger and smaller in size, do not have the networks or experience to navigate these complexities easily, and many of the institutional procedures that have been simplified are still more conducive to larger players or manufacturers who have been in the market for longer. Manufacturers, being relatively established and typically more familiar with regulatory pathways, report fewer challenges here, with only 22 percent indicating significant institutional hurdles (Figure 5.2).

Technological barriers appear to be a significant challenge across the sector, with almost one-third, 32 percent of total respondents citing them as a hurdle in scaling-up (Figure 5.3). Among service providers, 35 percent report facing technological challenges, a relatively higher percentage compared to manufacturers, where only 11 percent of firms perceive this as a barrier. Hybrid firms, report the highest proportion (37 percent), likely reflecting their need to integrate diverse technological processes to balance both production and service. However, our discussion with respondents surface that most firms in the RE sector operate within a low-technology environment, where basic technical skills suffice. This reflects the industry's current focus on standard tasks such as installations and service provisioning rather than innovation-driven, high-tech activities, indicating that technology is not yet a critical determinant of success for most RE firms across sectors.



*Figure 5.3* Challenges faced at the scaling-up stage across type of business activity (B).

*Source:* Primary Survey, 2019.

In stark contrast, uncertainty of demand emerges as a pervasive issue, with 70 percent of respondents identifying it as a challenge. Service providers are the most affected, with a significant 77 percent reporting demand uncertainty, compared to 44 percent of manufacturers. Hybrid firms also report substantial difficulties (74 percent), reflecting the widespread demand uncertainty in the RE market (Figure 5.3). The high proportion of service providers facing this challenge can be attributed to their emergent nature, smaller market share, and exposure to seasonal tendering processes invited by GEDA/MNRE. Manufacturers, often more established and less reliant on individual or residential consumer demand, are relatively insulated from this challenge. However, our observations highlight a pressing need for policies to stabilise demand across the sector, such as increasing consumer awareness and expanding market access for RE products and services.

Non-recovery or delayed recovery of financial dues stands out as a critical challenge, impacting 72 percent of the respondents operating RE businesses. This issue is especially pronounced for service providers, where a staggering 89 percent report financial difficulties, compared to just 33 percent of manufacturers. Hybrid firms are also significantly affected, with 68 percent citing financial recovery as a barrier (Figure 5.3). This disparity reflects the structural vulnerabilities of service providers, who often deal directly with end consumers, mostly (low demand) residential and rely heavily on government subsidies, which are prone to delays. Manufacturers, however, generally work with intermediaries or have long-term purchase agreements with governments or commercial consumers, and benefit from more predictable payment cycles.

Unavailability of skilled labour is another hurdle especially at the scaling-up stage, affecting 54 percent of total RE entrepreneurs interviewed,

with service providers (58 percent) and hybrid firms (53 percent) reporting slightly higher challenges than manufacturers (44 percent) (Figure 5.3). This barrier highlights systemic gaps in skill development programmes, which often fail to meet industry standards. Service firms, typically younger and less resourceful, are more vulnerable to labour shortages, while manufacturers, being relatively mature, tend to invest in in-house training to bridge skill gaps (Haldar, 2021a; Haldar & Tripathi, 2023). Owing to its industry wide nature, the challenge of skilled labour availability does not appear to be strongly associated with particular business type. Similar experiences from the developed world, e.g. Sweden suggests inadequate competence as a major challenge for RE businesses (Limeta, 2024). So, addressing this issue through better alignment of vocational training programmes with industry needs is critical for the sector's growth.

Availability of raw material and equipment is a pre-condition for scaling-up of RE businesses like any other production. As discussed above, access to credit or secure financial streams is a significant challenge for several entrepreneurs operating RE businesses in Gujarat. Similar observations emerge from emerging economies which are often faced by resource scarcity and inadequate finance (e.g. (Opoku et al., 2022)). This, in turn, hinders firms in scaling-up their production and service provisioning due to inability to access raw materials. Limited manufacturing capacity locally is also another challenge.

Observed through our analysis of the 54 RE entrepreneurs, 50 percent report no issues with raw material availability, while 35 percent regularly face shortages, and 15 percent encounter them occasionally. This distribution highlights a significant disparity among different types of business activities – services, manufacturing, and hybrid operations – demonstrating the structural and operational challenges specific to each category.

Service providers are disproportionately affected by raw material shortages, with 50 percent regularly experiencing delays, compared to only 11 percent of manufacturers. Hybrid firms, engaging in both services and manufacturing, lie somewhere in between, with 26 percent reporting regular shortages. This pattern suggests a strong relationship between the type of business activity and the likelihood of encountering supply chain disruptions, as confirmed by the statistical significance ( $p$ -value of 0.032) and a moderately strong Cramer's  $V$  value of 0.324 (Table 5.1).

The prevalence of shortages among service providers can be attributed to their emergent status and dependence on external suppliers for RE equipment. Service firms often lack the established supply chain networks and logistical resources that manufacturers possess, making them more vulnerable to delivery delays (Haldar & Tripathi, 2023). Manufacturers, however, tend to have more control over their raw material procurement, often maintaining direct relationships with suppliers or producing key components in-house. This operational autonomy relatively insulates them from the delays and inconsistencies faced by their service-oriented counterparts (Haldar, 2021a,b).

Table 5.1 Shortage of raw material at the scaling-up stage across business type

<i>Activity</i>	<i>No (%)</i>	<i>Yes (%)</i>	<i>Occasionally (%)</i>	<i>Total</i>
<i>Services – EPC and O&amp;M</i>	12 (46)	13 (50)	1 (4)	26 (100%)
<i>Manufacturing</i>	4 (44)	1 (11)	4 (44)	9 (100%)
<i>Manufacturing and Service</i>	11 (58)	5 (26)	3 (16)	19 (100%)
<i>Total firms</i>	27 (50)	19 (35)	8 (15)	54 (100%)
<i>Statistic</i>	Fisher's exact test P Value	9.905	Cramer's V Value P Value	0.324 0.021

Source: Primary Survey, 2019.

Hybrid firms, which blend service provision and manufacturing, experience a mix of these challenges. Their reliance on external supply chains for certain components parallels that of service providers, while their partial in-house production capacity provides some resilience, akin to manufacturers.

Our discussion so far makes it evident that broadly sustainability-oriented entrepreneurs face a wide array of technology, knowledge, market, and policy-related challenges at multiple stages and levels of their operation. To understand how these challenges might be mitigated through multilevel processes, the next section looks at firm level; market-driven; and national, subnational, and global policy perspectives that can stimulate SE in the RE industry, in particular.

### 5.3 Opportunities for sustainable entrepreneurship – micro- (firm level), meso- (market), and macro-(policy) level perspectives

In response to challenges posed to SE development particularly in the RE industry, government agencies such as MNRE, Ministry of Power (MoP), GEDA, and Ministry of Skill Development and Entrepreneurship (MSDE) have introduced certain policy and regulatory interventions that support SE by creating windows of opportunities at the regime level. In addition to these landscape level processes, market, and individual firm-related opportunities that support RE entrepreneurial niches include expectations of high profitability, presence of large potential consumer base, technological and marketing expertise, and brand value (Halдар, 2022, 2021b).

#### 5.3.1 Opportunities created by policy and regulatory processes

It is often observed that there is a negative perception regarding regulations among entrepreneurs, owing to complexity, policy volatility, bureaucratic

processes, and performance or quality thresholds set in a top-down manner (among other bottlenecks) that might hinder the functioning of these businesses (Álvarez et al., 2014; Begley et al., 2005; Gnyawali & Fogel, 1994). Interestingly, the RE industry is predominantly policy-driven given the landscape (national and supranational) pressures to decarbonise the economy evident through ambitious RE targets under India's NDCs. Thus, policy and regulatory interventions become key to ensure SE development and sustained growth in the uptake of RE technologies in India.

Drawing from our sample of 54 entrepreneurial ventures based in Gujarat, majority of the firms, i.e. 65 percent responded that the policy and regulatory environment was lax and riddled with loopholes which rendered it inefficient. Around 28 percent of the total respondents perceive the need to comply with regulations and standards irrelevant in determining the success or their business. While only 7 percent of the entrepreneurs interviewed report a high level of compliance with policy norms (Figure 5.4).

Understanding how regulatory and policy compliance is perceived by entrepreneurs based on the type of businesses they operate, i.e. services, manufacturing, or hybrid (both manufacturing and service), we observe a statistically significant relationship. The statistics also reveal a strong association between the business activity type and degree of compliance with regulations and policy norms.

Based on our observations, manufacturers exhibit a notably lax approach to compliance with 78 percent reporting loopholes and inefficiencies in the regulatory space. Cost pressures from competitive bidding force them to prioritise affordability over adherence to quality standards which often require more investments. Hence for these firms, stringent regulations are viewed as burdensome, leading to compromises in product quality, which might erode consumer trust and slow down the transition from conventional to RE sources (Figure 5.4).

On similar note, service providers, primarily involved in EPC and O&M, perceive compliance as not relevant for their operations. Almost half of these firms (42 percent) dismiss regulatory requirements as insignificant to their business growth since they primarily provide installation and maintenance services rather than engaging in production or energy generation. This perception further reflects weak enforcement of regulation including REC and RPOs in the sector. Similar trends are observed for hybrid businesses where a staggering 90 percent of entrepreneurs interviewed perceived policy rules as inefficient (Figure 5.4). Such non-existent or lenient compliance impacts the broader RE ecosystem by stifling market growth and sustainability. A lack of stringent regulations risks diminishing consumer confidence, slowing adoption rates.

Looking into more policy and regulatory interventions for supporting SE in the RE industry in Gujarat, an impressive 89 percent of total

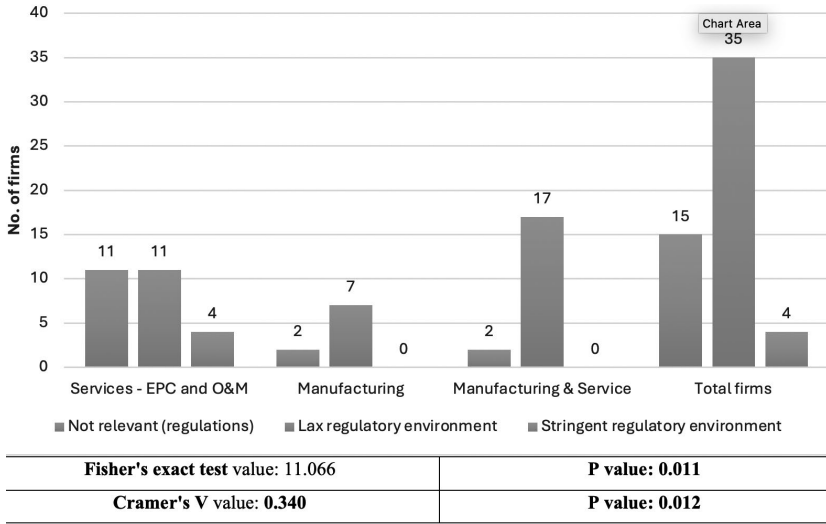
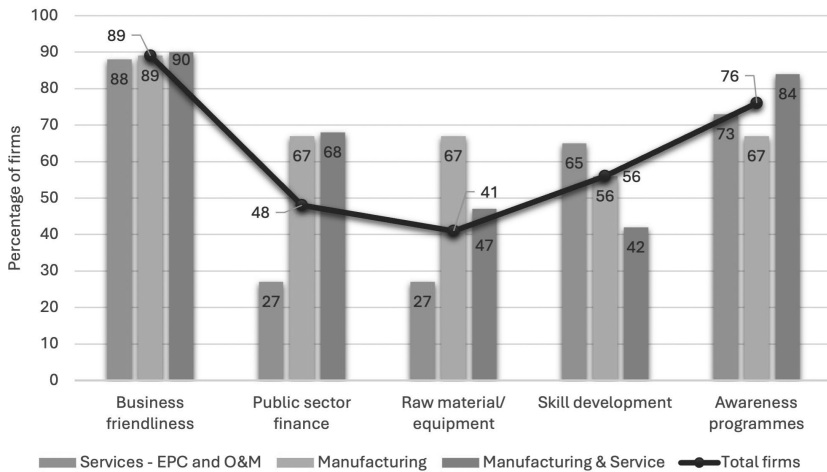


Figure 5.4 Degree of compliance with regulation (e.g. RPO/REC) across type of business activity.

Source: Primary Survey, 2019.

entrepreneurs surveyed consider the policy ecosystem to be business-friendly, reflecting widespread approval of government policies in this critical sector (Figure 5.5). This finding alludes to the broad-spectrum design of policy frameworks, which intentionally encompass the entire RE industry across different segments and business types. Policies enacted by the MNRE and the GEDA have been instrumental in fostering the adoption of RE technologies, benefiting both manufacturers and service providers (Haldar, 2022).

Access to financial loans from public sector banks or funding institutions emerges as a pivotal factor in scaling entrepreneurial ventures within the RE industry. Scholarly research consistently highlights financial liquidity as a prerequisite for entrepreneurial success (Black & Strahan, 2002). Yet only 48 percent of surveyed entrepreneurs reported securing loans from public sector institutions, expressing concerns regarding a notable funding gap. Established manufacturers with substantial turnover have greater success accessing loans (67 percent), often leveraging collateral to mitigate lender risk. In contrast, emerging service providers, often asset-light, face more significant barriers due to stringent asset or turnover requirements. This is evidenced by our interviews where only 27 percent of the EPC and O&M service providers were able to secure loans from public sector institutions (Figure 5.5). This pattern mirrors a persistent challenge documented in global development literature: limited access to credit constrains small



*Figure 5.5* Perceived opportunities from policy processes across type of business activity.

Source: Primary Survey, 2019.

businesses, particularly in emerging economies (Kuzilwa, 2005). Although national initiatives such as MUDRA Bank and Start-up India exist, their generalised mandates do not adequately address the specific financing needs of RE entrepreneurs. Banks’ inherent risk aversion further compounds the funding bottleneck, pointing towards a critical policy gap in sector-specific financial support (Haldar & Tripathi, 2023).

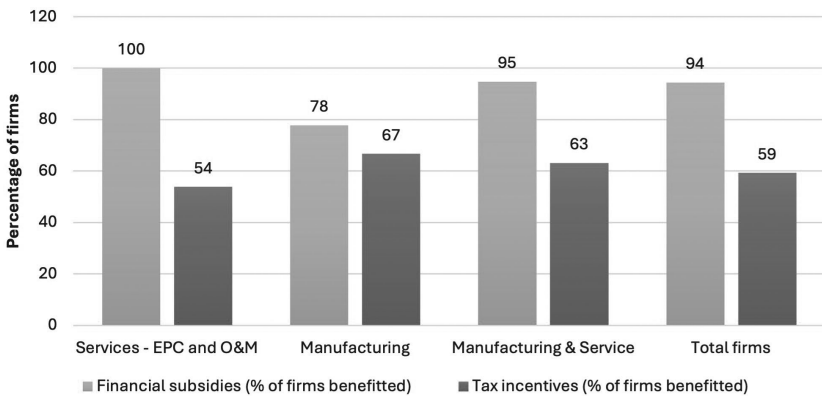
Equally pressing is the limited policy support for raw materials and equipment, reported by only 41 percent of surveyed firms. Manufacturers have benefited from sector-specific measures such as safeguard duties on imported solar panels, which offer a protective buffer against foreign competition (67 percent). A notable policy intervention includes the imposition of a 25 percent safeguard duty on solar panel imports, bolstering domestic manufacturing. However, service providers remain disadvantaged (only 27 percent being able to benefit) due to the absence of equivalent raw material procurement policies. While the Raw Material Assistance Scheme supports MSMEs broadly, its lack of RE-specific provisions limits its sectoral relevance (Haldar, 2021b,2022; Haldar & Tripathi, 2023).

Skill development initiatives led by MNRE are crucial for building a technically adept workforce. Yet only 55 percent of respondents found these programmes effective (Figure 5.5). Service providers were more likely (65 percent) than manufacturers (56 percent) to recognise the utility of skill development initiatives. However, almost half (44 percent) of total entrepreneurs interviewed perceive the current training framework as inadequate.

Despite the efforts of programmes such as the Pradhan Mantri Kaushal Vikas Yojana (PMKVY) and the Gujarat Institute of Solar Energy (GISE), the training provided often falls short of the sector's advanced technical requirements. Fee-based workshops offered by institutions like the Gujarat Energy Research and Management Institute (GERMI) remain out of reach for many entrepreneurs, suggesting a need for more accessible and specialised training modules (Halder, 2021a).

Further, marketing and consumer awareness campaigns spearheaded by MNRE and GEDA have played a transformative role in expanding the market for RE products and services. As our observations reveal, 76 percent of surveyed firms reported benefiting from these initiatives. Service providers (73 percent), in particular, have leveraged these campaigns to catalyse demand. However, since these programmes are designed to address the broader market landscape, their impact cannot be exclusively attributed to any specific business activity type observed from similar responses across all categories.

Subsidies and tax incentives are critical instruments in shaping entrepreneurial ecosystems, especially in emergent sectors like RE. Our findings illustrate a nuanced landscape where financial subsidies (indirect and direct) emerge as the most widely accessible mechanism, with all the service-oriented firms in EPC and O&M benefiting, compared to 78 percent of manufacturing firms and 95 percent of hybrid firms involved in both manufacturing and service. Overall, 94 percent of surveyed firms accessed financial subsidies, elucidating their central role in enabling entrepreneurial activity in the sector (Figure 5.6). This widespread access to subsidies aligns with broader literature emphasising their importance in addressing market



*Figure 5.6* Firms benefited from financial subsidies and tax incentives across type of business activity.

*Source:* Primary Survey, 2019.

failures and reducing capital barriers (Claro, 2006; Peng & Liu, 2018). Entrepreneurs, particularly in the service domain, highlighted during interviews how subsidies alleviate the heavy upfront costs of RE projects, such as solar rooftop installations. This is especially critical for asset-light businesses, where financial constraints often limit scalability. However, manufacturers, who typically require higher capital investments, reported challenges with delayed disbursements and administrative hurdles, which corroborates the existing argument that poorly executed financial interventions can hinder effectiveness of such policy instruments (Kemp & Pontoglio, 2011).

Tax incentives, while beneficial, exhibit a more selective reach. As our analysis shows, only 54 percent of service providers, 67 percent of manufacturers, and 63 percent of hybrid firms reported benefiting from these incentives, resulting in an overall utilisation rate of 59 percent (Figure 5.6). Such disparity surfaces the structural challenges within fiscal policies, where tax regimes often favour established firms with higher taxable incomes. For instance, manufacturers benefit from reduced Goods and Services Tax (GST) rates on solar equipment and accelerated depreciation policies for solar rooftop systems. These incentives create tangible advantages, facilitating investment in production capacity. Conversely, service providers face higher GST rates on activities such as EPC contracts (18 percent), a recurrent concern raised by entrepreneurs during interviews (Haldar, 2022, 2021a,b). Such discrepancies inflate operational costs for service providers, creating an uneven competitive landscape and diluting the broader impact of tax incentives.

Our findings resonate with existing literature which posits the critical balance required in designing subsidy and tax frameworks. There is a need for adaptive policies that evolve alongside industry maturity, a principle highly relevant to India's emerging RE sector (Acemoglu et al., 2016). During our interviews, entrepreneurs frequently emphasised the need for synchronised policy interventions that address the specific needs of manufacturers and service providers alike. For example, while financial subsidies enable immediate market entry, their delayed implementation for manufacturers suggests a pressing need for streamlined disbursement mechanisms. Similarly, tax incentives, though effective in incentivising capital investment, require recalibration to reduce the disproportionate burden on service-oriented firms. Our interviews further revealed a growing concern over the shifting fiscal landscape under the GST regime. Entrepreneurs lamented the removal of legacy incentives, such as 100 percent tax holidays and customs duty waivers, which were instrumental in fostering early-stage growth. This aligns with broader critiques in the literature, which caution against abrupt policy transitions that can destabilise emerging industries (Haas et al., 2011). The current policy structure, while well-intentioned, risks stalling momentum

by creating bottlenecks for service providers and especially MSMEs, who are essential contributors to the RE value chain.

### 5.3.2 *Firm-level (intrinsic) and market-related (extrinsic) opportunities*

Exploring the association between the type of business activity and the opportunities perceived by entrepreneurs in the RE sector in Gujarat reveals a nuanced interplay of market dynamics, firm maturity, and competitive pressures. According to our observations, only 43 percent of total entrepreneurs perceive high profitability as an opportunity for growth. This highlights a critical challenge in the sector: declining profit margins driven by competitive bidding and increasing market competition. Notably, 56 percent of manufacturers recognise high profitability as a growth incentive, compared to a smaller proportion (35 percent) of service providers (Figure 5.7). This contrast can be attributed to the relative maturity of manufacturers, which are often established firms facing lower competition due to limited players in the production of RE products. In contrast, service providers, characterised as younger and low capital-intensive businesses, experience heightened competition stemming from the influx of new entrants into the solar PV industry due to easing of regulations and subsidies. These dynamics align with studies that discuss the challenges of maintaining profitability in emerging, high-growth sectors (Peng & Liu, 2018).

Despite the challenges of profitability, 94 percent of RE entrepreneurs interviewed perceive the availability of a large potential consumer base as a significant growth opportunity (Figure 5.7). This perception spans across all types of business activities, emphasising the broad appeal of the RE market's expansion potential in response to national and global discourse. The identification of consumer bases is influenced by ownership structures and regional market dynamics rather than specific business activities, as noted in previous entrepreneurial studies (Walsh & Lipinski, 2009). Perceived opportunities from consumer base expansion, remains a key driver of entrepreneurial opportunity across sectors and business activity type.

Existing studies on entrepreneurial success identify technology as a key driver of competitive advantage and sectoral leadership (Peng & Liu, 2018). Technological knowledge is reported as another critical opportunity, recognised by 85 percent of RE entrepreneurs. Manufacturers unanimously view technological expertise as vital, reflecting their dependence on innovation in product development and supply chain management to maintain a competitive edge. Hybrid firms, which combine manufacturing and service activities, also demonstrate a strong appreciation for technological knowledge, with 95 percent considering it an opportunity. However, service providers lag relatively behind, with 73 percent perceiving technological knowledge as

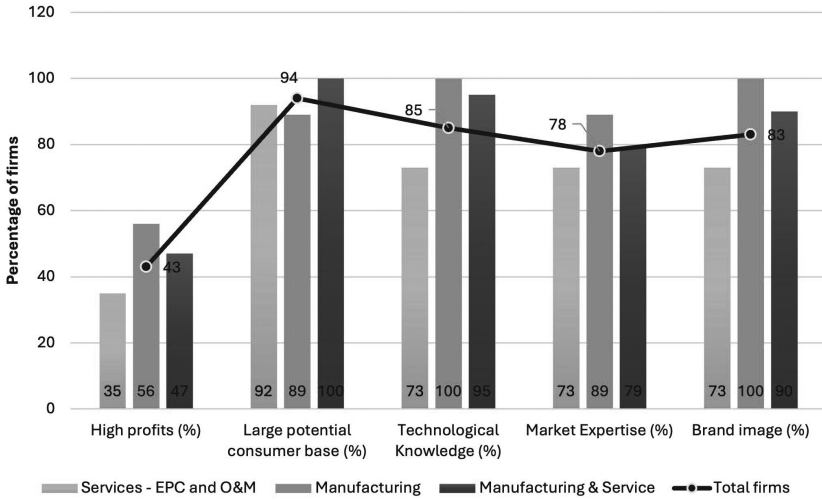


Figure 5.7 Perceived market and firm-level opportunities across type of business activity.

Source: Primary Survey, 2019.

a key growth driver (Figure 5.7). This difference is consistent with broader research, which shows that firms deeply embedded in production processes place a higher premium on technological capabilities (Kemp & Pontoglio, 2011). Our interviews also revealed that service-oriented firms, while recognising the importance of technology, often prioritise customer acquisition and operational scaling over technological innovation.

Marketing expertise is perceived by 78 percent of the total respondents as a crucial enabler of growth across all business types (Figure 5.7). Both service providers and manufacturers view marketing as essential for creating a larger consumer base and enhancing product visibility. Strategic marketing investments are frequently cited by entrepreneurs as critical for differentiation in a crowded market, aligning with established studies linking marketing strategies to firm performance and entrepreneurial success (Haldar, 2021; Hisrich & Ramadani, 2018; Walsh & Lipinski, 2009). As observed from our analysis marketing expertise serves as a universal growth enabler, with similar trends across specific business activities.

Brand image emerges as a significant factor for entrepreneurship and firm growth, with 83 percent of entrepreneurs acknowledging its importance. Manufacturers lead in this regard, with all surveyed firms emphasising brand image as critical, followed by hybrid firms (90 percent) and service providers (73 percent). Entrepreneurs frequently responded that a strong brand presence secures larger market shares, reduces price sensitivity

among consumers, and enhances long-term customer loyalty. These observations align with existing literature, which positions brand equity as a pivotal determinant of firm sustainability and profitability (Kim et al., 2003). Brand image serves as a universally recognised opportunity within the RE sector, conferring competitive advantages across all business activity types. This is further supported by the absence of statistically significant associations indicating a specific relationship between brand image and business activity (Haldar, 2021a).

#### **5.4 Conclusion**

The RE sector in India represents a dynamic nexus of sociotechnical transitions, where SE operates as a critical engine of systemic change. Drawing from empirical evidence, in this chapter we uncovered how sustainability-oriented entrepreneurs navigate the multilevel dynamics of niche innovation, regime transformation, and landscape pressures. Different types of enterprises – service-based, manufacturing, and hybrid – encounter unique configurations of opportunities and barriers, shaped by their roles within this sociotechnical ecosystem.

Service-based enterprises function as key niche actors, driving the uptake of RE technologies through direct consumer engagement and innovative service delivery models. However, their reliance on external funding and exposure to institutional bottlenecks renders them vulnerable to regime-level dynamics, such as bureaucratic inefficiencies and regulatory uncertainties. Conversely, manufacturing firms, with their entrenched positions in the production regime, demonstrate relative resilience to financial and institutional hurdles. Yet, their dependence on consumer awareness and raw material availability reflects ongoing tensions between niche innovations and the inertia of the established regime. Hybrid enterprises, operating across service delivery and manufacturing simultaneously face compounded challenges that highlight the need for integrated support mechanisms.

The opportunities identified for SE range from extrinsic conditions like policy-driven market expansion to more intrinsic characteristics like brand image and technological capacity. This demonstrates the importance of aligning niche innovation with broader regime transformation. At the landscape level, policy instruments such as financial subsidies and tax incentives have proven instrumental in fostering niche proliferation, yet inconsistencies in their design and implementation risk perpetuating regime resistance.

So, fostering a nuanced understanding of the differentiated opportunities and challenges of service, manufacturing, and hybrid enterprises, this chapter offers a roadmap for accelerating the transition towards a sustainable energy future. SE development will thus require not only the recalibration of policies and market instruments but also a commitment to fostering

inclusive, resilient, and adaptive entrepreneurial ecosystems that bridge the gap between technological potential and systemic transformation. Building on the comprehensive exploration so far on firm characteristics, entrepreneurial opportunities, systemic challenges, policy frameworks shaping the sociotechnical shift towards RE, while leveraging SE as a critical change agency, the next chapter will synthesise these findings to demonstrate the study's key conceptual frame and empirical contributions. It will also present actionable propositions, offering a forward-looking perspective on fostering sustainable energy transitions in India and similar emerging economies.

## 6 In conclusion

### A multilevel framework for energy transitions through sustainable entrepreneurship and the way forward

#### 6.1 Introduction

Sustainable entrepreneurship, in its essence, involves the ‘discovery, creation and exploitation of opportunities to create future goods and services that sustain the natural and/or communal environment and provide development gain for others’ (Hörisch, 2015). It is an approach that goes beyond traditional business models by integrating environmental and social considerations into the core of its operations. As this book concludes, it is imperative to reflect on the profound significance of SE, particularly in the context of the escalating urgency for climate action while delivering on social justice and development needs simultaneously.

The imperative for accelerated climate action is undeniable (Babiker et al., 2022). Customers worldwide increasingly prefer buying from businesses committed to reducing their carbon footprints. This shift in consumer behaviour, coupled with the stark realities of climate change, necessitates a fundamental shift in business practices (Moloney et al., 2010). SE emerges as a critical pathway towards achieving these goals, offering a powerful means to balance economic, environmental, and societal needs across diverse contexts and sectors.

This approach, as discussed in detail in Chapter 2, recognises the interconnectedness of these three pillars and seeks to support ventures that have potential for value creation across all dimensions. Sustainability-oriented entrepreneurs are hence positioned as niche actors who operate and engage with regime and landscape processes to enable whole-system transformations (discussed in Chapter 3). Although the focus of this book is on energy system transitions, the scope of SE ranges across multiple sectors including waste management, food, and transport. For instance, companies prioritising recycled materials in their production processes reduce their environmental footprint while promoting resource conservation and waste reduction – contributing to transformation towards a circular economy (Ngan et al., 2019). In the agricultural sector, in Samoa, a group of women entrepreneurs demonstrate the potential of SE in stimulating

recovery from natural disasters and ensuring social and economic value creation for disadvantaged communities (Gray et al., 2014). In addition to greening existing businesses, SE can potentially create entirely new ecosystems, bringing together diverse stakeholders and fostering collaboration across multiple (niche, regime, and landscape) levels to address complex challenges (Haldar, 2022).

The relevance of SE is particularly pronounced in the Indian context and similar emerging economies. These economies face unique challenges, including rapid population growth, resource scarcity, environmental degradation, and social inequities (Haldar et al., 2023; Haldar & Sharma, 2022b; Kumar & Sharma, 2024). In such contexts, SE has the potential to empower local communities by fostering local supply chains, sourcing raw materials from small-scale producers, and creating employment opportunities (Jain & Koch, 2021). Furthermore, sustainability-oriented businesses leverage technology for financial inclusion, providing micro-credit and financial services to previously unbanked populations, thereby contributing to economic empowerment and social equity (Muhammed Shafi et al., 2024).

India is at the cusp of a massive sociotechnical reordering through its ambitious decarbonisation goals (50 percent of installed electricity capacity through non-fossil by 2030) while dealing with the persisting energy access, affordability, and reliability concerns (Dubash et al., 2019). Energy being an input for its rapid urbanisation and infrastructure development does not just have sectoral implications but has wide-ranging systemic and cross-sectoral implications for just and sustainable development. Guided by policy and regulatory interventions responding to global climate and energy pressures (among others) the country has emerged as a global leader in RE, with a growing installed capacity of over 200 GW as of 2024 (MNRE, 2024).

In this context, we engaged with the broader conceptual and theoretical debates on SE and sustainability transitions to surface how this heterodox entrepreneurial domain is instrumental in addressing the energy, economy, and environment trilemma in India and similar Global South economies. This draws attention to the role of SE in diffusing the solar and wind energy technologies, creating jobs, reducing reliance on fossil fuels, and mitigating climate change. Specifically, as the Indian state of Gujarat contributes to 11 percent of the total RE mix of the country and has a strong history of entrepreneurial culture it stands as an interesting and relevant testing bed for our exploration of conditions at niche, regime, and landscape levels that support or resist entrepreneurship development in energy system transitions. Notably, smaller businesses are less susceptible to organisational lock-ins and are often driven by idealistic entrepreneurs, are more likely to pursue sustainability-related opportunities and drive radical innovation in this sector (Hörisch, 2015). Hence, we analysed the specific intrinsic and external drivers and challenges faced by entrepreneurs operating RE businesses

across six districts in Gujarat – more than 80 percent of which comprised MSMEs (discussed in Chapter 5).

The contribution of this book is twofold. First, theoretically and conceptually, it advances the scholarship on entrepreneurship and sociotechnical transitions by positioning sustainability-oriented entrepreneurs as critical niche change agents. These actors leverage windows of opportunity created by interactions between landscape and regime dynamics to destabilise the dominant fossil-fuel regime. In doing so, this work critically engages with sociotechnical transition frameworks, addressing their apolitical, technocentric biases and overemphasis on novelty. Second, empirically, the book offers a nuanced, place-based, and systemic analysis of the interventions required to enable whole-system transitions towards sustainable development. By operationalising the Multi Level Perspective (MLP) framework through an in-depth empirical study of RE entrepreneurs in India, it contextualises the unique challenges and drivers shaped by the conditions in emerging economies, aligning these insights with goals of energy security, affordability, access, and decarbonisation. The debates and policy propositions put forth through this book are hence relevant to similar Global South emerging economies and can be adapted to other systems in addition to energy transitions.

Moving ahead, we discuss in detail the conceptual and empirical contributions of this work, policy propositions in the context of broader climate change debates, and the way ahead for researchers and practitioners.

## **6.2 Conceptual and empirical contribution**

Despite its immense potential and support mechanisms, SE, particularly to RE transitions, faces various challenges. As analysed in Chapter 5, access to capital, uncertainty of demand, low profitability, non-recovery or delays in financial dues, inadequate access to locally sourced raw materials, inadequate supply of skilled labour, and institutional bottlenecks (e.g. bureaucracy, policy volatility, complex processes) are among the key hurdles that entrepreneurs in this industry often encounter. Specific to policy and regulatory space, challenges include low compliance with regulations and standards such as REC and RPOs, distribution companies pushing back on incentives such as net-metering, risk awareness of public finance institutions, and dominance of indirect subsidies for RE technology adoption over direct fiscal and monetary incentives. GST rates and accelerated depreciation were particularly highlighted by our respondents as instruments that need careful consideration and alignment with needs of the service providers and manufacturers. Overcoming these challenges requires a concerted effort from governments, investors, and civil society to create an enabling environment for SE. Some of the major opportunities identified so far, for SE development in India's (specifically Gujarat's) energy landscape include

expectations of market expansion due to policy push and ambitious national and subnational RE targets, technological expertise of ventures, marketing expertise, and established brand value. It becomes evident from our exploration that both individual- and firm-level conditions (intrinsic and micro) and extrinsic regime- (meso) and landscape (macro)-level conditions shape the pathway for transition from conventional to renewable energy systems. Sustainability-oriented entrepreneurs, although framed as niche actors, leverage social networks and develop technological, marketing, and business competencies while interacting with an array of actors and institutions at state and national levels to facilitate this transition. Based on this premise, we contribute to the MLP framework of sociotechnical transitions by offering a human-centric-agentic perspective. This approach emphasises the role of entrepreneurs as dynamic agents navigating politically entrenched socio-technical systems to drive transformative change, fostering a balance among environmental, economic, and societal dimensions of development.

We now operationalise the MLP framework adopting a place-based empirical approach specific to the Indian and similar Global South economy contexts, particularly to the energy system transition (Figure 6.1).

The foundational premise of this integrative framework is that the transition from conventional to RE system emerges as a dynamic, multilevel process influenced by a complex interplay of individual-level characteristics and broader systemic drivers, including policy mechanisms and market dynamics. This transformation reflects the evolutionary shift of energy systems under the pressures of technological innovation, environmental imperatives, and institutional change, and can be analysed through the interconnected levels of niche (micro), regime (meso), and landscape (macro) (Figure 6.1).

At the niche level, sustainability-oriented entrepreneurial actors – driven by their vision, strategic foresight, and innovative capacity – serve as catalysts for the adoption and diffusion of RE technologies. Intrinsic factors, such as the entrepreneur's educational background, environmental orientation, and familial influences (as discussed in Chapter 2), coupled with the structural characteristics of their firms, significantly determine the trajectory of these enterprises within the RE sector. Through iterative learning processes, these niche agents acquire technical expertise, develop business strategies, and construct robust social and informational networks, enabling them to challenge the dominant regime of conventional fossil-fuel energy. By leveraging emerging windows of opportunity – such as shifts in consumer preferences, global environmental concerns, and evolving policy priorities – these actors create internal momentum that destabilises established socio-technical systems.

Simultaneously, landscape-level forces, including regulatory incentives, fiscal subsidies, skill development programmes, and international forums for business collaboration, amplify the efforts of niche actors.

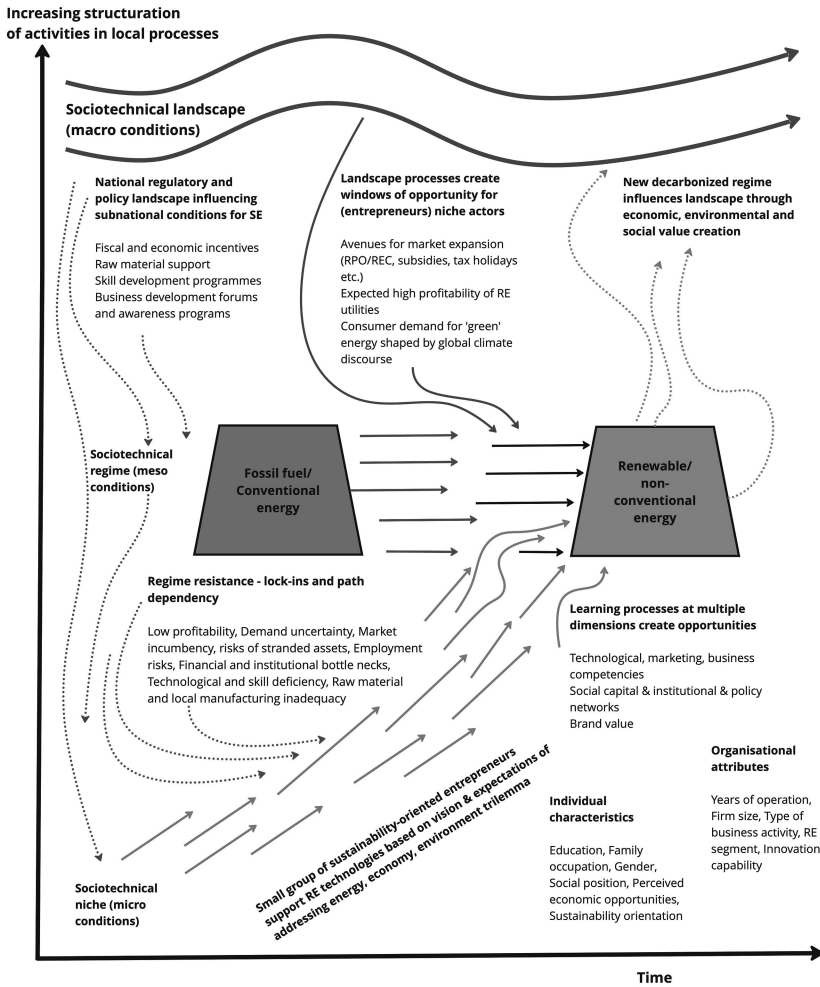


Figure 6.1 A multilevel integrative framework for energy transition through sustainable entrepreneurship.

Source: Author's Composition Based on (Geels, 2012; Haldar, 2022).

These macroeconomic and institutional interventions provide the financial and operational scaffolding necessary to diffuse RE innovations within an entrenched regime. However, the existing regime resists transformation due to path dependencies and lock-in mechanisms, such as reliance on non-renewable energy technologies, capital constraints, infrastructure risks, incumbent vested interests, regulatory inertia, and insufficient consumer demand for RE products. This resistance brings the complexity of regime

inertia to the forefront, where market and policy imperfections exacerbate the friction between incumbent and emergent paradigms (Figure 6.1).

Over time, as niche actors align and stabilise through the convergence of technological, market, and institutional advancements, and as regime-level lock-in mechanisms are progressively weakened, the systemic transition to the RE system takes place. This transition signifies not merely a sectoral shift but a fundamental reconfiguration of the socio-technical regime, wherein RE (and sustainability-oriented industries) emerges as the dominant economic paradigm. Once stabilised, the new regime exerts a reciprocal influence on landscape-level factors, shaping broader political systems, regulatory frameworks, and market dynamics through its economic, societal, and environmental value creation. Thus, the interplay of processes across the niche, regime, and landscape levels exemplifies the mechanisms of transformative change, surfacing the critical role of entrepreneurship in driving the transition to a ‘green’ and sustainable economy.

### **6.3 Contribution to policy and practice**

The latest science on climate change is clear. It calls for urgent and accelerated mitigation and adaptation action to address the risks (economic, environmental, and societal) of climate change and limit global warming to 1.5 degree Celsius above pre-industrial temperatures (Babiker et al., 2022; Calvin et al., 2023; Revi et al., 2022). This mandates cross-sectoral and inter- and intra-governmental collaboration, along with concerted and strategic action from multiple actors including private sector and civil society organisations (Haldar et al., 2024a,b; Peddibhotla et al., 2024). On this pretext, this book argues that sustainability-oriented entrepreneurs are at the core of such transformative change at systemic levels. Especially in emerging Global South economies like India, where public finance is limited and resources are constrained, SE emerges as an actionable strategy to balance development needs with climate action. Having recognised the challenges and opportunities as well as intrinsic characteristics that fuel SE in India, we now put forth some policy and practice propositions to foster and advance an ecosystem for SE specific to energy system transitions. To situate these propositions in the context of the global climate change discourse, we discuss them within the scope of enabling conditions for ‘strengthening and implementing the global response’ as put forth by the IPCC Special Report on Global Warming of 1.5 degree Celsius (de Coninck et al., 2022). This report posits six enabling conditions crucial for achieving the 1.5 degree goal, namely, governance, institutions, lifestyle and behavioural change, technological innovation, policy, and finance.

This preceding analysis, structured around the sociotechnical transition framework, demonstrates how RE entrepreneurship in India and the Global

South, in general, like all other economies, is contingent upon the dynamic interactions between institutional frameworks, technological innovation, market mechanisms, and societal behaviour. Table 6.1 presents the critical enablers that could support systemic transitions towards non-conventional energy, illustrating that a successful shift necessitates a confluence of robust governance, innovative financial models, and transformative technological advancements.

From a sociotechnical perspective, the Global South faces unique opportunities and constraints. Our propositions delineate how the interplay of long-term policy coherence and inclusive governance can address institutional inertia, allowing for smoother alignment of various actors and institutions within the energy ecosystem. The explicit emphasis on decentralised governance and active participation by MSMEs could foster a more just and equitable energy transition, which is particularly vital for Global South economies with diverse regional disparities and socio-economic stratification.

Financial mechanisms, as discussed in the Table 6.1, are foundational to reducing risk and enabling innovation. The use of instruments like green bonds, partial risk guarantees, and carbon pricing serves not only to de-risk investments but also to reconfigure dominant economic systems to support emergent clean energy technologies. These financial innovations can play a critical role in destabilising dominant regimes while nurturing niche technologies and SE practices.

Technological innovation, another key enabler in the sociotechnical transition, emerges not merely as a technical process but as an outcome of coordinated institutional, market, and societal action. By promoting localised manufacturing and technology transfer mechanisms, the Global South can avoid dependence on global supply chains, building resilience and fostering self-reliance. Such interventions can support new entrepreneurial spaces that reconfigure the socioeconomic landscape, particularly by empowering MSMEs.

Finally, the behavioural and lifestyle changes embodying the demand side of sociotechnical transitions are essential for the legitimization and adoption of RE technologies. The societal uptake of decentralised energy solutions – such as rooftop solar and microgrids – point towards the mutual shaping of technology and culture, where innovation is not just diffused but socially embedded.

Hence, through the analysis and propositions suggested so far, we make it clear that the sociotechnical transition framework enables us to situate SE within the broader dynamics of systemic change. By evaluating the governance, financial, technological, and societal dimensions concurrently, this approach transcends the traditional silos of policy and technology to envision a holistic, inclusive, and sustainable energy future especially in resource scarce and politically complex contexts. Such a perspective positions entrepreneurship as both an agent and a beneficiary of the RE transition, with the potential to catalyse deep structural transformations in economies across the Global South.

*Table 6.1* Locating practice and policy propositions in the 1.5 degree *Celsius* debate

<i>Enabling conditions</i>	<i>Policy and practice propositions</i>
<b>Policy and governance</b>	<p>Coherent planning and execution foster alignment and coordination among institutions across multiple levels of governance regarding RE targets and climate and development goals, in general.</p> <p>Intergovernmental cooperation – Market expansion through adoption and diffusion of diverse RE applications beyond electricity (e.g. Ministry of Housing and Urban Affairs, MoP, MNRE, Ministry of Road Transport and Highways, Ministry of Skill Development and Entrepreneurship/MSDE)</p> <p>Strengthen compliance mechanisms – e.g. Renewable Purchase Obligations (RPOs) and Renewable Energy Certificates (RECs).</p> <p>Promote multi-stakeholder engagement by including consumers, MSMEs, and entrepreneurs in policy formulation and governance processes.</p> <p>Need for policy certainty – Mid- and Long-term stable policies (10–15 years) to attract sustained investment in the RE sector.</p>
<b>Institutions</b>	<p>Capacity building of Discoms and RE and entrepreneurship nodal institutions (e.g. MNRE, SECI, GEDA, Climate Change Department) to ensure timely disbursements of financial incentives and effective policy implementation</p> <p>Robust institutional mechanisms to mitigate payment risks against PPAs and SE development (e.g. Sovereign guarantees, viability gap funding, regulatory safeguards)</p>
<b>Behavioural and lifestyle change</b>	<p>Incorporate more industry-relevant, on-site training programmes in skill development initiatives (e.g. GISE, PMKVY) to meet industry demands.</p> <p>Large-scale awareness campaigns to educate consumers on the benefits of RE adoption for applications beyond electricity, such as cooking, cooling, and transport.</p> <p>Subsidies and awareness programmes promoting decentralised and small-scale RE solutions for residential and community use</p> <p>Foster consumer trust and willingness to adopt RE solutions by improving the reliability and affordability of RE technologies.</p>

(Continued)

Table 6.1 (Continued)

<i>Enabling conditions</i>	<i>Policy and practice propositions</i>
<b>Technological innovation</b>	<p>Incentivise domestic manufacturing of RE utilities through capital subsidies and tax incentives to reduce reliance on imports and promote local technology development.</p> <p>Encourage innovation grants and tax credits for entrepreneurs developing novel RE solutions for heating, cooling, cooking, and transport.</p> <p>Establish technology transfer platforms to adopt global best practices in RE technology development and scale up deployment.</p> <p>Improve lifestyle performance, efficiency, and cost effectiveness – Public investments and incentives for investments on R&amp;D to promote product innovations in advanced RE technologies (e.g. solar PV systems, wind turbines, battery storage)</p>
<b>Finance</b>	<p>Leverage public-private partnerships (PPPs) and green bonds to attract private investments into RE infrastructure.</p> <p>Implement financial mechanisms like carbon pricing (e.g. taxes or emission trading schemes) to redirect capital towards clean energy projects.</p> <p>Revisit reverse bidding/auction mechanisms to create a level playing field for MSMEs in the RE sector.</p> <p>Leverage the National Clean Energy Fund (NCEF) to create targeted financial instruments such as partial risk guarantees, interest subventions, and viability gap funding for RE entrepreneurs and MSMEs.</p> <p>Stable and predictable financial frameworks to cushion investment risks in the RE industry especially for MSMEs and technology-driven entrepreneurs who require higher capital investments.</p>

*Source:* Author's composition based on (de Coninck et al., 2022)

## 6.4 The way ahead

As we conclude this book, it has become evident that energy system transition in the Global South contexts, and particularly in India, presents a compelling case for rethinking the dynamics of innovation, power, politics, and participation in sociotechnical systems. The role of private sector is paramount in this regard. Through this book, we highlight the role of sustainability-oriented entrepreneurs in destabilising socio-culturally

and techno-politically entrenched regimes and creating pathways for transformative change. However, the way forward necessitates a critical interrogation of existing gaps, not only in knowledge and policy but also in the practice and cultural systems that mediate just and inclusive transitions.

#### *6.4.1 Recognising power and politics in sociotechnical systems*

A critical dimension often overlooked in sociotechnical transitions is the politics of innovation. Who benefits, who is excluded, and who decides the trajectory of transitions? Future research must go beyond technocentric and purely market-oriented framings to unpack the power dynamics that shape decision-making processes in energy transitions. This includes understanding how dominant actors (e.g. fossil-fuel incumbents) maintain their influence through policy lobbying, infrastructure investments, and market control, and how grassroots actors can mobilise to challenge these power asymmetries.

Adopting a pluralistic approach to innovation and systemic change is essential. Grassroots innovations – solutions emerging from communities and marginalised groups often also offer rich insights into socially inclusive pathways for energy transitions (Kumar & Sharma, 2024, 2023). Researchers should explore how grassroots initiatives can be linked to broader regime and landscape changes, fostering bottom-up approaches, including those to sustainable entrepreneurship, that complement top-down policies.

#### *6.4.2 Building resilient and just entrepreneurial ecosystems*

Policymakers and practitioners must prioritise the co-creation of innovation systems that reflect the diversity of actors and the dynamic of resource, development needs, and environmental concerns in the Global South contexts. Sustainability-oriented entrepreneurs are not just economic agents but also cultural and political actors who shape the narrative of transitions (often addressed in institutional entrepreneurship and social entrepreneurship literature). Supporting SE requires embedding broad transition and entrepreneurship theories in local contexts, addressing social inequalities, and fostering institutional support for energy and similar infrastructure projects across different modalities based on ownership models, governance structures, etc.

Tailored support for MSMEs can enable a broader distribution of benefits from energy transitions. This includes financial mechanisms that cater to the needs of smaller players, such as interest subventions, partial risk guarantees, and micro-financing models. Such interventions ensure that the goals of transitions are not dictated by monopolistic power arrangements or captured by large incumbents but remain open to diverse forms of entrepreneurship.

Moving ahead, sociotechnical transition framework emphasises the co-evolution of technological, institutional, and societal systems. However,

innovation often remains constrained by narrow market logic. Future research and practice must explore pathways for non-market innovations, particularly those addressing the needs of marginalised and underserved communities. These could include community-owned RE projects, open-source technology platforms, and cooperative business models that prioritise social and environmental value over short-term profit.

To this end, governments must invest in innovation systems that balance competitive markets with public goods. Public investments in R&D should not only target advanced technologies but also explore frugal innovations that align with the resource constraints and priorities of the emerging economies of the Global South. For example, low-cost battery storage systems or modular solar technologies designed for off-grid consumers can accelerate transitions while addressing equity concerns.

#### *6.4.3 The critical role of intermediaries in mediating niche – regime dynamics*

Intermediary organisations – such as non-profits, research institutions, and advocacy networks – play a crucial role in bridging the gap between niche innovations and regime-level changes. These actors can facilitate knowledge sharing, provide legitimacy to emerging innovations, and mediate between entrepreneurs and policymakers (Peddibhotla et al., 2024). Future research needs to focus on the institutional design and governance of these intermediaries, particularly in contexts where state capacity is limited. For practitioners, engaging with intermediaries can help overcome systemic barriers, such as regulatory inertia and infrastructure bottlenecks. Policy programmes need to actively involve intermediaries in multi-stakeholder collaborations, enabling experimentation and adaptive learning in energy transitions.

#### *6.4.4 Rethinking the role of the state*

The state must move beyond a passive role as a regulator to actively shaping the direction and pace of transitions. Policymakers in the Global South might benefit by adopting a transformative approach, where innovation, economic, and industrialisation policies are explicitly tied to societal challenges, such as achieving universal energy access or reducing air pollution. Such policies could encourage experimentation and cushion against failure, recognising that transitions are iterative and nonlinear processes. The state also has a critical role in institutionalising participatory governance frameworks. This includes creating platforms for inclusive decision-making, where entrepreneurs, civil society, and marginalised communities have equal agency in shaping energy futures. Without such inclusivity, transition processes risk perpetuating existing inequities and power asymmetries (Haldar et al., 2024b; Hoffman et al., 2021).

#### 6.4.5 *Towards transformative change*

On a concluding note, scholars must embrace a more reflexive and critical approach to studying sociotechnical transitions. This includes questioning the assumptions underlying transition frameworks, such as the overemphasis on radical innovations and technological novelty or market-based solutions. Future research should explore the intersections of power, culture, and agency in transitions, particularly in contexts shaped by colonial legacies, resource constraints, and political instability (Kalaskar & Haldar, 2024). There is an equally pressing need to develop methods for analysing the systemic impacts of transitions beyond economic indicators. Metrics that capture social justice, ecological resilience, and community wellbeing can provide a more holistic understanding of sustainable development.

Thus, the sociotechnical transition framework offers a powerful lens for understanding the complexities of energy and similar system transitions. However, its true potential lies in embracing the messiness of real-world systems – where power, politics, and people intersect to shape the future. Private sector participation and SE is an important if not the only dimension in unfolding this complex dynamic. By addressing these dimensions, researchers, policymakers, and practitioners can co-create pathways towards just and inclusive energy futures, leveraging the transformative potential of SE and other forms of entrepreneurship as a catalyst for systemic change.



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# References

- Abbas, M. H., & Bulut, M. (2024). Navigating the landscape of sustainable entrepreneurship research: A systematic literature review. *Discover Sustainability*, 5(1), 171. <https://doi.org/10.1007/s43621-024-00293-4>
- Abhishek, M. K., & Goel, M. M. (2021). *Gujarat Enabling State Level Climate Mitigation Actions in the Power Sector*. <https://irade.org/Discussion%20Paper%20Power%20Sector%20-%20Gujarat.pdf>
- Acemoglu, D., Akcigit, U., Hanley, D., & Kerr, W. (2016). Transition to clean technology. *Journal of Political Economy*, 124(1), 52–104. <https://doi.org/10.1086/684511>
- Acharya, A. (2021). Advent of renewable energy market– understanding critical success factors in PPA model. *Energy and Environment Research*, 11(1), 1. <https://doi.org/10.5539/eervl1n1p1>
- Agarwal, K. K., & Upadhyay, R. K. (2009). Attitude of youth towards entrepreneurship: A case study of Varanasi. *IUP Journal of Entrepreneurship Development*, 6(2), 49.
- Aghelie, A., Sorooshian, S., & Azizan, N. A. (2016). Research gap in sustainpreneurship. *Indian Journal of Science and Technology*, 9(12), 1–6.
- Álvarez, C., Urbano, D., & Amorós, J. E. (2014). GEM research: Achievements and challenges. *Small Business Economics*, 42, 445–465.
- Ananthram, S., & Chan, C. (2021). Institutions and frugal innovation: The case of Jugaad. *Asia Pacific Journal of Management*, 38(3), 1031–1060.
- Anbarasan, P., & Sushil. (2018). Stakeholder engagement in sustainable enterprise: Evolving a conceptual framework, and a case study of ITC. *Business Strategy and the Environment*, 27(3), 282–299. <https://doi.org/10.1002/bse.1999>
- Anderson, A. R. (1998). Cultivating the garden of Eden: Environmental entrepreneurship. *Journal of Organizational Change Management*, 11(2), 135–144.
- Arowoshegbe, A. O., Emmanuel, U., & Gina, A. (2016). Sustainability and triple bottom line: An overview of two interrelated concepts. *Igbinedion University Journal of Accounting*, 2(16), 88–126.
- Babiker, M., Bazaz, A., Bertoldi, P., Creutzig, F., De Coninck, H., De Kleijne, K., Dhakal, S., Haldar, S., Jiang, K., Kilkış, Ş., Klaus, I., Krishnaswamy, J., Lwasa, S., Niamir, L., Pathak, M., Portugal Pereira, J., Revi, A., Roy, J., Seto, K., ... Ürges-Vorsatz, D. (2022). *What the Latest Science on Climate Change Mitigation Means for Cities and Urban Areas*. <https://doi.org/10.24943/SUPSV310.2022>

- Bardhan, R., Debnath, R., & Jana, A. (2019). Evolution of sustainable energy policies in India since 1947: A review. *Wiley Interdisciplinary Reviews: Energy and Environment*, 8(5), e340.
- Basu, R. R., Banerjee, P. M., & Sweeny, E. G. (2013). Frugal innovation: Core competencies to address global sustainability. *Journal of Management for Global Sustainability*, 1(2), 5.
- Begley, T. M., Tan, W.-L., & Schoch, H. (2005). Politico-economic factors associated with interest in starting a business: A multi-country study. *Entrepreneurship Theory and Practice*, 29(1), 35–55. <https://doi.org/10.1111/j.1540-6520.2005.00068.x>
- Belz, F. M., & Binder, J. K. (2017). Sustainable entrepreneurship: A convergent process model. *Business Strategy and the Environment*, 26(1), 1–17.
- Bennett, S. J. (1991). *Ecopreneuring: The complete guide to small business opportunities from the environmental revolution*. (No Title).
- Berle, G. (1993). *The green entrepreneur: Business opportunities that can save the Earth make you money*. Liberty Hall Press
- Bird, L., Milligan, M., & Lew, D. (2013). *Integrating Variable Renewable Energy: Challenges and Solutions*. National Renewable Energy Lab (NREL), <https://doi.org/10.2172/1097911>
- Black, S. E., & Strahan, P. E. (2002). Entrepreneurship and bank credit availability. *The Journal of Finance*, 57(6), 2807–2833. <https://doi.org/10.1111/1540-6261.00513>
- Blue, R. J. (1990). *Ecopreneuring: Managing for Results*. Scott, Foresman.
- Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, 45, 9–19. <https://doi.org/10.1016/j.jclepro.2012.07.007>
- Bouzarovski, S., & Simcock, N. (2017). Spatializing energy justice. *Energy Policy*, 107, 640–648.
- Brundtland, G. H., & Khalid, M. (1987). *Our Common Future*. Oxford University Press.
- BRUNNSCHWEILER, C. N. (2010). Finance for renewable energy: An empirical analysis of developing and transition economies. *Environment and Development Economics*, 15(3), 241–274. <https://doi.org/10.1017/S1355770X1000001X>
- Calvin, K., Dasgupta, D., Krinner, G., Mukherji, A., Thorne, P. W., Trisos, C., Romero, J., Aldunce, P., Barrett, K., Blanco, G., Cheung, W. W. L., Connors, S., Denton, F., Diongue-Niang, A., Dodman, D., Garschagen, M., Geden, O., Hayward, B., Jones, C., ... Ha, M. (2023). *IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee & J. Romero (eds.)]*. IPCC, Geneva, Switzerland. <https://doi.org/10.59327/IPCC/AR6-9789291691647>
- Carney, M. (2005). Corporate governance and competitive advantage in family-controlled firms. *Entrepreneurship Theory and Practice*, 29(3), 249–265. <https://doi.org/10.1111/j.1540-6520.2005.00081.x>
- Castka, P., Balzarova, M. A., Bamber, C. J., & Sharp, J. M. (2004). How can SMEs effectively implement the CSR agenda? A UK case study perspective. *Corporate Social Responsibility and Environmental Management*, 11(3), 140–149.
- CEA. (2023). *Report on Optimal Generation Mix for 2029-30*. [https://cea.nic.in/wp-content/uploads/notification/2023/05/Optimal\\_mix\\_report\\_\\_2029\\_30\\_Version\\_2.0\\_\\_For\\_Uploading.pdf](https://cea.nic.in/wp-content/uploads/notification/2023/05/Optimal_mix_report__2029_30_Version_2.0__For_Uploading.pdf)

- Charles Rajesh Kumar, J., & Majid, M. (2024). Advances and development of wind-solar hybrid renewable energy technologies for energy transition and sustainable future in India. *Energy & Environment*, 35(5), 2517–2565. <https://doi.org/10.1177/0958305X231152481>
- Chawla, U., Mohnot, R., Fadahunsi, A., & Mulchandani, D. (2024). The bright revolution: Accelerating adoption of solar energy in India's dynamic landscape. *International Journal of Energy Economics and Policy*, 14(4), 226–233. <https://doi.org/10.32479/ijecp.16388>
- Cherp, A., Vinichenko, V., Jewell, J., Brutschin, E., & Sovacool, B. (2018). Integrating techno-economic, socio-technical and political perspectives on national energy transitions: A meta-theoretical framework. *Energy Research & Social Science*, 37, 175–190. <https://doi.org/10.1016/j.erss.2017.09.015>
- Clarke, L., Jiang, K., Akimoto, K., Babiker, M., Blanford, G., Fisher-Vanden, K., Hourcade, J.-C., Krey, V., Kriegler, E., & Löschel, A. (2014). *Assessing transformation pathways*. In: *Climate Change 2014: Mitigation of Climate Change. IPCC Working Group III Contribution to AR5*. Cambridge University Press.
- Claro, S. (2006). Supporting inefficient firms with capital subsidies: China and Germany in the 1990s. *Journal of Comparative Economics*, 34(2), 377–401. <https://doi.org/10.1016/j.jce.2005.12.001>
- Coenen, L., Benneworth, P., & Truffer, B. (2012). Toward a spatial perspective on sustainability transitions. *Research Policy*, 41(6), 968–979.
- Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing*, 22(1), 29–49.
- Contreras, F., & Dornberger, U. (2022). Sustainable entrepreneurship as a field of knowledge: Analyzing the Global South. *Sustainability*, 15(1), 31. <https://doi.org/10.3390/su15010031>
- Contreras, O. E., & Rodríguez, L. T. (2015). A case on a case: Embedding sustainable entrepreneurship into a managerial-skills course. *Proceedings of the European Conference on Innovation and Entrepreneurship, ECIE* (pp. 139–146). University of Genoa.
- Crals, E., & Vereeck, L. (2005). The affordability of sustainable entrepreneurship certification for SMEs. *The International Journal of Sustainable Development & World Ecology*, 12(2), 173–183.
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). Sage Publications.
- Dalla Longa, F., Fragkos, P., Pupo Nogueira, L., & van der Zwaan, B. (2022). System-level effects of increased energy efficiency in global low-carbon scenarios: A model comparison. *Computers & Industrial Engineering*, 167, 108029. <https://doi.org/10.1016/j.cie.2022.108029>
- Das, A., Jani, H. K., Nagababu, G., & Kachhwaha, S. S. (2020). A comprehensive review of wind-solar hybrid energy policies in India: Barriers and recommendations. *Renewable Energy Focus*, 35, 108–121.
- de Coninck, H., Revi, A., Babiker, M., Bertoldi, P., Buckeridge, M., Cartwright, A., Dong, W., Ford, J., Fuss, S., Hourcade, J.-C., Ley, D., Mechler, R., Newman, P., Revokatova, S., Schultz, S., Steg, L., & Sugiyama, T. (2022). Strengthening and Implementing the Global Response. In V. Masson-Delmotte, P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, & T. Waterfield (eds.), *Global Warming of 1.5°C* (pp. 313–444). Cambridge University Press. <https://doi.org/10.1017/9781009157940.006>

- Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing*, 22(1), 50–76.
- Dhahri, S., Slimani, S., & Omri, A. (2021). Behavioral entrepreneurship for achieving the sustainable development goals. *Technological Forecasting and Social Change*, 165, 120561. <https://doi.org/10.1016/j.techfore.2020.120561>
- Dickel, P. (2018). Exploring the role of entrepreneurial orientation in clean technology ventures. *International Journal of Entrepreneurial Venturing*, 10(1), 56. <https://doi.org/10.1504/IJEV.2018.090980>
- DNA India. (2018, April 21). *Solar Power Capacity at Charanka Solar Park to Touch 790 MW*. <https://www.dnaindia.com/Ahmedabad/Report-Solar-Power-Capacity-at-Charanka-Solar-Park-to-Touch-790-Mw-2607133>.
- Dubash, N. K., & Rajan, S. C. (2001). Power politics: Process of power sector reform in India. *Economic and Political Weekly*, 36(35), 3367–3390.
- Dubash, N. K., Swain, A. K., & Bhatia, P. (2019). The disruptive politics of renewable energy. *The India Forum*, 1–15.
- Eastwood, D., Eaton, M., Guyer, C., & Stark, T. (2001). An examination of employment change in Northern Ireland's environmental industry, 1993–2003. *European Environment*, 11(4), 197–210.
- Eckhardt, J. T., & Shane, S. A. (2003). Opportunities and entrepreneurship. *Journal of Management*, 29(3), 333–349.
- Ehie, I. C., & Olibe, K. (2010). The effect of R&D investment on firm value: An examination of US manufacturing and service industries. *International Journal of Production Economics*, 128(1), 127–135. <https://doi.org/10.1016/j.ijpe.2010.06.005>
- Elkington, J. (1986). *The Green Capitalist: Industry's Search for Environmental Excellence*. Earthlife.
- Energy and Petrochemicals Department. (2016). *Gujarat Wind Power Policy - 2016*. [https://www.cbip.org/policies2019/PD\\_07\\_Dec\\_2018\\_Policies/Gujarat/2-Wind/2%20Order%20Gujarat\\_Wind\\_Power\\_Policy-2016.pdf](https://www.cbip.org/policies2019/PD_07_Dec_2018_Policies/Gujarat/2-Wind/2%20Order%20Gujarat_Wind_Power_Policy-2016.pdf)
- Energy and Petrochemicals Department. (2018a). *Gujarat Repowering of the Wind Projects Policy - 2018*. <https://www.nitiforstates.gov.in/public-assets/Policy/policy-repo/energy/PSSNAD000092.pdf>
- Energy and Petrochemicals Department. (2018b). *Gujarat Wind-Solar Hybrid Power Policy - 2018*. [https://indextb.com/files/2020/10/8c6da74e-969b-4658-afd2-3b8601addc14\\_Gujarat%20Wind-Solar%20Hybrid%20Power%20Policy%202018.pdf](https://indextb.com/files/2020/10/8c6da74e-969b-4658-afd2-3b8601addc14_Gujarat%20Wind-Solar%20Hybrid%20Power%20Policy%202018.pdf)
- Energy and Petrochemicals Department. (2019a). *Policy for Development of Small Scale Distributed Solar Projects - 2019*. [https://indextb.com/files/2024/3/81528a45-12d0-4154-b1a3-1183df382eed\\_Policy%20for%20development%20small%20scale%20distributed%20solar%20project-2019.pdf](https://indextb.com/files/2024/3/81528a45-12d0-4154-b1a3-1183df382eed_Policy%20for%20development%20small%20scale%20distributed%20solar%20project-2019.pdf)
- Energy and Petrochemicals Department. (2019b). *SURYA- Gujarat (11/2015/2442/B)*. [https://guj-cpd.gujarat.gov.in/ViewFile?fileName=7jwvtaGwThvT2VOjfXRpkDXVdr7FPqz8AcC4V7MJDOWw1dBNSUpdHASH\\_HASHk6C-qSWD2g1m2u8eudrI4bL3HASH\\_HASHbHASH\\_HASHDywAtnYy7RiPd-wlFyts9eBjKtsXPl6nkNtHASH\\_HASHHASH\\_HASH9BU1sKp8cohHyVIP-kV9a85wWfvJLpiynA==](https://guj-cpd.gujarat.gov.in/ViewFile?fileName=7jwvtaGwThvT2VOjfXRpkDXVdr7FPqz8AcC4V7MJDOWw1dBNSUpdHASH_HASHk6C-qSWD2g1m2u8eudrI4bL3HASH_HASHbHASH_HASHDywAtnYy7RiPd-wlFyts9eBjKtsXPl6nkNtHASH_HASHHASH_HASH9BU1sKp8cohHyVIP-kV9a85wWfvJLpiynA==)

- Energy and Petrochemicals Department. (2020). *Gujarat Solar Power Policy 2021*. <https://suryagujarat.guvnl.in/Gujarat-Solar-Power-Policy-2021.pdf>
- Energy and Petrochemicals Department. (2023). *Gujarat Renewable Energy Policy - 2023*. <https://cdn.vibrantgujarat.com/event/document/1698657395807-Gujarat-Renewable-Energy-Policy.pdf>
- Energy and Petrochemicals Department, G. of G. (2009). *Solar Power Policy- 2009* (11-2008-2176-B). [https://indextb.com/files/2020/10/8c6da74e-969b-4658-afd2-3b8601addc14\\_Gujarat%20Wind-Solar%20Hybrid%20Power%20Policy%202018.pdf](https://indextb.com/files/2020/10/8c6da74e-969b-4658-afd2-3b8601addc14_Gujarat%20Wind-Solar%20Hybrid%20Power%20Policy%202018.pdf)
- Energy and Petrochemicals Department, G. of G. (2015). *Gujarat Solar Power Policy - 2015* (11-2015-2442-B). <https://faolex.fao.org/docs/pdf/IND169747.pdf>
- Erikson, T. (2001). "The promise of entrepreneurship as a field of research": A few comments and some suggested extensions. *Academy of Management Review*, 26(1), 12–13.
- Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., & Barlow, C. Y. (2017). Business model innovation for sustainability: Towards a unified perspective for creation of sustainable business models. *Business Strategy and the Environment*, 26(5), 597–608. <https://doi.org/10.1002/bse.1939>
- Ferguson, N., Manela, E., & Sargent, D. J. (2011). *The Shock of the Global: The 1970s in Perspective*. Belknap Press.
- Gabriel, C.-A. (2016). What is challenging renewable energy entrepreneurs in developing countries? *Renewable and Sustainable Energy Reviews*, 64, 362–371. <https://doi.org/10.1016/j.rser.2016.06.025>
- Gandhi, H. H., Hoex, B., & Hallam, B. J. (2022). Strategic investment risks threatening India's renewable energy ambition. *Energy Strategy Reviews*, 43, 100921. <https://doi.org/10.1016/j.esr.2022.100921>
- Gangopadhyay, A., Seshadri, A. K., & Patil, B. (2024). Wind-solar-storage trade-offs in a decarbonizing electricity system. *Applied Energy*, 353, 121994.
- Garg, A., Maheshwari, J., Verma, R., & Mishra, V. (2024). *Renewable Energy Policy by 2030 for Gujarat*. [https://www.iima.ac.in/sites/default/files/2024-07/RE%20Policy%20for%20Gujarat%202030%20Report\\_Final%20%2820062024%29.pdf](https://www.iima.ac.in/sites/default/files/2024-07/RE%20Policy%20for%20Gujarat%202030%20Report_Final%20%2820062024%29.pdf)
- Garg, V., Gulia, J., Thayillam, A., & Sharma, P. (2022). *India's Renewable Energy Open Access Market: Trends and Outlook*. Tech. rep. New Delhi: IEEEFA.
- Ge, M., Friedrich, J., & Vigna, L. (2024). *Where Do Emissions Come From?* World Resources Institute.
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy*, 31(8–9), 1257–1274. [https://doi.org/10.1016/S0048-7333\(02\)00062-8](https://doi.org/10.1016/S0048-7333(02)00062-8)
- Geels, F. W. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1(1), 24–40. <https://doi.org/10.1016/j.eist.2011.02.002>
- Geels, F. W. (2012). A socio-technical analysis of low-carbon transitions: Introducing the multi-level perspective into transport studies. *Journal of Transport Geography*, 24, 471–482. <https://doi.org/10.1016/j.jtrangeo.2012.01.021>
- Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society*, 31(5), 21–40.

- Geels, F. W., Berkhout, F., & van Vuuren, D. P. (2016). Bridging analytical approaches for low-carbon transitions. *Nature Climate Change*, 6(6), 576–583. <https://doi.org/10.1038/nclimate2980>
- Geels, F. W., & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy*, 36(3), 399–417. <https://doi.org/10.1016/j.respol.2007.01.003>
- George, G., McGahan, A. M., & Prabhu, J. (2012). Innovation for inclusive growth: Towards a theoretical framework and a research agenda. *Journal of Management Studies*, 49(4), 661–683.
- Georg Hansen, E., & Schaltegger, S. (2013). 100 per cent organic? A sustainable entrepreneurship perspective on the diffusion of organic clothing. *Corporate Governance: The International Journal of Business in Society*, 13(5), 583–598. <https://doi.org/10.1108/CG-06-2013-0074>
- Ghose, D., Pradhan, S., & Shabbiruddin. (2022). Development of model for assessment of renewable energy sources: A case study on Gujarat, India. *International Journal of Ambient Energy*, 43(1), 1157–1166. <https://doi.org/10.1080/01430750.2019.1691650>
- Ghosh, D., Bryant, G., & Pillai, P. (2023). Who wins and who loses from renewable energy transition? Large-scale solar, land, and livelihood in Karnataka, India. *Globalizations*, 20(8), 1328–1343.
- Gnyawali, D. R., & Fogel, D. S. (1994). Environments for entrepreneurship development: Key dimensions and research implications. *Entrepreneurship Theory and Practice*, 18(4), 43–62. <https://doi.org/10.1177/104225879401800403>
- GPRD., & GUVNL. (2019). *Suryashakti Kisan Yojana (SKY)*. [https://Www.Gprd.in/Sky.Php#:~:Text=Suryashakti%20Kisan%20Yojana%20\(SKY\)%20is,Grid%20and%20earn%20the%20income.](https://Www.Gprd.in/Sky.Php#:~:Text=Suryashakti%20Kisan%20Yojana%20(SKY)%20is,Grid%20and%20earn%20the%20income.)
- Gray, B. J., Duncan, S., Kirkwood, J., & Walton, S. (2014). Encouraging sustainable entrepreneurship in climate-threatened communities: A Samoan case study. *Entrepreneurship & Regional Development*, 26(5–6), 401–430. <https://doi.org/10.1080/08985626.2014.922622>
- Gregory, J., & Sovacool, B. K. (2019). The financial risks and barriers to electricity infrastructure in Kenya, Tanzania, and Mozambique: A critical and systematic review of the academic literature. *Energy Policy*, 125, 145–153. <https://doi.org/10.1016/j.enpol.2018.10.026>
- Grubler, A. (2012). Energy transitions research: Insights and cautionary tales. *Energy Policy*, 50, 8–16. <https://doi.org/10.1016/j.enpol.2012.02.070>
- Grubler, A., Wilson, C., & Nemet, G. (2016). Apples, oranges, and consistent comparisons of the temporal dynamics of energy transitions. *Energy Research & Social Science*, 22, 18–25. <https://doi.org/10.1016/j.erss.2016.08.015>
- Haas, R., Resch, G., Panzer, C., Busch, S., Ragwitz, M., & Held, A. (2011). Efficiency and effectiveness of promotion systems for electricity generation from renewable energy sources – Lessons from EU countries. *Energy*, 36(4), 2186–2193. <https://doi.org/10.1016/j.energy.2010.06.028>
- Haldar, S. (2019a). Green entrepreneurship in the renewable energy sector – a case study of Gujarat. *Journal of Science and Technology Policy Management*, 10(1). <https://doi.org/10.1108/JSTPM-12-2017-0070>
- Haldar, S. (2019b). Green entrepreneurship in theory and practice: Insights from India. *International Journal of Green Economics*, 13(2). <https://doi.org/10.1504/IJGE.2019.103232>

- Haldar, S. (2019c). Towards a conceptual understanding of sustainability-driven entrepreneurship. *Corporate Social Responsibility and Environmental Management*, 26(6). <https://doi.org/10.1002/csr.1763>
- Haldar, S. (2021a). *Green Entrepreneurship in the Renewable Energy Sector: A Case study of Gujarat* [Unpublished]. Central University of Gujarat.
- Haldar, S. (2021b). Sustainable entrepreneurship development in the renewable energy sector: Insights from Gujarat, India. *African Journal of Science, Technology, Innovation and Development*, 13(7). <https://doi.org/10.1080/20421338.2020.1796004>
- Haldar, S. (2022). A landscape level analysis of entrepreneurship and sustainable energy transitions: Evidences from Gujarat, India. *Sustainable Development*, 30(4). <https://doi.org/10.1002/sd.2244>
- Haldar, S., Grillitsch, M., & Bazaz, A. (2024a). *A Human-Centric Approach to Energy Justice: Embedding Agency and Capabilities in Transitions Discourse*. Lund University, CIRCLE-Centre for Innovation Research.
- Haldar, S., Hoffman, J., Verma, M., Peddibhotla, A., & Bazaz, A. (2024b). Reimagining energy infrastructure for justice: Power, politics, and institutional work in India's 2.05 GW Pavagada solar park. *Energy Research & Social Science*, 116, 103645. <https://doi.org/https://doi.org/10.1016/j.erss.2024.103645>
- Haldar, S., Peddibhotla, A., & Bazaz, A. (2023). Analysing intersections of justice with energy transitions in India - A systematic literature review. *Energy Research & Social Science*, 98, 103010. <https://doi.org/10.1016/J.ERSS.2023.103010>
- Haldar, S., & Sharma, G. (2022a). Impact of urbanization on per capita energy use and emissions in India. *International Journal of Energy Sector Management*, 16(1). <https://doi.org/10.1108/IJESM-01-2021-0010>
- Haldar, S., & Sharma, G. (2022b). Possibility spaces for citizen-driven innovations? Classification and functions of urban makerspaces in Bengaluru, India. *International Journal of Green Economics*, 16(2). <https://doi.org/10.1504/IJGE.2022.10052509>
- Haldar, S., & Tripathi, T. (2023). What besets entrepreneurs in renewable energy sector? – Insights from the Indian state of Gujarat. *International Journal of Energy Sector Management*, 17(2). <https://doi.org/10.1108/IJESM-06-2021-0002>
- Hall, J. K., Daneke, G. A., & Lenox, M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing*, 25(5), 439–448.
- Halme, M., Lindeman, S., & Linna, P. (2012). Innovation for inclusive business: Intrapreneurial bricolage in multinational corporations. *Journal of Management Studies*, 49(4), 743–784.
- Hisrich, R. D., & Ramadani, V. (2018). *Entrepreneurial Marketing: A Practical Managerial Approach*. Edward Elgar Publishing.
- Hockerts, K., & Wüstenhagen, R. (2010). Greening Goliaths versus emerging Davids — Theorizing about the role of incumbents and new entrants in sustainable entrepreneurship. *Journal of Business Venturing*, 25(5), 481–492. <https://doi.org/10.1016/j.jbusvent.2009.07.005>
- Hoffman, J., Davies, M., Bauwens, T., Späth, P., Hajer, M. A., Arifi, B., Bazaz, A., & Swilling, M. (2021). Working to align energy transitions and social equity: An integrative framework linking institutional work, imaginaries and energy justice. *Energy Research & Social Science*, 82, 102317.

- Hoogendoorn, B., Guerra, D., & Van Der Zwan, P. (2015). What drives environmental practices of SMEs? *Small Business Economics*, *44*, 759–781.
- Hoogendoorn, B., Van der Zwan, P., & Thurik, R. (2019). Sustainable entrepreneurship: The role of perceived barriers and risk. *Journal of Business Ethics*, *157*, 1133–1154.
- Hörisch, J. (2015). The Role of sustainable entrepreneurship in sustainability transitions: A conceptual synthesis against the background of the multi-level perspective. *Administrative Sciences*, *5*(4), 286–300. <https://doi.org/10.3390/admsci5040286>
- Hossain, M. (2020). Frugal innovation: Conception, development, diffusion, and outcome. *Journal of Cleaner Production*, *262*, 121456.
- IEA. (2021a). *India Energy Outlook 2021*. <https://www.iea.org/reports/india-energy-outlook-2021>
- IEA. (2021b, May 12). *Integrated Energy Policy*. <https://www.iea.org/policies/4518-integrated-energy-policy>
- Ioannou, I., & Serafeim, G. (2012). What drives corporate social performance? The role of nation-level institutions. *Journal of International Business Studies*, *43*, 834–864.
- Isaak, R. (2016). The making of the ecopreneur. In *Making Ecopreneurs*, M. Schaper (ed.) (pp. 43–57). Routledge.
- Jacobsson, S., & Johnson, A. (2000). The diffusion of renewable energy technology: An analytical framework and key issues for research. *Energy Policy*, *28*(9), 625–640. [https://doi.org/10.1016/S0301-4215\(00\)00041-0](https://doi.org/10.1016/S0301-4215(00)00041-0)
- Jain, S., & Koch, J. (2021). Crafting markets and fostering entrepreneurship within underserved communities: Social ventures and clean energy provision in Asia. In *Business, Entrepreneurship and Innovation toward Poverty Reduction* (pp. 176–196). Routledge.
- Joseph, K. L. (2010). The politics of power: Electricity reform in India. *Energy Policy*, *38*(1), 503–511. <https://doi.org/10.1016/j.enpol.2009.09.041>
- Kalaskar, R., & Haldar, S. (2024). *Many Roads to Justice: A Longitudinal Analysis of Global Scholarship on Energy Transitions*. Lund University, CIRCLE-Centre for Innovation Research.
- Katsikis, I. N., & Kyrgidou, L. P. (2007). THE CONCEPT OF SUSTAINABLE ENTREPRENEURSHIP: A CONCEPTUAL FRAMEWORK AND EMPIRICAL ANALYSIS. *Academy of Management Proceedings*, *2007*(1), 1–6.
- Kemp, R., & Pontoglio, S. (2011). The innovation effects of environmental policy instruments — A typical case of the blind men and the elephant? *Ecological Economics*, *72*, 28–36. <https://doi.org/10.1016/j.ecolecon.2011.09.014>
- Kemp, R., Schot, J., & Hoogma, R. (1998). Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management. *Technology Analysis & Strategic Management*, *10*(2), 175–198. <https://doi.org/10.1080/09537329808524310>
- Khurana, M., & Banerjee, S. G. (2014). *Beyond Crisis: The Financial Performance of India's Power Sector*. World Bank Publications.
- Kim, H., Gon Kim, W., & An, J. A. (2003). The effect of consumer - based brand equity on firms' financial performance. *Journal of Consumer Marketing*, *20*(4), 335–351. <https://doi.org/10.1108/07363760310483694>

- Kimmitt, J., & Muñoz, P. (2018). Sensemaking the ‘social’in social entrepreneurship. *International Small Business Journal*, 36(8), 859–886.
- Kirzner, I. M. (1990). Self - interest and the new bashing of economics: A fresh opportunity in the perennial debate? *Critical Review*, 4(1–2), 27–40. <https://doi.org/10.1080/08913819008459591>
- Kirzner, I. M. (2015). *Competition and Entrepreneurship*. University of Chicago press.
- Kshitij, A., & Mandal, K. (2022). Reviewing the National Solar Mission in India from the Lens of Mission Oriented Innovation Policies. *Asian Research Policy*. [https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.kistep.re.kr/arpDownload.es%3Fissuе\\_list\\_no%3D36%26list\\_no%3D213&ved=2ahUKEwjM3\\_3Kv6WMAxW3HBAIHdVIDJlQFnoECAoQAQ&usg=AOvVaw0uaUTioB9onfNzNlfNehCu](https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://www.kistep.re.kr/arpDownload.es%3Fissuе_list_no%3D36%26list_no%3D213&ved=2ahUKEwjM3_3Kv6WMAxW3HBAIHdVIDJlQFnoECAoQAQ&usg=AOvVaw0uaUTioB9onfNzNlfNehCu)
- Kumar, H., & Sharma, G. (2023). Grassroots innovations and sustainable energy use in urban contexts: Case studies from India. *Journal of Science and Technology Policy Management*, 14(3), 529–546. <https://doi.org/10.1108/JSTPM-03-2021-0042>
- Kumar, H., & Sharma, G. (2024). *Grassroots Innovation: Discourse, Policy and Practice in the Global South*. Taylor & Francis.
- Kuzilwa, J. A. (2005). The role of credit for small business success. *The Journal of Entrepreneurship*, 14(2), 131–161. <https://doi.org/10.1177/097135570501400204>
- Lans, T., Blok, V., & Wesselink, R. (2014). Learning apart and together: Towards an integrated competence framework for sustainable entrepreneurship in higher education. *Journal of Cleaner Production*, 62, 37–47. <https://doi.org/10.1016/j.jclepro.2013.03.036>
- Larsson, M., Milestad, R., Hahn, T., & Von Oelreich, J. (2016). The resilience of a sustainability entrepreneur in the swedish food system. *Sustainability*, 8(6), 550. <https://doi.org/10.3390/su8060550>
- Lee, B. H., Georgallis, P. (Panikos), & Struben, J. (2022). Sustainable entrepreneurship under market uncertainty: Opportunities, challenges and impact. In *Handbook on the Business of Sustainability*, G. George, M. Haas, H. Joshi, A. McGahan, & P. Tracey (eds.). Edward Elgar Publishing. <https://doi.org/10.4337/9781839105340.00022>
- Levien, M. (2012). The land question: Special economic zones and the political economy of dispossession in India. *The Journal of Peasant Studies*, 39(3–4), 933–969. <https://doi.org/10.1080/03066150.2012.656268>
- Lewis, J. I. (2007). Technology acquisition and innovation in the developing world: Wind Turbine development in China and India. *Studies in Comparative International Development*, 42(3–4), 208–232. <https://doi.org/10.1007/s12116-007-9012-6>
- Licht, A. N., & Siegel, J. I. (2006). *The Social Dimensions of Entrepreneurship*. M. Casson & B. Yeung (eds.). Oxford University Press. <https://ssrn.com/abstract=824844>
- Limeta, G. E. (2024). *Entrepreneurship in Renewable Energy: A Quantitative Study on Barriers & Sustainability in Solar PV Business Development in Sweden*. Jönköping University.
- Linnanen, L. (2016). An insider’s experiences with environmental entrepreneurship. In *Making Ecopreneurs*, M. Schaper (ed.) (pp. 109–121). Routledge.

- Madhanagopal, D., Samuel, L., & Gandhi, K. (2022). Localized policy responses for climate change and developmental complications: Discussions from three coastal regions of India. In *Climate Change and Risk in South and Southeast Asia*, D. Madhanagopa & S. Momtaz (eds.) (pp. 236–265). Routledge.
- Magro, E., & Wilson, J. R. (2013). Complex innovation policy systems: Towards an evaluation mix. *Research Policy*, 42(9), 1647–1656. <https://doi.org/10.1016/j.respol.2013.06.005>
- Mair, J., & Marti, I. (2009). Entrepreneurship in and around institutional voids: A case study from Bangladesh. *Journal of Business Venturing*, 24(5), 419–435.
- Marin, A., Mitchell, R. K., & Lee, J. H. (2015). The vulnerability and strength duality in ethnic business: A model of stakeholder salience and social capital. *Journal of Business Ethics*, 130, 271–289.
- Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy*, 41(6), 955–967. <https://doi.org/10.1016/j.respol.2012.02.013>
- McMullen, J. S., Bagby, D. R., & Palich, L. E. (2008). Economic freedom and the motivation to engage in entrepreneurial action. *Entrepreneurship Theory and Practice*, 32(5), 875–895.
- Medina, C., Ana, C. R. M., & González, G. (2022). Transmission grids to foster high penetration of large-scale variable renewable energy sources—A review of challenges, problems, and solutions. *International Journal of Renewable Energy Research (IJRER)*, 12(1), 146–169.
- MNRE. (2015). *National Offshore Wind Energy Policy*. <https://www.cecp-eu.in/uploads/documents/fowind/83f27fc705a9090f00da25ccc76e0b9d.pdf>
- MNRE. (2022). *Production Linked Incentive (PLI) Scheme: National Programme on High Efficiency Solar PV Modules*. <https://mnre.gov.in/production-linked-incentive-pli/>
- MNRE. (2024, November 13). *India's Renewable Energy Capacity Hits New Milestone Renewable Energy Now Constitutes More Than 46.3% of Total Capacity*.
- MoP. (2025). *500GW Nonfossil Fuel Target*. Ministry of Power, Government of India. <https://powermin.gov.in/en/content/500gw-nonfossil-fuel-target>
- Moloney, S., Horne, R. E., & Fien, J. (2010). Transitioning to low carbon communities—from behaviour change to systemic change: Lessons from Australia. *Energy Policy*, 38(12), 7614–7623. <https://doi.org/10.1016/j.enpol.2009.06.058>
- Muhammed Shafi, M. K., Shafi, K. M., & Saleem, S. (2024). Microfinance-driven banking initiatives for advancing financial inclusion; Evidences from India. In B. Awwad (Ed.), *The AI Revolution: Driving Business Innovation and Research: Volume 2* (pp. 467–481). Springer Nature Switzerland. [https://doi.org/10.1007/978-3-031-54383-8\\_36](https://doi.org/10.1007/978-3-031-54383-8_36)
- Muñoz, P., & Cohen, B. (2018). Sustainable entrepreneurship research: Taking stock and looking ahead. *Business Strategy and the Environment*, 27(3), 300–322.
- Muñoz, P., & Dimov, D. (2015). The call of the whole in understanding the development of sustainable ventures. *Journal of Business Venturing*, 30(4), 632–654.
- Munro, P. (2023). Energy justice, modernity and transitions: More-than-modern energy for all in the Global South. In *Handbook on Energy Justice*, S. Bouzarovski, S. Fuller, & T. Reames (eds.) (pp. 213–225). Edward Elgar Publishing.

- Ney, S., Beckmann, M., Graebnitz, D., & Mirkovic, R. (2014). Social entrepreneurs and social change: Tracing impacts of social entrepreneurship through ideas, structures and practices. *International Journal of Entrepreneurial Venturing*, 6(1), 51–68.
- Ngan, S. L., How, B. S., Teng, S. Y., Promentilla, M. A. B., Yatim, P., Er, A. C., & Lam, H. L. (2019). Prioritization of sustainability indicators for promoting the circular economy: The case of developing countries. *Renewable and Sustainable Energy Reviews*, 111, 314–331. <https://doi.org/10.1016/j.rser.2019.05.001>
- Nikolaou, I. E., Tasopoulou, K., & Tsagarakis, K. (2018). A Typology of green entrepreneurs based on institutional and resource-based views. *The Journal of Entrepreneurship*, 27(1), 111–132. <https://doi.org/10.1177/0971355717738601>
- NITI Aayog, & Vasudha Foundation. (2025). *Gujarat State Profile: A Comprehensive Overview*. India Climate and Energy Dashboard. <https://iced.niti.gov.in/state-report/gujarat>
- Norman, J., Maycock, A. C., Troccoli, A., & Dessai, S. (2024). The role of repowering India's ageing wind farms in achieving net-zero ambitions. *Environmental Research Letters*, 19(3), 034031. <https://doi.org/10.1088/1748-9326/ad28db>
- OECD. (2013). *Entrepreneurship at a Glance 2013*. OECD.
- OECD. (2017). *Entrepreneurship at a Glance 2017*. OECD. [https://doi.org/10.1787/entrepreneur\\_aag-2017-en](https://doi.org/10.1787/entrepreneur_aag-2017-en)
- Onoshakpor, C., & Ogundana, O. M. (2024). Motivating entrepreneurial activities to achieve sustainable development in sub-saharan Africa. In *Innovation, Entrepreneurship and the Informal Economy in Sub-Saharan Africa: A Sustainable Development Agenda*, A. S. Ibidunni, O. M. Ogundana, & M. A. Olokundun (eds.) (pp. 93–120). Springer.
- Opoku, O. A., Sampson, L. E., Henry, O., & Anak, J. A. (2022). Exploring challenges and prospects of solar energy entrepreneurship of Accra Metropolis in Ghana. *International Journal of Business, Technology and Organizational Behavior (IJTOB)*, 2(1), 94–107.
- Orozco-Meléndez, J. F., & Paneque-Gálvez, J. (2022). A role for grassroots innovation toward agroecological transitions in the Global South? Evidence from Mexico. *Ecological Economics*, 201, 107582.
- Pachauri, S., van Ruijven, B. J., Nagai, Y., Riahi, K., van Vuuren, D. P., Brew-Hammond, A., & Nakicenovic, N. (2013). Pathways to achieve universal household access to modern energy by 2030. *Environmental Research Letters*, 8(2), 024015. <https://doi.org/10.1088/1748-9326/8/2/024015>
- Pacheco, D. F., Dean, T. J., & Payne, D. S. (2010). Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development. *Journal of Business Venturing*, 25(5), 464–480.
- Parrish, B. D. (2010). Sustainability-driven entrepreneurship: Principles of organization design. *Journal of Business Venturing*, 25(5), 510–523.
- Patzelt, H., & Shepherd, D. A. (2011). Recognizing opportunities for sustainable development. *Entrepreneurship Theory and Practice*, 35(4), 631–652.
- Peddibhotla, A., Haldar, S., & Bazaz, A. (2024). Watt's fair in Mumbai: Intermediaries' impact on energy justice in informal settlements. *Environmental Research: Energy*, 1(4), 045006. <https://doi.org/10.1088/2753-3751/ad7ebe>

- Peng, H., & Liu, Y. (2018). How government subsidies promote the growth of entrepreneurial companies in clean energy industry: An empirical study in China. *Journal of Cleaner Production*, 188, 508–520. <https://doi.org/10.1016/j.jclepro.2018.03.126>
- Pergelova, A., & Angulo-Ruiz, F. (2014). The impact of government financial support on the performance of new firms: The role of competitive advantage as an intermediate outcome. *Entrepreneurship and Regional Development*, 26(9–10), 663–705. <https://doi.org/10.1080/08985626.2014.980757>
- Pesciarelli, E. (1989). Smith, Bentham, and the development of contrasting ideas on entrepreneurship. *History of Political Economy*, 21(3), 521–536.
- Petersen, H. (2016). The competitive strategies of ecopreneurs: Striving for market leadership by promoting sustainability. In *Making Ecopreneurs*, M. Schaper (ed.) (pp. 223–236). Routledge.
- Pindado, J., De Queiroz, V., & De La Torre, C. (2010). How do firm characteristics influence the relationship between R&D and firm value? *Financial Management*, 39(2), 757–782. <https://doi.org/10.1111/j.1755-053X.2010.01091.x>
- Pinkse, J., & Groot, K. (2015). Sustainable entrepreneurship and corporate political activity: Overcoming market barriers in the clean energy sector. *Entrepreneurship Theory and Practice*, 39(3), 633–654.
- Porter, M. E., & Kramer, M. R. (2011). The big idea: Creating shared value. *Harvard Business Review*, 89(1–2), 1–12.
- Prakash, O., Ahmad, A., Kumar, A., Chatterjee, R., Sharma, S., Alayi, R., & Monfared, H. (2022). The compressive study of energy security prospects in India through Solar Power. *International Journal of Low-Carbon Technologies*. <https://doi.org/10.1093/ijlct/ctac075>
- Quinn, J. B. (1971). *Next Big Industry: Environmental Improvement*. Harvard Business Review.
- Radjou, N., & Prabhu, J. (2015). *Frugal Innovation: How to do More with Less*. The Economist.
- Raihan, A., Sarker, T., & Zimon, G. (2024). An Investigation on the Prospects, Challenges and Policy Consequences of Renewable Energy Technology Development for India's Environmental Sustainability. *WSEAS TRANSACTIONS ON ENVIRONMENT AND DEVELOPMENT*, 20, 365–390. <https://doi.org/10.37394/232015.2024.20.35>
- Read, S., Sarasvathy, S., Dew, N., & Wiltbank, R. (2016). *Effectual Entrepreneurship*. Routledge.
- Revi, A., Roberts, D., Klaus, I., Bazaz, A., Krishnaswamy, J., Singh, C., Eichel, A., Kodira, P. P., Seth, S., Adelekan, I., Babiker, M., Bertoldi, P., Cartwright, A., Chow, W., Colenbrander, S., Creutzig, F., Dawson, R., De Coninck, H., De Kleijne, K., Dhakal, S., Gallardo, L., Garschagen, M., Haasnoot, M., Haldar, S., Hamdi, R., Hashizume, M., Islam, A.K.M. S., Jiang, K., Kilkış, S., Klimont, Z., Lemos, M. F., Ley, D., Lwasa, S., McPhearson, T., Niamir, L., Otto, F., Pathak, M., Pelling, M., Pinto, I., Pörtner, H.-O., Pereira, J. P., Raghavan, K., Roy, J., Sara, L. M., Seto, K. C., Simpson, N. P., Solecki, W., Some, S., Sörensson, A. A., Steg, L., Szopa, S., Thomas, A., Trisos, C., & Ürges-Vorsatz, D. (2022). *The Summary for Urban Policymakers of the IPCC's Sixth Assessment Report*. Indian Institute for Human Settlements, Bangalore, India, 10–24943.

- Rizos, V., Behrens, A., Van der Gaast, W., Hofman, E., Ioannou, A., Kafyke, T., Flamos, A., Rinaldi, R., Papadelis, S., & Hirschnitz-Garbers, M. (2016). Implementation of circular economy business models by small and medium-sized enterprises (SMEs): Barriers and enablers. *Sustainability*, 8(11), 1212.
- Rosário, A., Raimundo, R., & Cruz, S. (2022). Sustainable entrepreneurship: A literature review. *Sustainability*, 14(9), 5556. <https://doi.org/10.3390/su14095556>
- Sarango-Lalangui, P., Santos, J. L. S., & Hormiga, E. (2018). The development of sustainable entrepreneurship research field. *Sustainability*, 10(6), 2005.
- Sarkar, P. K. (2024). 3 Power sector transformation: An Indian perspective. In *Handbook of Electrical Power Systems*, O. D. Doleski & M. Freunek (eds.) (pp. 53–94). De Gruyter. <https://doi.org/10.1515/9783111264271-003>
- Sawhney, A. (2024). *Tradeable Renewable Energy Credit Markets: Lessons from India*, H. Phoumin, R. Nepal & F.i Kimura, & F. Taghizadeh-Hesary (eds.) (pp. 79–99). Springer. [https://doi.org/10.1007/978-981-99-8239-4\\_4](https://doi.org/10.1007/978-981-99-8239-4_4)
- Schaefer, K., Corner, P. D., & Kearins, K. (2015). Social, environmental and sustainable entrepreneurship research. *Organization & Environment*, 28(4), 394–413. <https://doi.org/10.1177/1086026615621111>
- Schaltegger, S. (2002). A framework for ecopreneurship: Leading bioneers and environmental managers to ecopreneurship. *Greener Management International*, 38, 45–58. <https://www.jstor.org/stable/greemanainte.38.45>
- Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: Categories and interactions. *Business Strategy and the Environment*, 20(4), 222–237.
- Schaper, M. (2002). Introduction: The essence of ecopreneurship. *Greener Management International*, 38, 26–30.
- Scherer, F. M. (2011). *New Perspectives on Economic Growth and Technological Innovation*. Brookings Institution Press.
- Schoeffler, S. (1978). Good Productivity vs. Bad Productivity. *PIMS Letter on Business Strategy*, 11, 11–18.
- Schot, J., Kanger, L., & Verbong, G. (2016). The roles of users in shaping transitions to new energy systems. *Nature Energy*, 1(5), 16054. <https://doi.org/10.1038/nenergy.2016.54>
- Scott, J. M., & Thompson, J. (2012). Making ecopreneurs: Developing sustainable entrepreneurship (2nd ed.). *International Journal of Entrepreneurial Behavior & Research*, 18(3), 383–386. <https://doi.org/10.1108/13552551211228052>
- Segal, G., Borgia, D., & Schoenfeld, J. (2005). The motivation to become an entrepreneur. *International Journal of Entrepreneurial Behavior & Research*, 11(1), 42–57.
- Shanmugam, K. R., & Kulshreshtha, P. (2005). Efficiency analysis of coal-based thermal power generation in India during post-reform era. *International Journal of Global Energy Issues*, 23(1), 15. <https://doi.org/10.1504/IJGEI.2005.006408>
- Shepherd, D. A., & Patzelt, H. (2011). The new field of sustainable entrepreneurship: Studying entrepreneurial action linking “what is to be sustained” with “what is to be developed.” *Entrepreneurship Theory and Practice*, 35(1), 137–163.
- Singh, K., Meena, R. S., Kumar, S., Dhyani, S., Sheoran, S., Singh, H. M., Pathak, V. V., Khalid, Z., Singh, A., Chopra, K., Bajar, S., Ansari, F. A., Gupta, S. K.,

- Varjani, S., Kothari, R., Tyagi, V. V., Singh, B., & Byun, C. (2023). India's renewable energy research and policies to phase down coal: Success after Paris agreement and possibilities post-Glasgow Climate Pact. *Biomass and Bioenergy*, 177, 106944. <https://doi.org/10.1016/j.biombioe.2023.106944>
- Slaper, T. F., & Hall, T. J. (2011). The triple bottom line: What is it and how does it work. *Indiana Business Review*, 86(1), 4–8.
- Smil, V. (2010). *Energy Transitions: History, Requirements, Prospects*. Bloomsbury Publishing.
- Smith, W., & Chimucheka, T. (2014). Entrepreneurship, economic growth and entrepreneurship theories. *Mediterranean Journal of Social Sciences*, 5(14), 160–168.
- Spence, M., Ben Boubaker Gherib, J., & Ondoua Biwolé, V. (2011). Sustainable entrepreneurship: is entrepreneurial will enough? A north–south comparison. *Journal of Business Ethics*, 99, 335–367.
- Srinivasan, M., Ghoge, K., Haldar, S., Bazaz, A. B., & Revi, A. (2023). *Climate finance in India 2023*. Indian Institute for Human Settlements. <https://doi.org/10.24943/CFI11.2023>
- Stark, W. (2004). *Jeremy Bentham's Economic Writings*. Routledge.
- Stenholm, P., Acs, Z. J., & Wuebker, R. (2015). Exploring country-level institutional arrangements on the rate and type of entrepreneurial activity. In *Global Entrepreneurship, Institutions and Incentive*, Z. J. Acs (ed.) (pp. 387–404). Edward Elgar Publishing.
- Streefkerk, H. (1997). Gujarati entrepreneurship: Historical continuity against changing perspectives. *Economic and Political Weekly*, 32(8), M2–M10. <https://www.jstor.org/stable/4405117>
- Styczynski, A. B. (2024). India's energy (R) evolution. In *India's Energy Revolution*, A. B. Styczynski (ed.) (pp. 1–14). Routledge India.
- Swedberg, R. (2000). Entrepreneurship: The social science view. (*No Title*).
- Swedberg, R. (2009). Schumpeter's full model of entrepreneurship: Economic, non-economic and social entrepreneurship. In *An Introduction to Social Entrepreneurship: Voices, Preconditions, Contexts*, R. Ziegler (ed.) (pp. 77–106). Edward Elgar. <https://doi.org/10.4337/9781848446229>
- Tagotra, N. (2017). The political economy of renewable energy: Prospects and challenges for the renewable energy sector in India post-Paris negotiations. *India Quarterly: A Journal of International Affairs*, 73(1), 99–113. <https://doi.org/10.1177/0974928416686584>
- Temper, L., Avila, S., Bene, D. Del, Gobby, J., Kosoy, N., Billon, P. Le, Martinez-Alier, J., Perkins, P., Roy, B., Scheidel, A., & Walter, M. (2020). Movements shaping climate futures: A systematic mapping of protests against fossil fuel and low-carbon energy projects. *Environmental Research Letters*, 15(12), 123004. <https://doi.org/10.1088/1748-9326/abc197>
- Terán-Yépez, E., Marín-Carrillo, G. M., Casado-Belmonte, M. del P., & Capobianco-Uriarte, M. de las M. (2020). Sustainable entrepreneurship: Review of its evolution and new trends. *Journal of Cleaner Production*, 252, 119742. <https://doi.org/10.1016/j.jclepro.2019.119742>
- Thompson, N., Kiefer, K., & York, J. G. (2011). *Distinctions not Dichotomies: Exploring Social, Sustainable, and Environmental Entrepreneurship* (pp. 201–229). [https://doi.org/10.1108/S1074-7540\(2011\)0000013012](https://doi.org/10.1108/S1074-7540(2011)0000013012)

- Tryndina, N., An, J., Varyash, I., Litvishko, O., Khomyakova, L., Barykin, S., & Kalinina, O. (2022). Renewable energy incentives on the road to sustainable development during climate change: A review. *Frontiers in Environmental Science*, 10. <https://doi.org/10.3389/fenvs.2022.1016803>
- Unruh, G. C. (2000). Understanding carbon lock-in. *Energy Policy*, 28(12), 817–830. [https://doi.org/10.1016/S0301-4215\(00\)00070-7](https://doi.org/10.1016/S0301-4215(00)00070-7)
- Urbaniec, M. (2018). Sustainable entrepreneurship: Innovation-related activities in European enterprises. *Polish Journal of Environmental Studies*, 27(4), 1773–1779.
- Urbano, D., Guerrero, M., Ferreira, J. J., & Fernandes, C. I. (2019). New technology entrepreneurship initiatives: Which strategic orientations and environmental conditions matter in the new socio-economic landscape? *The Journal of Technology Transfer*, 44, 1577–1602.
- Vachani, S., & Smith, N. C. (2008). Socially responsible distribution: Distribution strategies for reaching the bottom of the Pyramid. *California Management Review*, 50(2), 52–84. <https://doi.org/10.2307/41166435>
- van Lente, H., Hekkert, M., Smits, R., & van Waveren, B. (2003). Roles of systemic intermediaries in transition processes. *International Journal of Innovation Management*, 07(03), 247–279. <https://doi.org/10.1142/S1363919603000817>
- Venkatesan, S., Bala, Dr. M. L., & Sumathi, Dr. N. (2015). Renewable energy market in India – an overview. *International Journal of Scientific Research*, 4. <https://api.semanticscholar.org/CorpusID:157956318>
- Wagner, M. (2017). *Entrepreneurship, Innovation and Sustainability*. Routledge.
- Walley, E. E., & Taylor, D. W. (2002). Opportunists, champions, mavericks...? A typology of green entrepreneurs. *Greener Management International*, 38, 31–43.
- Walley, L., Taylor, D., & Greig, K. (2016). Beyond the visionary champion: Testing a typology of green entrepreneurs. In *Making Ecopreneurs*, M. Schaper (ed.) (pp. 59–74). Routledge.
- Walsh, M. F., & Lipinski, J. (2009). The role of the marketing function in small and medium sized enterprises. *Journal of Small Business and Enterprise Development*, 16(4), 569–585. <https://doi.org/10.1108/14626000911000929>
- Wennekers, S., Uhlaner, L., & Thurik, R. (2002). Entrepreneurship and its conditions: A macro perspective. *International Journal of Entrepreneurship Education (IJEE)*, 1(1), 25–64.
- Wilson, C., Grubler, A., Bauer, N., Krey, V., & Riahi, K. (2013). Future capacity growth of energy technologies: Are scenarios consistent with historical evidence? *Climatic Change*, 118(2), 381–395. <https://doi.org/10.1007/s10584-012-0618-y>
- WISE. (2017). *Renewables India 2017: Towards Grid Parity, Status of RE Development in India*, 2016-17.
- Yazdani, S., & Dola, K. (2013). Sustainable city priorities in Global North Versus Global South. *Journal of Sustainable Development*, 6(7). <https://doi.org/10.5539/jsd.v6n7p38>
- York, J. G., & Venkataraman, S. (2010). The entrepreneur–environment nexus: Uncertainty, innovation, and allocation. *Journal of Business Venturing*, 25(5), 449–463.



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