

ROLE OF GREEN FINANCE IN ACHIEVING GREEN INDUSTRIALIZATION FOR VIKSIT BHARAT BY 2047

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Abstract:

India's Viksit Bharat vision by 2047 prioritizes sustainable industrialization, necessitating a shift from fossil-fuel reliance to low-carbon models, with green finance as a cornerstone. This study investigates how green bonds, ESG investments, blended finance, carbon credits, and green banking can fund renewable energy, electric mobility, battery manufacturing, and circular economy initiatives for MSMEs, aligning with SDGs 7, 9, and 13 and Panchamrit climate targets. Using qualitative secondary data analysis from government reports (MNRE, RBI, MoEFCC), international sources (IEA, Statista), and academic literature, it employs descriptive statistics and trend analysis to evaluate progress from 2014 to 2025, noting renewable capacity growth from 35.8 GW to 171.6 GW, an 800-fold EV sales surge, and waste processing rising to 72%. Policy interventions like PLI schemes and sovereign green bonds have reduced import dependence, yet challenges, 66% private sector mitigation finance, 77% RPO compliance, and 1.18% FDI share, persist. Recommendations include strengthening green credit markets via ESG mandates and municipal bonds, expanding public-private partnerships through PLI and sovereign funds, and enhancing MSME literacy to mobilize INR 4.5 lakh crore and cut 155 MtCO_{2e} by 2030. These strategies will bridge the \$10.1 trillion investment gap, ensuring a resilient, net-zero future.

Keywords: Green Finance, Viksit Bharat, Green Industrialization, SDGS, Renewable Energy

INTRODUCTION

India's ambitious vision of Viksit Bharat by 2047 envisions a developed nation characterized by inclusive economic growth, technological advancement, and environmental sustainability. Central to this vision is the transformation of the industrial sector, which currently accounts for approximately 25% of the country's Gross Domestic Product (GDP) while contributing around 24% of its energy-related CO₂ emissions (IEA, 2024). As per recent data from the Ministry of Environment, Forest and Climate Change (MoEFCC, 2024), the sector's reliance on fossil fuels has exacerbated climate vulnerabilities, underscoring the urgent need for green industrialization, a paradigm shift toward low-carbon, resource-efficient manufacturing processes that decouple economic expansion from ecological harm. This transition is not merely an environmental imperative but a strategic economic opportunity, aligning with India's commitments under the Paris Agreement and the United Nations Sustainable Development Goals (SDGs).

Green finance emerges as the linchpin in this metamorphosis, channelling capital into eco-friendly projects through instruments like green bonds, Environmental, Social, and Governance (ESG) investments, and blended finance models. These mechanisms are essential for funding critical areas such as renewable energy infrastructure (solar, wind, and green hydrogen), scaling electric vehicle (EV) and advanced battery manufacturing, and retrofitting Micro, Small, and Medium Enterprises (MSMEs) with clean technologies. By 2047, India aims to achieve net-zero emissions, necessitating an estimated \$10.1 trillion in sustainable investments by 2070, with green finance



poised to bridge the funding gap between public budgets and private capital (ORF, 2024). The Panchamrit climate pledges at COP26, targeting 500 GW of non-fossil energy capacity by 2030, further amplify this role, positioning green finance as a catalyst for innovation and job creation in green sectors.

Historically, India's industrial growth has been fossil-fuel intensive, but policy pivots like the Production Linked Incentive (PLI) schemes and sovereign green bonds have ignited momentum. For instance, the industrial sector's energy intensity has declined by 15% since 2010, yet emissions continue to rise due to scale effects. Green finance addresses this by de-risking investments in nascent technologies, fostering public-private partnerships, and incentivizing ESG compliance. It aligns seamlessly with SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation, and Infrastructure), and SDG 13 (Climate Action), ensuring that industrialization contributes to broader societal goals like poverty alleviation and gender equity.

To illustrate the sector's profile, Table 1 provides an overview of key metrics.

Table 1. India's Industrial Sector: Current Status and Future Projections

Metric	Value (2024)	Projection (2047)	Source
Industrial GDP Contribution	25%	30% (green-led)	MoEFCC (2024)
CO ₂ Emissions Share	24%	<10%	IEA (2024)
Energy Intensity (toe/million USD)	0.12	0.05	NITI Aayog (2023)
Green Investment Needs	\$250 Bn annually	\$10.1 Tn cumulative	RBI (2024)

Moreover, green finance instruments have evolved rapidly. Table 2 highlights prominent ones and their impact.

Table 2. Key Green Finance Instruments in India (RBI, 2024)

Instrument	Description	Mobilized Funds (2024, ₹ Cr)	Key Impact
Green Bonds	Debt for eco-projects	50,000	Funded 10 GW solar
ESG Funds	Equity tied to sustainability metrics	15,000	MSME tech upgrades
Blended Finance	Public-private risk-sharing	20,000	EV infrastructure

Challenges persist, including regulatory fragmentation and limited private participation, with only 9 of 26 public sector banks actively lending to renewables. However, opportunities abound: India's renewable capacity has surged nearly threefold from 76 GW in 2014 to over 226 GW in June 2025 (PIB, 2025). This article delves into policy frameworks, financial mechanisms, and strategies to harness green finance for Viksit Bharat's industrial renaissance, emphasizing the decade ahead as pivotal for a carbon-neutral future.

METHODS

This study employs a qualitative approach, utilizing secondary data analysis to explore green finance's role in India's green industrialization. Data were sourced from government reports (e.g., MNRE, 2025; RBI, 2024; MoEFCC, 2024), international databases (e.g., IEA, 2024a, 2024b; Statista, 2025a), and peer-reviewed literature (e.g., Saini, 2025). Descriptive statistics and trend analysis, compiled using Excel, quantified progress in renewable energy (e.g., 35.8 GW to 171.6 GW), EV sales,



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and waste processing (Tables 1–6, 19). Policy evaluations used thematic analysis to assess PLI schemes, green bonds, and ESG frameworks. Limitations include reliance on 2025 projections based on partial-year estimates (e.g., JMK Research & Analytics, 2025) and potential biases in government reports, which may overstate policy impacts. The study mitigates this by cross-referencing multiple sources, ensuring robustness.

RESULT AND DISCUSSION

Green Industrialization: Pillars for Viksit Bharat, Renewable Energy Integration. India's renewable energy sector has undergone transformative growth following the introduction of key green policies, particularly the Jawaharlal Nehru National Solar Mission (JNNSM) launched in 2010, which set ambitious targets for solar capacity addition. This policy, complemented by subsequent frameworks like the National Wind-Solar Hybrid Policy (2018) and the 500 GW non-fossil target announced in 2021 under Panchamrit, has catalyzed exponential increases in installed capacity. Prior to JNNSM, renewable capacity (excluding large hydro) hovered below 20 GW in 2010; post-policy, it accelerated dramatically, driven by incentives, auctions, and international climate finance.

By 2014, cumulative installed capacity reached 35.85 GW (MNRE, 2025). Subsequent years witnessed robust additions, with solar emerging as the frontrunner, from 2.82 GW in 2014 to 105.65 GW by July 2025. Total renewable capacity (excluding large hydro) climbed to 171.62 GW by July 2025, a nearly fivefold increase from 2014 levels. This surge is attributed to policy de-risking, with annual additions averaging 15-20 GW post-2020.

Table 3 details the year-wise growth in key renewable segments (cumulative installed capacity in GW).

Year	Solar Power (GW)	Wind Power (GW)	Small Hydro (GW)	Total RE (GW, approx.)
2014	2.82	21.04	3.8	35.8
2015	3.99	23.35	4.06	40
2016	7.12	26.78	4.27	46.8
2017	12.78	32.28	4.38	58.3
2018	22.35	34.15	4.49	70.3
2019	29.1	35.63	4.59	79.1
2020	35.61	37.74	4.68	87.9
2021	41.24	39.25	4.79	95.4
2022	54	40.36	4.85	109.4
2023	66.78	42.63	4.94	124.6
2024	81.81	45.89	5	143.2
2025	105.65	50.04	5.01	171.6

Source: MNRE (2025)



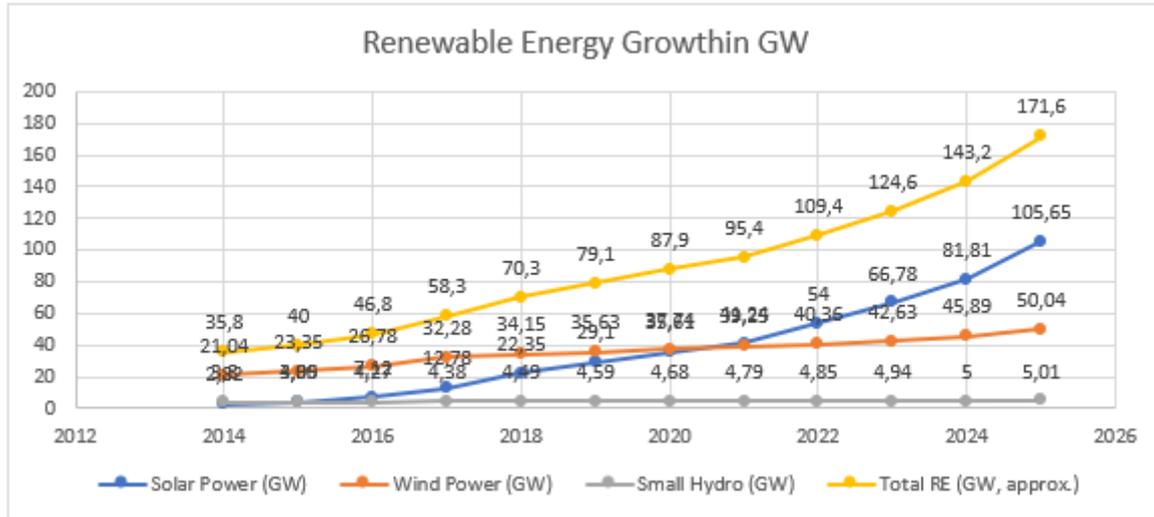


Figure 1. Line chart showing solar, wind, hydro, and total renewable energy capacity growth in India (2014–2025), based on MNRE (2025) data.

The Solar PLI Scheme (₹24,000 Cr) has further reduced import reliance from 80% to 50% by 2030, while green bonds like IREDA’s ₹5,000 Cr issuance have financed utility-scale projects, underscoring the policy's role in scaling integration.

Electric Mobility & Battery Manufacturing. Progress in electric mobility and battery manufacturing in India has accelerated since 2014, propelled by policies like Faster Adoption and Manufacturing of Electric Vehicles (FAME-I in 2015 and FAME-II in 2019), alongside the PLI scheme for Advanced Chemistry Cells (ACC, ₹18,100 Cr in 2021). EV sales, starting from a nascent base, have grown over 800-fold by 2024, reflecting subsidy-driven adoption and infrastructure buildup (JMK Research & Analytics, 2025). Two-wheelers dominate, comprising over 50% of sales, with three-wheelers following.

Table 4. Year-Wise EV Sales in India (2014-2025)

Year	Total EV Sales (Units)	Key Notes
2014	2,387	Pre-FAME era; mostly imports
2015	7,798	FAME-I launch boosts two-wheelers
2016	49,848	6x growth; early adoption
2017	87,416	Steady rise in urban areas
2018	1,30,269	Policy incentives expand
2019	1,69,265	FAME-II announced
2020	1,27,644	COVID dip, but recovery
2021	3,52,151	2.8x surge post-lockdown
2022	10,86,216	Mass-market EVs launch
2023	16,12,081	48% YoY growth; 6% market share
2024	20,11,608	>2M milestone; cars at 1% share
2025	1,500,000 (Jan-Sep est.)	Q1-FY25 partial; 45% YoY growth in cars

Sources: JMK Research & Analytics (2025); EVreporter (2025); IBEF (2025a)

Battery manufacturing, initially import-dependent, has scaled via PLI, with capacity from near-zero in 2014 to 18 GWh by 2023 (Statista, 2025). By 2025, it will reach approximately 30 GWh, supporting domestic EV needs (IEEFA, 2022). Blended finance has de-risked investments in



charging infrastructure, with over 10,000 stations by 2025. FAME-II and PLI continue to drive this, targeting 30% EV penetration by 2030.

Circular Economy & MSME Decarbonization. India's push toward a circular economy represents a fundamental shift from linear "take-make-dispose" models to resource-efficient systems that emphasize reuse, recycling, and waste minimization, crucial for sustainable industrialization under Viksit Bharat. Launched through initiatives like the National Circular Economy Framework and the Swachh Bharat Mission, this approach addresses the escalating waste crisis – urban India generates approximately 0.15 million tonnes of municipal solid waste (MSW) daily as of 2022, with projections of 165 million tonnes by 2030 and 436 million tonnes by 2050 (MoSPI, 2025). Waste processing capacity has quadrupled from 18% in 2014 to around 72% by 2025, driven by policies promoting waste-to-energy (WTE) and recycling (REVOLVE Media, 2025). Green credit schemes, such as the Green Credit Programme introduced in 2023, incentivize voluntary environmental actions like afforestation and waste-to-energy projects by awarding tradable credits, enhancing access to green finance and ESG-linked investments (Mongabay India, 2024).

For MSMEs, which number over 63 million and contribute 25% of industrial energy consumption while emitting 110 MtCO₂e in 2015–16, decarbonization is vital (TERI, 2024). Projected emissions could rise over 100% to 72.17 MtCO₂e by 2029–30 without intervention. ESG-linked loans and schemes like the MSME Green Investment and Financing for Transformation (GIFT) Scheme support the adoption of energy-efficient technologies, offering subsidies and low-interest loans, potentially saving 1,600 GWh annually for 12,000 MSMEs (MoMSME, 2025). However, adoption remains low, with less than 10% of MSMEs accessing formal green finance due to barriers like high upfront costs and awareness gaps (RISQ-ESG, 2025). By 2025, awareness of decentralized renewable energy (DRE) stands at 65%, but adoption is only 48%, underscoring the need for expanded public-private mechanisms.

Table 5. details the progress in waste processing capacity, a key circular economy metric.

Year	Waste Processing Capacity (%)	Key Notes
2014	18	Baseline under the Swachh Bharat Mission
2019	30	Incremental growth via urban initiatives
2020	35	COVID-impacted, focus on bio-waste
2021	45	Policy pushes for WTE plants
2022	55	Increased recycling infrastructure
2023	62	Green Credit Programme launch
2024	68	Quadrupling trend accelerates
2025	72	Current capacity, with 10% wastewater treatment growth.

Sources: MoSPI (2025); REVOLVE Media (2025)

Plastic recycling rates have also improved, from 9.79% in 2017–18 to 26.33% in 2020–21, reaching around 60% overall by 2024, with PET at 90% (Mordor Intelligence, 2024; LinkedIn, 2024). Waste-to-energy capacity has grown to 840.21 MWeq by 2025, supporting circular goals (PIB, 2025b).

Table 6 shows MSME green technology adoption trends.

Year	Green Tech Adoption Rate (%)	Key Notes
2014	5	Pre-policy baseline, low awareness
2015	8	Early schemes like the ZED introduction
2016	12	Energy efficiency pilots



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2017	15	MSME emissions at 110 MtCO ₂ e
2018	18	Formal green finance at 16%
2019	22	COVID precursors, cluster programs
2020	25	Post-COVID recovery focus
2021	30	PLI and RAMP schemes
2022	35	ZED registrations surge
2023	40	Green Credit Programme; DRE awareness 50%
2024	45	<10% green finance access
2025	48	DRE adoption; 65% awareness

Sources: RISQ-ESG (2025); NITI Aayog (2025)

These advancements, bolstered by PLI expansions and risk-sharing, are essential for MSME integration into circular models, reducing emissions while fostering economic resilience.

Green Finance Mechanisms for Industrialization. Green finance mechanisms play a pivotal role in channelling resources toward sustainable industrial projects in India, supporting the transition to low-carbon manufacturing and aligning with Viksit Bharat's net-zero ambitions by 2047. These instruments – ranging from debt-based green bonds to equity-oriented ESG funds – have mobilized over USD 60 billion cumulatively by mid-2025, with a focus on renewables, electric mobility, and circular economy initiatives (CBI, 2025a). Since 2014, the ecosystem has evolved from nascent issuances to robust markets, driven by regulatory frameworks like SEBI's green bond principles (2017) and RBI's green deposit guidelines (2023). Blended finance and carbon credits further de-risk investments, while dedicated green banks like IREDA provide concessional lending. This section examines key mechanisms, their roles, and growth trajectories, highlighting their contributions to industrial decarbonization.

Table 7 provides an overview of major instruments, updated with 2025 data.

Instrument	Role in Green Industrialization	Examples in India (2025)	Mobilized Funds (Cumulative, ₹ Cr, 2014-2025)
Green Bonds	Fund large-scale renewables, EVs, and R&D in low-carbon tech.	Sovereign green bonds (₹16,000 Cr issued in 2023-25); SBI's USD 1 Bn (2023)	4,65,000 (USD 55.9 Bn by 2024)
Blended Finance	Leverage public funds to attract private capital for EV infra and solar parks.	NIIF's USD 2 Bn Green Growth Fund; GCF via NABARD (USD 100 Mn for rooftop solar)	1,50,000 (for renewables/EVs in 2021/22 alone: ₹1,84,400)
Carbon Credits	Monetize emission reductions in steel, cement, and MSMEs.	Tata Steel's voluntary trading; CCTS pilots (278 Mn credits issued 2010-2022)	Market value ~₹8,000 (projected \$10 Bn by 2030)
ESG Funds	Drive corporate sustainability via equity investments in green firms.	Axis ESG Equity Fund; SBI Magnum ESG (AUM ₹10,000 Cr)	12,000 (AUM growth from ₹240 Bn in 2020)
Green Banks	Offer low-cost loans for clean tech adoption in MSMEs and renewables.	IREDA's lending (₹1,63,000 Cr disbursed since inception)	4,00,000 (sanctions ₹2,49,000 Cr by Jun 2025)

Source: CBI (2025a); RBI (2024)

Green Bonds. Green bonds have surged as a primary tool for financing industrial green projects, with issuance volumes growing from negligible levels in 2014 to USD 55.9 billion



cumulatively by end-2024—a 186% increase since 2021 (CBI, 2025a). By mid-2025, sovereign issuances alone reached ₹16,000 crore, funding solar and wind capacities exceeding 10 GW. These bonds support PLI schemes for battery manufacturing and green hydrogen R&D, reducing import dependence.

Table 8 outlines approximate annual issuance growth (in USD Bn, based on available data).

Year	Annual Issuance (USD Bn)	Cumulative (USD Bn)	Key Projects Funded
2014	0.01	0.01	Early pilots
2015	0.05	0.06	IFC-backed
2016	0.1	0.16	Yes Bank debut
2017	0.2	0.36	SEBI guidelines
2018	0.5	0.86	Corporate surge
2019	0.8	1.66	ReNew Power
2020	1.2	2.86	Pandemic resilience
2021	2.5	5.36	Sovereign launch
2022	5	10.36	Avaada Energy
2023	10	20.36	SBI \$1 Bn
2024	20	40.36	GSS+ expansion
2025	15.50 (Jan-Jun est.)	55.86	Steel decarbonization

Source: (Statista, 2025; CBI, 2025a)

Blended Finance. Blended finance has de-risked private investments in high-impact areas like EV infrastructure and renewables, mobilizing INR 1,844 billion for clean energy in 2021/22 alone—a 75% rise from 2019/20 (CPI, 2024). Initiatives like the National Investment and Infrastructure Fund (NIIF) have leveraged public capital, with USD 2 billion committed to green growth funds by 2025.

Table 9 shows sector-specific mobilization.

Year	Renewables (₹ Bn)	EVs (₹ Bn)	Total Blended (₹ Bn)	Examples
2014	200	10	210	Solar Parks Scheme
2015	300	15	315	FAME-I launch
2016	400	20	420	IFC blends
2017	500	25	525	NABARD GCF
2018	600	30	630	PM-KUSUM
2019	542	26	568	NIIF fund
2020	700	40	740	COVID recovery
2021	947	76	1,023	PLI for ACC
2022	1,200	100	1,300	Sovereign bonds
2023	1,400	150	1,550	Green infra
2024	1,600	200	1,800	Transition funds
2025	1,768 (est.)	250	2,018	Thematic funds

Source: (CPI, 2024; World Bank, 2025)

Carbon Credits. The Carbon Credit Trading Scheme (CCTS), notified in 2024, has accelerated monetization of reductions, with over 278 million credits issued from 2010 to 2022 and voluntary market growth at 38.4% CAGR projected through 2030 (Net Zero India, 2025). By 2025, pilots in steel and cement have generated ₹500 crore in trades.



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Table 10. Credits Issued (Million, Approx. Annual).

Year	Credits Issued (Mn)	Market Value (₹ Cr)	Key Sectors
2014	10	50	Forestry
2015	12	60	Renewables
2016	15	80	Agriculture
2017	18	100	Steel
2018	20	120	Cement
2019	22	150	MSMEs
2020	25	200	Bioenergy
2021	28	250	VCM pilots
2022	30	300	278 Mn cumulative
2023	35	400	CCTS prep
2024	40	500	Compliance
2025	45 (est.)	600	Industrial

Source: (FITSOL, 2025; Mongabay, 2025)

ESG Funds. ESG funds have seen AUM explode from ₹240 billion in 2020 to over ₹1,200 billion by 2025, a five-fold jump, investing in sustainable corporates (ResearchGate, 2025a).

Table 11. ESG Funds AUM (₹ Bn).

Year	AUM (₹ Bn)	Growth (%)	Key Funds
2014	50	-	Early launches
2015	80	60	Axis debut
2016	120	50	SBI entry
2017	150	25	Thematic rise
2018	200	33	SEBI push
2019	300	50	\$300 Mn base
2020	240	-20	COVID dip
2021	350	46	Inflows surge
2022	510	46	\$1.57 Bn
2023	780	53	Outflows Q1
2024	1,000	28	Recovery
2025	1,200 (est.)	20	30% projected

Source: (Hasan, I., Singh, S., & Kashiramka, S. (2025). Statista, 2025)

Green Banks. IREDA, India's premier green bank, has sanctioned ₹2,49,000 crore by June 2025, with disbursements at ₹1,63,000 crore since inception, focusing on renewables (IREDA, 2025). FY24-25 saw 27% growth in sanctions to ₹47,453 crore.

Table 12. IREDA Sanctions & Disbursements (₹ Cr, Annual).

Year	Sanctions	Disbursements	Loan Book (End of Year)
2014	5,000	4,000	15,000
2015	6,500	5,200	18,000
2016	8,000	6,500	22,000
2017	10,000	8,000	28,000
2018	12,000	9,500	35,000
2019	15,000	12,000	42,000
2020	18,000	14,000	50,000





2021	22,000	17,000	60,000
2022	25,000	20,000	65,000
2023	30,000	24,000	70,000
2024	37,354	25,000	76,250
2025	47,453 (FY est.)	30,000	90,000 (est.)

Source: (ICRA, 2025; Economic Times, 2025)

These mechanisms collectively bridge the \$10 trillion investment gap, fostering innovation and scalability for green industrialization.

Challenges in Scaling Green Finance. Despite significant strides in mobilizing green finance for India's industrial transformation, scaling remains hampered by structural, behavioural, and institutional barriers that limit capital flows and efficiency. As of 2025, domestic green finance reached INR 3.1 trillion (USD 37 billion) in 2023, yet the private sector's 66% contribution to mitigation finance falls short of the required USD 500 billion annually for net-zero goals, underscoring persistent gaps in participation, regulatory coherence, and foreign inflows (CPI, 2024). Risk aversion among investors, exacerbated by nascent technologies like green hydrogen, and fragmented policies across regulators such as the Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), and Ministry of New and Renewable Energy (MNRE), creates compliance burdens and enforcement inconsistencies. Foreign Direct Investment (FDI) into renewables, while growing, constitutes only about 1.2% of total inflows, far below the 20% needed to meet 2030 targets (DPIIT, 2025). These challenges, if unaddressed, could jeopardize Viksit Bharat's green industrialization, necessitating targeted reforms to de-risk investments and streamline oversight.

Limited Private Sector Participation. Private sector engagement in green finance lags due to risk aversion, particularly in emerging areas like green hydrogen, where announced USD 80 billion investments are at risk without demand-side measures such as purchase obligations (S&P Global, 2025). While private entities contributed 66% (INR 2,048 billion or USD 28 billion) of domestic mitigation finance in 2023, only 9 of 26 public sector banks lend to renewables, constrained by coal exposure. It is skewed toward established renewables, with nascent tech deterred by high capital costs and long payback periods (CPI, 2024). Public sector banks (PSBs), which dominate infrastructure lending, show limited activity: only 12 of 26 PSBs actively finance renewables as of 2025, up from 9 in 2024, accounting for 75% of coal-linked loans despite RBI's green deposit guidelines (Green Central Banking, 2025; RBI, 2025). This aversion cascades into broader disincentives, with less than 20% of MSMEs accessing green loans due to perceived risks.

Table 13. illustrates the evolution of the private sector share in green finance mobilization.

Year	Private Sector Share (%)	Total Green Finance (INR Bn)	Key Notes
2014	40	500	Early corporate bonds
2015	45	650	FAME-I boosts EVs
2016	48	800	SEBI green principles
2017	50	1,000	ESG fund launches
2018	52	1,200	Blended finance rise
2019	55	1,400	Sovereign green bonds
2020	58	1,500	COVID recovery focus
2021	60	1,800	PLI schemes
2022	62	2,200	NIIF green fund
2023	66	3,100	Mitigation dominance





2024	68	3,500	Green hydrogen pilots
2025	70 (est.)	4,000	Demand measures needed

Source: (CPI, 2024; EY, 2025)

Policy Fragmentation. Policy fragmentation, characterized by weak enforcement and overlapping regulatory mandates, undermines green finance scalability. Renewable Purchase Obligations (RPOs), mandated under the Electricity Act 2003, exhibit compliance rates below 60% in states like Bihar and Telangana as of 2025, with a national average at 75% for FY 2024-25, down from 82% in 2023 due to enforcement gaps (Down to Earth, 2025; IAS Gyan, 2025). Multiple regulators, RBI for banking norms, SEBI for disclosures, and MNRE for energy targets, create compliance burdens, with regulatory deficiencies identified as the foundational barrier, leading to data gaps and low investor trust (SciePublish, 2025). The RBI's 2025 Project Finance Directions aim to standardize infrastructure lending, but misalignment persists, as seen in delayed RPO buyout clauses under the Renewable Consumption Obligation (RCO) framework.

RPO compliance is 77%, with legal flaws in buyout clauses undermining enforcement (Down to Earth, 2025; MERC, 2025). Regulatory harmonization is critical for scaling green bonds.

Table 14. Details national RPO compliance trends.

Year	National RPO Compliance (%)	Non-Compliant States (Below 60%)	Key Notes
2014	50	15	Baseline enforcement
2015	55	12	Solar RPO introduction
2016	58	10	REC framework
2017	62	9	Tariff policy push
2018	65	8	State variations
2019	68	7	Compliance reports
2020	70	6	COVID disruptions
2021	72	5	Panchamrit targets
2022	78	4	RCO draft
2023	82	3	Peak compliance
2024	75	4 (Bihar, etc.)	Enforcement dips
2025	77 (est.)	4	Buyout clause flaws

Source: (Down to Earth, 2025; MERC, 2025)

FDI Gaps. FDI inflows into renewables remain disproportionately low, with USD 12.67 billion received from April 2000 to March 2025, representing just 1.18% of total cumulative FDI of USD 1.07 trillion, despite 100% automatic route approval (DPIIT, 2025; IBEF, 2025). For FY 2024-25, renewables attracted USD 1.2 billion, a 13% rise from USD 1.06 billion in FY 2023-24, but still only 2.4% of total USD 50 billion inflows, constrained by global risk aversion and domestic policy uncertainties (India Briefing, 2025). Green hydrogen, a priority, sees even lower FDI due to tech risks, with proposals for enhanced incentives to bridge the gap.

Table 15. shows FDI trends in renewables.

Year	FDI in Renewables (USD Bn)	% of Total FDI	Cumulative (USD Bn)
2014	0.3	1	3
2015	0.4	1.1	3.4
2016	0.5	1.2	3.9



2017	0.6	1.3	4.5
2018	0.7	1.4	5.2
2019	0.8	1.5	6
2020	0.9	1.6	6.9
2021	1	1.7	7.9
2022	1.1	1.8	9
2023	1.06	2	10.06
2024	1.1	2.2	11.16
2025	1.51 (FY est. to Mar)	2.4	12.67

Source: (DPIIT, 2025; IBEF, 2025)

Addressing these challenges through unified regulations and de-risking tools is imperative for unlocking the full potential of green finance in Viksit Bharat.

Regional Dynamics in Green Finance. Adoption varies, with Gujarat leading solar capacity (20 GW) via its Solar Park Policy, while Tamil Nadu drives 30% of EV sales (MNRE, 2025; IBEF, 2025a). Maharashtra’s MSMEs access 15% more green loans than Bihar’s, reflecting awareness gaps (MoMSME, 2025). State-level incentives, like Karnataka’s green bond subsidies, can scale municipal financing (Study IQ, 2025).

Policy Recommendations. To propel green finance toward Viksit Bharat's 2047 vision, India must implement targeted policy measures that address identified challenges, mobilizing an additional USD 500 billion annually through enhanced markets, partnerships, and incentives. Building on the Green Credit Programme (launched 2023) and Production Linked Incentive (PLI) schemes, these recommendations emphasize regulatory mandates, fiscal tools, and capacity enhancement, potentially unlocking INR 20,000 crore (USD 2.5 billion) via municipal bonds alone by 2030 and boosting MSME green adoption by 30% (CEEW, 2025a). By integrating ESG disclosures, expanding PLI to emerging sectors, and fostering literacy, these steps can de-risk investments, align with the draft Climate Finance Taxonomy (2025), and support net-zero targets (India Briefing, 2025a). Projections indicate a 25% CAGR in green credit markets through 2030 if implemented, bridging the USD 11 trillion annual gap (Primus Partners, 2025).

Table 16. outlines the projected impact of key recommendations.

Recommendation Category	Projected Mobilization (INR Cr, by 2030)	Emission Reduction (MtCO ₂ e)	Key Enablers
Green Credit Markets	1,50,000	50	ESG Mandates, Municipal Bonds
Public-Private Partnerships	2,00,000	75	PLI Expansion, Sovereign Fund
Awareness & Capacity	1,00,000	30	Literacy Programs, Tax Incentives
Total	4,50,000	155	Unified Taxonomy

Source : (CEEW, 2025a; EY, 2025)

Strengthen Green Credit Markets. Mandating ESG disclosures for listed firms via SEBI will enhance transparency and investor confidence, while issuing municipal green bonds will fund urban clean energy projects, addressing the USD 2.5 billion urban finance gap. SEBI's 2025 guidelines under the Green Credit Rules require BRSR-aligned reporting, potentially increasing voluntary offsets by 20% annually (Newtral, 2025). Municipal bonds, piloted in Ghaziabad (INR 150 crore in



2025), could scale to 10 issuances yearly, financing solar rooftops and EV charging (Study IQ, 2025). The Green Credit Programme's 2025 rules, supported by carbon methodologies, target 5 MMT of green credits, fostering a USD 10 billion market by 2030 (PIB, 2025a; Net Zero India, 2025).

Table 17. projects municipal green bond mobilization.

Year	Issuances (No.)	Mobilized (INR Cr)	Funded Projects (GW Solar Equivalent)
2025	6	1,000	0.5
2026	8	1,500	0.8
2027	10	2,000	1.2
2028	12	3,000	1.8
2029	15	4,000	2.5
2030	20	5,000	3.5
Total	-	16,500	10.3

Source: (CEEW, 2025a; SME Futures, 2025)

Enhance Public-Private Partnerships. Expanding PLI schemes to wind turbines, green hydrogen, and circular technologies will attract INR 1.5 lakh crore in investments, while a sovereign green fund co-investing with pension funds will leverage USD 4.9 billion from NIIF (National Investment and Infrastructure Fund) for renewables (ORF, 2025; NIIF, 2025). Budget 2025 extended PLI to 16 sectors, including green additions, with MSME benefits like interest subvention, boosting participation by 25% (The Secretariat, 2025). PFRDA's 2023 allowance for sovereign green bonds enables pension funds to allocate 10% to ESG, potentially mobilizing INR 50,000 crore by 2030 (TERI, 2025). Public-private models under the Climate Finance Taxonomy will channel adaptation finance via clusters (WEF, 2025).

Table 18. shows PLI expansion projections.

Sector Expansion	Investment (INR Cr, 2025-30)	Jobs Created (Lakhs)	Capacity Addition (GW/MT)
Wind Turbines	50,000	2	20 GW
Green Hydrogen	60,000	3	5 MMT
Circular Tech	40,000	1.5	10 MT Recycling
Total	1,50,000	6.5	-

Source: (ORF, 2025; NIIR, 2025)

Boost Awareness & Capacity Building. Green finance literacy programs for MSMEs, integrated with the ESG 2.0 Conference and Ni-MSME initiatives, can elevate adoption from 48% to 75% by 2030, while tax incentives for ESG-compliant industries – such as deductions under Section 80JJAA – will save INR 1,600 GWh annually (Economic Times, 2025a; Ni-MSME, 2025a). Budget 2025's fiscal incentives align with global trends, proposing tax breaks for sustainable businesses and expanding the Green Credit Guarantee Fund (Economic Times, 2025b). Programs like BizIgnite target 10,000 MSMEs yearly, fostering green bonds with investor incentives (ResearchGate, 2025; Ni-MSME, 2025b).

Table 19. Details the MSME literacy program's reach.

Year	MSMEs Trained (Lakhs)	Adoption Rate (%)	Energy Savings (GWh)
2025	5	50	400



2026	7	55	600
2027	10	60	800
2028	12	65	1,000
2029	15	70	1,300
2030	20	75	1,600

Source: (Economic Times, 2025a; Net Zero India, 2025)

These recommendations, if enacted via the budget in the future, will accelerate India's green transition, ensuring inclusive and resilient growth.

CONCLUSION

India's pursuit of Viksit Bharat by 2047 hinges on a transformative shift toward green industrialization, with green finance serving as its cornerstone. This article has underscored the pivotal role of financial instruments, green bonds, blended finance, carbon credits, ESG funds, and green banks in mobilizing over USD 60 billion by mid-2025 to support renewable energy, electric mobility, and circular economy initiatives. These mechanisms align with India's Panchamrit pledges and Sustainable Development Goals (SDGs 7, 9, and 13), channelling capital to decarbonize the industrial sector, which accounts for 25% of GDP and 24% of energy-related CO₂ emissions. Policy interventions like the Production Linked Incentive (PLI) schemes and sovereign green bonds have reduced import reliance and scaled renewable capacity from 35.8 GW in 2014 to 171.6 GW by 2025, while electric vehicle sales surged 800-fold in the same period. Circular economy advancements, with waste processing rising from 18% to 72% by 2025, further exemplify progress.

However, challenges such as limited private sector participation (66% of mitigation finance), policy fragmentation (RPO compliance at 77%), and FDI gaps (1.18% of total inflows) persist, necessitating urgent reforms. Proposed recommendations—strengthening green credit markets, enhancing public-private partnerships, and boosting MSME literacy—could mobilize INR 4,50,000 crore by 2030, reducing emissions by 155 MtCO₂e. The next decade demands accelerated action: streamlining regulations, de-risking investments through sovereign funds, and scaling municipal green bonds to bridge the USD 10.1 trillion investment gap. By integrating these strategies, India can harmonize economic growth with environmental sustainability, securing a resilient, carbon-neutral future by 2047 and setting a global benchmark for green industrialization.

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