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Green Taxation under GST 2.0: Incentivising Renewable Energy and Circular Economy Enterprises

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Abstract: *Purpose: This paper examines how India's GST 2.0 reform treats renewable energy and circular economy enterprises, and identifies the frictions in input tax credit (ITC), rate structure, refunds and compliance that weaken the fiscal signal for green investment.*
Methodology: The study combines a doctrinal analysis of the CGST Act, the Finance Act 2025, rate notifications and key judicial and advance-ruling decisions; stylised cost arithmetic on credit denial, composite rates and inverted duty; a comparative review of Germany's zero-rating of photovoltaic systems and China's refund-based support for resource recycling; and a synthesis of OECD, World Bank, NITI Aayog and peer-reviewed literature. It is a secondary, document-based study and does not use primary survey data.
Findings: Five findings emerge: (1) ITC eligibility for renewable assets remains contested and was narrowed by the Finance Act 2025; (2) the cut to 5 per cent on renewable devices leaves a residual rate mismatch and exposure to inverted duty; (3) compliance costs fall disproportionately on small firms, and refund claims, the statutory remedy for inversion, are associated with markedly higher compliance cost; (4) GST draws no distinction between virgin and recycled materials, weakening circular business models; and (5) fiscal instruments have lagged India's physical renewable build-out. Drawing on public-finance principles, the paper argues that reforms restoring VAT neutrality should precede concessional rates.
Practical implications: A sequenced reform package is proposed, specifying the legal instrument, qualitative fiscal effect, administrative risk and phasing of each measure, together with the constraints imposed by GST Council consensus, revenue sharing and the risk of greenwashing.
value: The paper applies a green-taxation lens to GST 2.0, which has so far been discussed mainly in terms of rate rationalisation and MSME compliance, and links Indian doctrine on ITC to comparative evidence and to the VAT-neutrality literature..

Keywords: GST 2.0, Green Taxation, Input Tax Credit, Circular Economy, Renewable Energy, MSMEs

I. INTRODUCTION

Goods and Services Tax (GST), introduced in India on 1 July 2017, replaced a fragmented indirect tax structure of excise duty, value-added tax, service tax and entry tax with a unified "One Nation, One Tax" framework administered jointly by the Union and the States (Press Information Bureau [PIB], 2026). Eight years into implementation, the GST Council approved a landmark rationalisation popularly termed GST 2.0 at its 56th meeting on 3 September 2025, collapsing the main four-slab structure of 5, 12, 18 and 28 per cent into a simplified two-slab regime of 5 and 18 per

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cent, with a residual 40 per cent rate reserved for luxury and 'sin' goods, effective 22 September 2025 (PIB, 2025; Ministry of Finance, 2025).

This reform, framed around structural simplification, rate rationalisation and ease of doing business, arrives at a moment when India's green economy transition has become a fiscal as well as an environmental imperative. A tax system does not merely raise revenue; it signals what a government wants an economy to produce more of and less of. For renewable energy developers, waste-recycling enterprises and other circular economy ventures, the signal sent by the pre-2.0 GST framework has been mixed at best. Green capital goods such as solar power plants have been drawn into disputes over whether they constitute 'immovable property' for the purposes of Input Tax Credit (ITC) (Chief Commissioner v. Safari Retreats, 2024; Authority for Advance Ruling, Gujarat, 2024; Authority for Advance Ruling, Kerala, 2025); the introduction of GST itself raised the estimated generation cost of new solar power by almost 6 per cent while lowering the variable cost of existing coal-fired power (Beaton et al., 2019); components of the same renewable energy value chain are taxed at different rates, creating an inverted duty structure (PIB, 2025); and the compliance load imposed on small enterprises the primary vehicle for green entrepreneurship in India remains high relative to firm size, a pattern consistent with the international finding that compliance costs fall disproportionately on small firms (Eichfelder & Vaillancourt, 2014), and a concern that simplification measures such as quarterly return filing have sought to address (PIB, 2026).

In this paper, 'enterprises' means firms engaged in renewable energy generation and equipment supply and in recycling, remanufacturing and other circular activities, with particular attention to start-ups and micro, small and medium enterprises (MSMEs), which are most exposed to capital-cost and working-capital frictions. The available evidence on GST is stronger for MSMEs in general than for start-ups specifically, a limitation discussed in Section IV-J.

A. Research Gap

The literature on GST in India is extensive on questions of revenue neutrality, compliance cost and MSME formalisation, and a growing literature separately addresses environmental taxation principles articulated by the OECD and the World Bank (OECD, 2001, 2021; World Bank, 2024). However, three gaps remain under-addressed. First, the current GST framework offers no differential rate structure or green-certification-linked incentive for environmentally innovative firms, treating a solar EPC contractor and a conventional construction firm alike for the purposes of Section 17(5)(d) of the CGST Act (Central Goods and Services Tax Act, 2017). Second, policy coherence across the MSME, start-up and environment ministries remains limited, so that green fiscal incentives designed under schemes such as the Green Hydrogen Mission or the Production Linked Incentive schemes are not mirrored in GST design. Third, the integration of OECD green tax principles in particular the polluter-pays and double-dividend rationales for environmentally related taxes into Indian indirect tax law remains at an early stage (OECD, 2001, 2021; Bovenberg & de Mooij, 1994; Goulder, 1995). This paper addresses these gaps by examining GST 2.0 specifically through a green taxation lens, rather than through the general MSME-compliance or revenue-rationalisation lenses that dominate existing commentary.

B. Research Questions and Contribution

The study addresses three research questions:

RQ1. To what extent do ITC restrictions, the rate structure and compliance rules under GST, including GST 2.0, raise capital cost and lock up working capital for renewable energy and circular economy enterprises?

RQ2. How do these GST design choices compare with the VAT instruments that Germany and China use for renewable energy and recycling, and what do VAT-neutrality and green-tax principles imply for the choice of instrument?

RQ3. Which reforms, through which legal instruments, would strengthen the fiscal signal to green enterprises while respecting the revenue, administrative and federal-consensus constraints of GST?

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The paper contributes in three ways. First, it applies a green-taxation lens to GST 2.0, which has been discussed mainly in terms of rate rationalisation and MSME compliance. Second, it combines doctrinal analysis of ITC rulings with stylised cost arithmetic and comparative evidence, so that the legal and economic arguments can be assessed together. Third, it translates the analysis into a sequenced reform roadmap with explicit legal instruments, and relates the proposals to SDG 7 (Affordable and Clean Energy), SDG 13 (Climate Action) (United Nations, 2015) and the Viksit Bharat 2047 goals.

II. METHODOLOGY

The study adopts a qualitative, doctrinal-comparative design supplemented by stylised quantitative illustration, appropriate to a policy-evaluation exercise at the intersection of tax law and environmental economics. It has four components: (i) a doctrinal analysis of the statutory provisions, notifications and judicial and advance-ruling decisions governing ITC and rates for renewable energy and recycling; (ii) stylised cost arithmetic that quantifies the effect of credit denial, composite rates and inverted duty under stated assumptions; (iii) a comparative analysis of Germany and China; and (iv) a synthesis of policy documents and the scholarly literature. Data were drawn from six categories of sources:

NITI Aayog and ministry reports: policy documents on the circular economy and the energy transition issued by NITI Aayog and the Ministry of Power (NITI Aayog, 2026; Ministry of Power, 2025);

OECD guidelines: foundational and current guidance on environmentally related taxes, energy taxation and pollution pricing (OECD, 2001, 2019, 2021);

World Bank reports: carbon-pricing benchmarking and green-transition studies (World Bank, 2024);

Scholarly and research literature: peer-reviewed journal articles, books and institutional research reports on environmental taxation, VAT design, compliance costs, clean-technology innovation, circular economy policy and Indian GST (Bovenberg & de Mooij, 1994; Goulder, 1995; Porter & van der Linde, 1995; Jaffe et al., 2005; Ebrill et al., 2001; Keen, 2013; Hepburn, 2006; Gillingham & Stock, 2018; Eichfelder & Vaillancourt, 2014; Kirchherr et al., 2017; Geissdoerfer et al., 2017; Ghisellini et al., 2016; Milios, 2018; Sureka, 2024; Vishnuhadevi & Hima Bindu, 2022; Beaton et al., 2019; CSE, 2025);

GST Council, statutory and comparative legal materials: existing GST rate schedules, ITC provisions, AAR rulings, judicial decisions, the recommendations of the 56th GST Council meeting, and the German and Chinese VAT provisions analysed in Section IV-F (Central Goods and Services Tax Act, 2017; Finance Act, 2025; Ministry of Finance, 2025; Chief Commissioner v. Safari Retreats, 2024; Authority for Advance Ruling, Gujarat, 2024; Authority for Advance Ruling, Kerala, 2025);

UN SDG framework: India's Nationally Determined Contribution and associated SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action) alignment metrics (UNFCCC, 2022; United Nations, 2015).

Doctrinal analysis proceeded by identifying the operative provisions (CGST Act, ss. 9, 17(2), 17(5)(d), 54(3) and 103; Finance Act, 2025), then the decisions interpreting them, and coding each decision for the asset, its use, the holding on ITC and the test applied (Table 1). The decisions analysed are those identified in the secondary sources reviewed and should be read as an illustrative sample and not an exhaustive survey. The cost arithmetic (Tables 2 and 3) uses statutory rates from Notification No. 9/2025, Central Tax (Rate) and explicitly stated assumptions; it is illustrative and not an empirical estimate. Germany and China were selected as contrasting designs a rate-based instrument for a clean-energy asset and a refund-based instrument for recycling, operating within credit-invoice VAT systems comparable to India's. Findings were triangulated across these sources and organised thematically into five key findings, from which policy recommendations were derived using a comparative benchmarking approach against OECD and World Bank green-tax design principles (OECD, 2001, 2021; World Bank, 2024). To limit confirmation bias, each legal proposition is tied to a primary source and each empirical claim to a peer-reviewed or institutional publication. As a secondary, document-based study, the analysis generates no primary survey data; its contribution lies in synthesising dispersed

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statutory, regulatory and policy material into a single green-taxation assessment of GST 2.0, and in specifying how the proposals would be implemented.

III. LITERATURE REVIEW

A. Environmental taxation and instrument choice

Environmental or 'green' taxation rests on the Pigouvian logic that prices should reflect the full social cost of production and consumption, including externalities such as carbon emissions and resource depletion (Pigou, 1920). The OECD's foundational work on environmentally related taxes catalogued how member countries used tax differentiation lower rates on cleaner substitutes, higher rates on polluting inputs to internalise environmental costs without necessarily raising the overall tax burden, a principle later extended into its guidance on taxing energy use for sustainable development (OECD, 2001, 2019, 2021). The 'double dividend' debate, which asks whether green taxes can both improve the environment and reduce distortions elsewhere in the tax system, has qualified the more optimistic claims made for such reforms (Bovenberg & de Mooij, 1994; Goulder, 1995). The World Bank's recurring assessment of carbon pricing instruments globally similarly documents the continued expansion of carbon taxes and emissions trading schemes, instruments that operate alongside rather than in place of general consumption taxes (World Bank, 2024). Innovation economics adds a further rationale for differentiated treatment of clean-technology firms: because they face both a pollution externality and the under-provision of knowledge spillovers, environmental pricing alone under-supports them (Jaffe et al., 2005), even as well-designed environmental policy can stimulate innovation offsets (Porter & van der Linde, 1995).

Instrument choice is itself contested. Price-based instruments, regulation and subsidies differ in cost-effectiveness depending on uncertainty, administrative capacity and context (Hepburn, 2006; Sterner, 2003), and empirical assessments find that the cost per tonne of emissions abated varies widely across climate policies (Gillingham & Stock, 2018). This matters for GST, which is a general consumption tax and not a purpose-built environmental instrument.

B. VAT design, neutrality and green goods

The VAT literature provides a second pillar. A well-designed VAT taxes final consumption and is neutral towards production decisions because input tax is creditable; departures from this principle reduced rates, exemptions and blocked credits are generally treated as sources of distortion, classification disputes and administrative cost (Ebrill et al., 2001; Keen, 2013). Reduced rates in particular are widely regarded as a poor instrument for distributional objectives, because the benefit leaks to those who do not need it (Ebrill et al., 2001).

This creates a tension for green taxation under GST that the present paper takes seriously. The strongest case for intervention is for measures that restore neutrality credit, and where credit cannot be used, refund of tax on green capital inputs whereas concessional rates need a stronger justification, namely the innovation externality discussed above, and carry higher distortion and revenue costs.

C. GST in India: credit, compliance and energy

Within India, GST scholarship has largely concentrated on three themes: the compliance burden imposed on MSMEs, classification disputes arising from multiple tax slabs, and the treatment of Input Tax Credit for capital-intensive sectors. GST is a dual, destination-based VAT whose design rests on a seamless credit chain (Rao, 2019), and the public-finance literature stresses that full creditability of input tax is what keeps such a tax neutral with respect to production, so that blocked credits reintroduce cascading into the cost of capital goods (Keen, 2013). Survey evidence from Indian MSMEs finds that blocked credits and uncertainty about ITC eligibility are significant obstacles (Sureka, 2024), and a survey of GST-registered firms in Tamil Nadu finds compliance costs to be strongly regressive in firm size (Vishnuhadevi & Hima Bindu, 2022). Research on the energy sector shows why this matters for green investment: the IISD, CEEW assessment found that the move to GST raised the cost of generation for new solar PV by almost 6 per cent while reducing the variable cost of existing coal-fired power by 1.6 per cent, and concluded that the reform

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introduced a relative bias in favour of coal (Beaton et al., 2019). Sector-specific litigation has centred on whether solar installations qualify as 'plant and machinery' (eligible for ITC) or as 'immovable property' constructed on own account under Section 17(5)(d). More recent rulings, including a Kerala AAR decision on rooftop solar used for common-area maintenance, have begun to narrow this ambiguity in favour of the taxpayer where installations can be dismantled without substantial damage (Authority for Advance Ruling, Kerala, 2025) echoing the functionality test endorsed by the Supreme Court in Safari Retreats (Chief Commissioner v. Safari Retreats, 2024) but the underlying statutory ambiguity persists at the national level, particularly after the Finance Act, 2025 retrospectively replaced 'plant or machinery' with 'plant and machinery' in Section 17(5)(d) (Finance Act, 2025).

D. Circular economy and fiscal policy

On the circular economy, the academic literature has moved from definitional debates (Kirchherr et al., 2017; Geissdoerfer et al., 2017; Ghisellini et al., 2016) towards the design of policy instruments, with Milios (2018) arguing for a comprehensive policy mix rather than isolated measures, while critical work cautions that circularity has conceptual and physical limits (Korhonen et al., 2018). In India, NITI Aayog has positioned resource efficiency as a growth strategy rather than solely a compliance obligation, and its sector-specific work on waste tyres situates circularity within the Viksit Bharat 2047 vision and the Extended Producer Responsibility (EPR) framework (NITI Aayog, 2026). Empirical work by the Centre for Science and Environment finds that the GST structure draws no distinction between virgin and recycled materials, which disadvantages formal recyclers, and recommends linking GST relief to verified recycling (Centre for Science and Environment [CSE], 2025). At the same time, India's renewable energy capacity build-out has itself accelerated: the country reached 50 per cent of cumulative installed electricity capacity from non-fossil sources in June 2025, five years ahead of its Nationally Determined Contribution (NDC) target date of 2030 (Ministry of Power, 2025). What remains comparatively under-examined in this literature is whether the fiscal instrument most directly touching day-to-day enterprise activity GST has kept pace with this physical and policy momentum. This paper positions itself at that intersection.

E. Conceptual framework

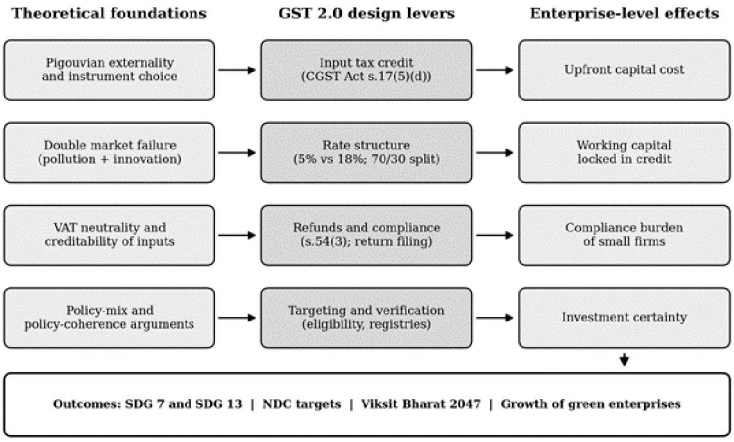


Figure 1. Conceptual framework linking green-tax theory, GST design levers and enterprise outcomes (authors' framework).

Figure 1 integrates these strands. Green-tax theory (externality, double market failure) explains why intervention may be warranted; VAT theory explains which GST features are neutral and which distort; and the policy-mix literature explains why GST measures must be coherent with other instruments. The framework maps four GST design levers credit, rates, refunds and compliance, and targeting onto four enterprise-level effects (capital cost, working capital,

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compliance burden and investment certainty), which in turn condition the contribution of enterprises to SDG 7, SDG 13, India's NDC and Viksit Bharat 2047 (United Nations, 2015; UNFCCC, 2022). The findings in Section IV are organised around these levers.

IV. RESULTS AND DISCUSSION

A. Finding 1: ITC Denial on Green Inputs

Section 17(5)(d) of the CGST Act, 2017 blocks Input Tax Credit on goods and services used for the construction of immovable property on one's own account (Central Goods and Services Tax Act, 2017). Where a solar power plant is treated as immovable property, ITC is therefore denied on the inputs, capital goods and services used in its construction, which runs against the neutrality rationale of the credit mechanism (Keen, 2013). Survey evidence from Indian MSMEs likewise identifies blocked credits as a significant obstacle (Sureka, 2024). Because electricity is itself exempt from GST (Ministry of Finance, 2017), the credit question arises most sharply for captive users and for businesses that put solar plants to use in making taxable supplies. The denial raises the upfront capital cost of renewable energy projects precisely at the stage project finance and construction where green start-ups are most cash-constrained. It is notable that more recent rulings, including decisions of the Gujarat and Kerala AARs, have taken a more favourable view where installations can be dismantled without substantial damage, treating rooftop solar plants as 'plant and machinery' rather than immovable property and thereby permitting ITC (Authority for Advance Ruling, Gujarat, 2024; Authority for Advance Ruling, Kerala, 2025). The position is nevertheless unsettled: the Supreme Court's functionality test in Safari Retreats (Chief Commissioner v. Safari Retreats, 2024) was followed by the Finance Act, 2025, which with effect from 1 July 2017 replaced 'plant or machinery' with 'plant and machinery' in Section 17(5)(d), tying the clause back to the Explanation to Section 17 that excludes land, buildings and other civil structures (Finance Act, 2025). The resulting inconsistency across jurisdictions and fact patterns leaves renewable energy developers unable to underwrite ITC eligibility with confidence at the project-appraisal stage, itself a deterrent to investment. Table 1 summarises the principal developments.

Table 1. Selected judicial and legislative developments on ITC for solar and similar assets

Decision	Forum and date	Asset and use	Treatment of ITC	Test or reasoning
Chief Commissioner v. Safari Retreats	Supreme Court of India, 3 October 2024	Interpretation of Section 17(5)(d) generally; relevant to renewable assets by analogy	Functionality test applied to 'plant or machinery'	Substantive function of the asset, not its legal classification as immovable property
AAR Gujarat (Unique Welding Products)	Authority for Advance Ruling, Gujarat; January 2024	Rooftop solar plant used captively in a manufacturing unit	ITC allowed	Plant and machinery, not immovable property, because not permanently fastened to the building
AAR Kerala (Grand Centre Mall)	Authority for Advance Ruling, Kerala; 19 May 2025	Rooftop solar plant serving common-area maintenance services of a mall	ITC allowed	Installation can be dismantled without substantial damage
Finance Act, 2025	Parliament; effective retrospectively from 1 July 2017	All assets within Section 17(5)(d)	'Plant or machinery' replaced by 'plant and machinery'	Ties the clause to the Explanation to Section 17; narrows the functionality reading

Source: authors' compilation from the decisions and statutes cited. The set is illustrative and not exhaustive.

Three features stand out. First, outcomes turn on the physical and functional characteristics of the installation (fastening, dismantlability, use), which are fact-intensive and hard to underwrite before a project is financed. Second,

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favourable advance rulings bind only the applicant and the concerned authorities (Central Goods and Services Tax Act, 2017), so they cannot provide sector-wide certainty. Third, the Finance Act, 2025 amendment moved in the opposite direction from the functionality test, so the legal position for a developer in another jurisdiction or with a different installation remains open.

B. Finding 2: Rate Mismatch Locks Working Capital

Until 21 September 2025, renewable energy devices and their parts, including solar modules, attracted GST at 12 per cent; the 56th GST Council recommended a reduction to the merit rate of 5 per cent from 22 September 2025 (PIB, 2025), which was given effect by Notification No. 9/2025, Central Tax (Rate) (Ministry of Finance, 2025). The cut lowers project capital cost, but it also sharpens a rate mismatch along the value chain: the 5 per cent entry covers notified renewable energy devices and parts for their manufacture, whereas goods and services falling outside it continue to attract the standard 18 per cent, and solar contracts that combine goods with taxable services are split, with the value of the goods deemed to be 70 per cent of the contract (Ministry of Finance, 2025; Beaton et al., 2019). Where a manufacturer's output is taxed at 5 per cent while its inputs bear 18 per cent, the result is a textbook inverted duty structure. Unutilised credit can be recovered only through a refund claim under Section 54(3) of the CGST Act, and that route is confined to inverted rates and does not extend to nil-rated or fully exempt outward supplies (Central Goods and Services Tax Act, 2017). Working capital therefore becomes trapped in refund claims rather than being available for reinvestment, a burden that falls hardest on start-ups without deep balance sheets; correcting inverted duty structures was itself an avowed objective of GST 2.0 (PIB, 2026).

Tables 2 and 3 quantify these effects under stated assumptions. They illustrate the arithmetic of the tax and are not empirical estimates for any project or firm.

Table 2. Composite GST on a turnkey solar contract (per □100 of contract value)

Case	Computation	GST (□)
Before 22 September 2025	0.70 × 12% + 0.30 × 18%	13.80
From 22 September 2025 (GST 2.0)	0.70 × 5% + 0.30 × 18%	8.90
Reduction due to GST 2.0	13.80 − 8.90	4.90

Notes: Assumes the contract falls within the 70 per cent goods-value rule applicable to the notified renewable-device entry, with the remainder taxed as services at 18 per cent (Ministry of Finance, 2025; Beaton et al., 2019). Where ITC is available to a user making taxable supplies, this tax is recovered and is neutral; where ITC is blocked under Section 17(5)(d), the full □8.90 becomes a cost, an uplift of 8.9 per cent on the pre-tax contract value.

Table 3. Credit accumulation for a manufacturer with 5% output tax and 18% input tax (per □100 of pre-tax sales)

Inputs taxed at 18% (□)	Input GST (□)	Output GST at 5% (□)	Credit accumulated (□)
30	5.40	5.00	0.40
50	9.00	5.00	4.00
70	12.60	5.00	7.60

Notes: Assumes all inputs bear 18 per cent GST and output is taxed at 5 per cent. Inversion begins when 18 per cent-rated inputs exceed 5/18, or about 27.8 per cent, of the pre-tax sales value. Accumulated credit can be recovered only through a refund claim under Section 54(3) (Central Goods and Services Tax Act, 2017). If the credit at the 70 per cent input share were recovered after 90 days and financed at an assumed 10 per cent a year, the carrying cost would be about □0.19 per □100 of sales (7.60 × 0.10 × 90/365).

The arithmetic yields two insights. First, GST 2.0 reduced but did not remove the cost of credit denial: on a notional 70/30 turnkey contract the embedded tax fell from □13.80 to □8.90 per □100, which remains a material uplift where credit is blocked. Second, inversion arises as soon as inputs taxed at 18 per cent exceed roughly 28 per cent of sales

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value, a threshold that manufacturers who assemble components may plausibly cross, so trapped credit can become a liquidity constraint for small firms with thin balance sheets and not merely an interest cost.

C. Finding 3: Heavy Compliance Burden on MSMEs

Evidence on GST compliance costs is consistent with the international literature. A survey of 247 GST-registered firms in Tamil Nadu (2019, 20) found mean compliance costs, internal and external, of about 1.45 per cent of annual turnover for firms with turnover up to □4 million, against about 0.02 per cent for the largest firms, and found that firms with refund claims incurred roughly twice the compliance cost of firms without them (mean □74,078 against □33,732) (Vishnuhadevi & Hima Bindu, 2022). The second result bears directly on this paper, because a refund claim is the only statutory remedy for the inverted duty exposure discussed in Finding 2. The study is not specific to green enterprises, but the regressive pattern is consistent with the broader literature (Eichfelder & Vaillancourt, 2014). Over the same period in which the GST taxpayer base expanded from roughly 66.5 lakh registrants in 2017 to about 1.65 crore in May 2026 (PIB, 2026), green start-ups filing close to 25 returns a year (twelve each of GSTR-1 and GSTR-3B, plus an annual return) have absorbed a compliance load disproportionate to their scale. The quarterly return filing and monthly payment (QRMP) scheme for taxpayers with turnover of up to □5 crore, and the three-working-day registration route for low-risk applicants, have eased this load (PIB, 2026), but it remains material for early-stage ventures. For an early-stage renewable energy or circular economy venture, this represents a direct productivity drag that competes with product development and market-building for scarce founder time.

D. Finding 4: India's Circular Economy Potential Remains Untapped

India's circular economy is widely regarded as a large growth opportunity, yet circular business models are not scaling on their own: globally, the share of secondary materials in the economy fell from 9.1 per cent in 2018 to 7.2 per cent in 2023 (Circle Economy & Deloitte, 2024). Research by the Centre for Science and Environment finds that the GST structure makes no distinction between virgin and recycled materials, and that rationalising GST on industrial waste could turn a projected business-as-usual fiscal loss from the sector into a net revenue gain (CSE, 2025); the wider literature likewise argues that circular transitions need a policy mix in which fiscal instruments are aligned with regulation (Milios, 2018). The absence of green tax incentives concessional rates for recycled-content goods, extended producer responsibility-linked credits, or GST relief for refurbishment and remanufacturing services suppresses adoption of circular business models. NITI Aayog's sector-specific work on waste tyres makes clear that the policy architecture for circularity is being built; the report notes that recycled products from end-of-life tyres attract GST at 18 per cent, recommends that the Ministry of Environment, Forest and Climate Change and the Ministry of Finance review the rate (formal recyclers have called for a cut to 5 per cent), and proposes separate HSN codes for crumb rubber and micronised rubber powder (NITI Aayog, 2026). The corresponding fiscal architecture under GST has yet to catch up.

E. Finding 5: SDG and NDC Alignment Gap

India's updated Nationally Determined Contribution commits it to about 50 per cent of cumulative installed electric power capacity from non-fossil sources by 2030 (UNFCCC, 2022), while the headline target of 500 GW of non-fossil capacity by 2030 was announced by the Prime Minister at COP26 in 2021. Progress has in fact been faster than anticipated: India reached the 50 per cent non-fossil share of cumulative installed capacity in June 2025, five years ahead of schedule (Ministry of Power, 2025). This is a material update on the base-year figures used in early SDG 7 tracking exercises, and it strengthens rather than weakens the case made here: physical capacity has outpaced the fiscal instruments designed to support it. GST 2.0 therefore arrives at a moment when the tax system's alignment with SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action) (United Nations, 2015) is not a distant aspiration but an immediately actionable design choice.

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F. International Comparison: Germany and China

Comparative evidence helps assess whether the reforms proposed in Section IV-G are administrable within a credit-invoice VAT. Germany and China illustrate two contrasting designs: zero-rating of a defined clean-energy asset bundle, and refund-based support for resource recycling. Their institutional settings differ from India's, so the comparison is used to extract design lessons and not to claim that either model can be transplanted (Ranta et al., 2018).

1) Germany: zero-rating of photovoltaic systems. From 1 January 2023, Germany applies a zero rate of VAT to the supply and installation of photovoltaic systems, including their essential components and electricity storage, when the supply is made to the operator of a system installed on or near residential buildings or public and other buildings used for common-good activities (UStG, § 12(3)). Two design features are relevant to India. First, zero-rating differs from exemption: the supplier remains entitled to recover input tax, so the credit chain is not broken (Ebrill et al., 2001). Second, the zero rate covers the goods, the installation service and the main components as a bundle, so no split between goods and services at different rates arises; this contrasts with the 70/30 rule in India (Table 2). The measure is also conditioned by location and operator, which narrows its scope and therefore its fiscal cost.

2) China: refund-based support for resource recycling. China supports recycling mainly through refunds and not through lower statutory rates. Under Cai Shui [2015] No. 78, taxpayers selling products and services generated from the comprehensive utilisation of resources could claim a refund of VAT immediately after payment, at percentages set product by product in an attached catalogue (MoF, STA, 2015). Since 1 March 2022, MoF, STA Announcement No. 40 of 2021 has replaced that Circular and also allows VAT-registered recyclers of recovered resources to choose a simplified levy at 3 per cent instead of ordinary credit-based computation (MoF, STA, 2021). Two features are relevant to India. First, the benefit is tied to catalogued product categories and technical conditions, which addresses the targeting problem that concessional rates create. Second, the simplified-levy option can be read as a response to the weak invoice trail of collection from informal suppliers, a problem that CSE also documents for Indian waste streams (CSE, 2025).

Table 4. Comparison of GST/VAT instruments for renewable energy and recycling

Feature	India (GST 2.0)	Germany	China
Main instrument	5% GST on notified renewable devices and parts; services at 18%	0% VAT on PV systems, components, storage and installation (UStG § 12(3))	VAT refund after payment on catalogued resource-utilisation products; optional 3% simplified levy for recyclers of recovered resources
Bundled supplies	70% of contract value deemed goods and 30% services (Table 2)	Bundle zero-rated as a whole	Product- or service-specific catalogue entries
Credit chain	Output at 5% against inputs at 18% can invert; Section 17(5)(d) may block credit on immovable assets	Zero rating preserves supplier input-tax recovery	Refund compensates for tax paid; simplified levy forgoes input credit
Targeting	Entry in the rate schedule; no link to certification	Location and operator conditions	Catalogue conditions; refund percentage varies by product
Design lesson for India	Align rates along the value chain and fix the credit chain	Treat the asset bundle uniformly with narrow eligibility	Link relief to verified recycling activity

Source: authors' analysis of the provisions cited in Sections IV-A and 6.

3) Lessons and limits of transfer. Three lessons follow. Treating the asset bundle uniformly removes the goods, services rate mismatch that Table 2 illustrates; tying relief to verified activity, as in China, answers the targeting and

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greenwashing objections discussed in Section IV-H; and narrow eligibility conditions, as in Germany, contain fiscal cost. At the same time, India's dual federal GST, the dominance of informal operators in waste streams and the need for GST Council consensus mean that these designs would need adaptation and not simple adoption.

G. Discussion and Policy Recommendations

GST 2.0 offers a near-term fiscal lever for embedding environmental accountability into business incentives, consistent with the Viksit Bharat 2047 agenda. Building on the findings above, the comparative evidence in Section IV-F and OECD and World Bank green-tax design principles (OECD, 2001; OECD, 2021; World Bank, 2024), three recommendations follow, sequenced so that neutrality-restoring reforms precede concessional rates (Section 7.4).

1) Restore Input Tax Credit on Green Capital Goods. The Central Board of Indirect Taxes and Customs, or the GST Council through clarificatory notification, should resolve the movable/immovable classification ambiguity under Section 17(5)(d) by codifying rather than leaving to case-by-case AAR adjudication the treatment of solar power plants, wind installations, waste-to-energy plants and similar renewable assets (including their foundations and structural supports) as 'plant and machinery' eligible for ITC on inputs, capital goods and services, subject to the apportionment rules of Section 17(2) where the asset is used for exempt supplies such as electricity (Central Goods and Services Tax Act, 2017; Ministry of Finance, 2017). Such a clarification would be consistent with the direction already taken by recent AAR rulings (Authority for Advance Ruling, Gujarat, 2024; Authority for Advance Ruling, Kerala, 2025) and would address the narrowing of clause (d) by the Finance Act, 2025 (Finance Act, 2025).

2) Align Rates and Introduce Targeted Concessional Rates. A rate structure that aligns balance-of-system components (such as mounting structures and battery storage) and installation services with the merit rate of 5 per cent now applied to solar modules and other notified renewable energy devices (PIB, 2025) would remove the inverted duty exposure identified in Finding 2; the German treatment of the photovoltaic system, its components and installation as a single zero-rated bundle shows that this is administrable (UStG, § 12(3)). Beyond renewable energy, concessional or zero-rated categories for certified green goods and services recycled-content products, remanufactured goods, extended producer responsibility services would extend the same logic to circular economy enterprises, mirroring the differentiated-rate approach the OECD documents across member countries (OECD, 2001, 2019), and would echo the review of GST on recycled tyre products recommended by NITI Aayog (NITI Aayog, 2026) and the proposal to link GST relief to verified recycling (CSE, 2025). China's design shows how relief can be tied to verified recycling activity and not to a statutory rate alone (MoF, STA, 2021). Differentiated treatment of early-stage clean technologies is also consistent with the dual market-failure argument for supporting such firms (Jaffe et al., 2005), but, as Section IV-H explains, concessional rates should be narrow and time-limited.

3) Harmonise GST with MSME, Start-up and Climate Policy. Green fiscal incentives are currently distributed across the Ministry of New and Renewable Energy, the Ministry of Environment, Forest and Climate Change, and MSME-specific schemes, with limited cross-referencing into GST design. A formal coordination mechanism for instance, a green-certification registry maintained jointly by MNRE/MoEFCC and the GST Network, against which differential rates and restored ITC could be verified would harmonise GST reform with MSME policy, start-up initiatives and India's NDC commitments under the Paris Agreement (UNFCCC, 2022), closing the policy-coherence gap identified in Section I-A.

Collectively, these three measures would convert GST 2.0 from a rate-simplification exercise into a genuine green-taxation instrument: one that reduces the cost burden on circular economy start-ups, offers predictability to renewable energy investors, and positions India's indirect tax system as an active contributor to rather than a passive bystander to its climate commitments.

H. Is GST the Right Instrument? Counter-arguments and Constraints

The recommendations above face four objections. The first is VAT neutrality. The VAT literature treats differentiated rates as blunt and distortionary and favours few rates (Ebrill et al., 2001; Keen, 2013), and the rationale of GST 2.0 was

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itself to reduce slabs and disputes (PIB, 2025). The response proposed here is sequencing: reforms that restore neutrality clarified ITC for green capital goods, faster refund of credit accumulated on green inputs and alignment of rates along the solar value chain are consistent with VAT principles and should come first, whereas concessional rates should be confined to narrowly defined, verifiable categories and reviewed after a fixed period.

The second objection concerns instrument choice. Subsidies, accelerated depreciation, concessional finance or production-linked incentives may be better targeted than a consumption tax, and the cost per tonne of abatement differs widely across policies (Gillingham & Stock, 2018; Hepburn, 2006). GST measures should therefore complement and not replace these instruments, and their coherence with them is the purpose of Recommendation 3 of Section IV-G.

The third objection concerns revenue and federalism. GST revenue is shared between the Union and the States, so rate concessions impose costs on both, and decisions of the GST Council require a three-fourths weighted majority in which the Union holds one-third of the votes (Constitution of India, art. 279A). Scenario-based work by the CSE suggests that rationalising GST on industrial waste could improve revenue by formalising transactions (CSE, 2025), but this is a modelled scenario and not an observed outcome, so the fiscal effects in Table 5 are stated qualitatively.

The fourth objection is administrative and concerns greenwashing. A new certification registry could invite misclassification and fraud. To limit this, eligibility should rely on existing verifiable registries such as the approved lists maintained for renewable devices and the registrations maintained under extended producer responsibility rules integrated with the GST Network, with audit sampling and sunset clauses.

I. Implementation Roadmap

Table 5 translates the recommendations into legal instruments, qualitative fiscal effects, administrative risks and phasing.

Table 5. Implementation roadmap

Reform	Legal instrument	Fiscal effect	Administrative risk	Phasing
Clarify ITC on renewable and recycling plant used for taxable supplies	Amendment to Section 17(5)(d) and the Explanation to Section 17 through the Finance Bill; interim CBIC circular	Low: mainly timing and neutrality	Medium: definitional disputes over 'plant'	Next Finance Bill
Credit or refund route for exempt renewable generators	Council recommendation; amendment to Sections 17(2) and 54	Moderate to high: new refund outflow	Medium to high: valuation and fraud	Pilot after review; medium term
Align rates on balance-of-system components and services with the 5% entry	Council recommendation; rate notification under Section 9(1)	Low to moderate: revenue forgone on aligned items	Low	Next Council meeting
Faster refund of accumulated credit for green enterprises	CBIC circular; automated processing for registered green enterprises	Neutral (timing)	Low	Near term
Differentiated treatment of recycled-content goods and verified recycling services	Council recommendation; notification with eligibility conditions and sunset clause	Uncertain: scenario-dependent (CSE, 2025)	High: classification and leakage	Pilot for two or three waste streams, then review

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Reform	Legal instrument	Fiscal effect	Administrative risk	Phasing
Verification registry linked to the GST Network	Administrative integration of existing renewable-device and EPR registries; no new statute	Negligible	Medium: data quality	Medium term

Notes: Fiscal effects and administrative risks are the authors' qualitative judgements and not model estimates.

J. Limitations and Future Research

This study has six limitations. First, GST 2.0 took effect on 22 September 2025, so outcome data on investment, prices and revenue are not yet available in published datasets and the analysis is necessarily ex ante. Second, the doctrinal sample is small: it comprises one Supreme Court decision, two advance rulings and one statutory amendment, and advance rulings bind only the applicant. A systematic dataset of appellate-authority and High Court decisions on renewable and recycling assets should be compiled. Third, the cost arithmetic in Tables 2 and 3 uses assumed input shares and a single financing rate; project-level cost data from developers and manufacturers would allow empirical estimation. Fourth, the study uses no primary data. Structured interviews with start-up founders, project developers and tax practitioners, or a survey of green MSMEs, would test the findings, and linking GST Network data to renewable-device and EPR registries, if access is granted, would permit firm-level analysis. Fifth, the comparative analysis covers only Germany and China; reduced-rate regimes in the European Union and other emerging economies could be added. Sixth, the evidence on compliance costs comes from MSMEs in general, and from one Indian state, and not from green start-ups, and the fiscal effects in Table 5 are qualitative; microsimulation or general-equilibrium modelling of the revenue and incidence effects is a priority for future work.

V. CONCLUSION

This paper has argued that India's green economy transition requires a fiscal architecture that goes beyond revenue collection to actively shape market behaviour. GST 2.0's rate rationalisation, effective from 22 September 2025, simplifies the tax structure but does not, on its own, resolve the specific frictions facing renewable energy and circular economy enterprises: contested ITC eligibility for green capital assets, residual exposure to inverted duty where inputs bear 18 per cent, a disproportionate compliance burden on small firms, an underexploited circular economy opportunity, and a fiscal framework that has not kept pace with India's accelerating renewable energy build-out. Restoring ITC on green inputs, aligning rates along the value chain and, in narrow and verifiable categories, introducing concessional rates for certified green goods and services would together position GST 2.0 as a strategic instrument for sustainable entrepreneurship. Sequencing matters: because GST is a general consumption tax, reforms that restore neutrality should precede concessions, which should be targeted, verified and time-limited. International experience Germany's zero-rating of photovoltaic systems and China's refund-based support for resource recycling shows that both rate-based and refund-based designs are feasible, but each carries eligibility conditions that India would need to adapt to its federal and informal-sector context. Doing so would align India's indirect tax system with SDG 7 and SDG 13 and support the fiscal innovation needed to realise the Viksit Bharat 2047 vision.

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