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Economic Impacts of Extended Producer Responsibility (EPR) on India's Lubricating Oil and Grease Industry: Costs, Benefits and Pathways to Circularity

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Abstract

The introduction of Extended Producer Responsibility (EPR) under the Hazardous and Other Wastes (Management and Transboundary Movement) Second Amendment Rules, 2023 (effective 1 April 2024) has fundamentally altered the economics of India's lubricating oil sector. Producers and importers of base and lubricating oils must now meet phased recycling targets rising from 5% in FY 2024–25 to 50% by FY 2030–31, fulfilled through the purchase of EPR certificates from registered recyclers. This paper analyses short-term compliance costs (estimated INR 1–6 per litre price impact on lubricants at higher targets), infrastructure investments, and long-term benefits including foreign-exchange savings (potential >₹5,000 crore[1] annually at scale), energy savings (re-refining uses one-third the energy of virgin base-oil production), GHG reductions (~1.5 MMT CO_2e by FY 2030–31), and formal job creation in collection and re-refining. The re-refining industry is projected to require 600–700 KT additional capacity by FY 2030–31, driving market growth for re-refined base oil (RRBO). Grease is largely exempt from EPR targets (as it does not generate reclaimable used oil), resulting in negligible direct economic impact beyond general hazardous-waste obligations. Drawing primarily on the FICCI-RECEIC-Deloitte (2025) report and official CPCB data, the analysis concludes that while initial compliance burdens exist, EPR is catalysing a net-positive economic transformation toward resource efficiency and self-reliance, provided collection formalisation and RRBO incentives are strengthened.

Keywords: extended producer responsibility, used lubricating oil, re-refined base oil, circular economy, hazardous waste management, lubricant industry.

1. Introduction

India is the world's third-largest consumer of lubricants after the United States and China, with total consumption projected to grow from approximately 4.2–4.4 million metric tonnes (MMT) in FY 2022–23 to 4.8–5.6 MMT by FY 2030–31 at a conservative compound annual growth rate (CAGR) of 2–4% (FICCI et al., 2025). This expanding market generates an estimated 1.5–2.0 MMT of used lubricating oil annually — a hazardous waste classified under Schedule V of the Hazardous and Other Wastes Rules. When improperly managed, used oil contaminates soil and groundwater, posing serious risks to human health and ecosystems. Moreover, the traditional linear model of lubricant production is highly resource-intensive: producing one gallon of virgin base oil requires approximately 159 litres of crude oil, whereas

re-refining one gallon of used oil can yield up to 2.4 litres of high-quality lubricant, offering massive savings in energy, raw materials, and foreign exchange (FICCI et al., 2025).

Globally, the lubricant industry is shifting toward circular-economy principles, driven by stringent regulations and resource scarcity. In India, this transition gained momentum with the introduction of Extended Producer Responsibility (EPR) under the Hazardous and Other Wastes (Management and Transboundary Movement) Second Amendment Rules, 2023 (effective 1 April 2024). The EPR framework shifts end-of-life responsibility from the government and informal sector to producers and importers of base and lubricating oils. Compliance is achieved through the purchase of EPR certificates issued by registered recyclers via the central CPCB portal (eprusedoil.cpcb.gov.in), with certificates carrying weightage of 1.0 for re-refining and 0.25 for energy recovery. Targets are phased and calculated on sales two years prior (Y-2), rising progressively from 5% in FY 2024–25 to 50% by FY 2030–31.

Research Objectives This paper has three primary objectives:

1. To analyse the short-term compliance costs and long-term economic benefits of the EPR regime for the lubricating oil sector, including certificate purchase, infrastructure investment, foreign-exchange savings, energy efficiency, GHG reductions, and employment generation.
2. To quantify the projected demand for EPR certificates and the additional re-refining capacity required by FY 2030–31.
3. To evaluate the negligible economic impact on the grease sub-sector (which is exempt from EPR targets) and to propose policy pathways for achieving circularity in the overall lubricant value chain.

Significance of the Study The study is significant for multiple reasons. First, it provides the first comprehensive cost-benefit analysis of India's Used Oil EPR framework using the latest FICCI-RECEIC-Deloitte (2025) projections and CPCB data, filling a critical empirical gap in the literature. Second, it demonstrates that EPR can deliver a net economic benefit of approximately ₹7,000 crore (≈ US$ 840 million) annually at full scale while advancing India's Atmanirbhar Bharat, India's vision of economic self-reliance launched in 2020, and net-zero goals. Third, by highlighting the exemption of grease and recommending targeted incentives for re-refined base oil (RRBO), the paper offers actionable policy insights for regulators, producers, and recyclers. Finally, the findings contribute to the broader global discourse on EPR implementation in emerging economies, where informal collection systems and capacity constraints pose unique challenges.

2. Literature Review

Extended Producer Responsibility (EPR) originated in Europe in the 1990s to shift end-of-life product responsibility from governments to producers, encouraging eco-design and better recycling systems (Lindhqvist, 2000). In India, EPR now applies to plastics, e-waste, batteries, and, since the Hazardous and Other Wastes (Management and Transboundary Movement) Rules (MoEFCC, 2023), used lubricating oils. India generates approximately 1.5–2.0 MMT of used lubricating oil annually, much of which is processed through informal channels, resulting in environmental hazards and economic inefficiencies.

Implementation of EPR in the lubricants sector involves notable economic costs. Re-refining used oil requires capital-intensive technologies such as vacuum distillation and hydrotreating, plus investments in collection networks, certification, and reporting (Sarkar et al., 2023). Small-scale producers face disproportionate burdens due to limited economies of scale (Kenton, 2022; OECD, 2016), which can lead to higher lubricant prices and reduced competitiveness in the short term.

However, the long-term economic benefits are substantial. Re-refining can recover over 70% of base oil content (Oberle et al., 2019; PRAI, 2017), reducing India's dependence on imported base oils. Formal recycling networks create employment in collection and processing while lowering public health costs by reducing soil and water contamination (Banerji et al., 2026). EPR credit trading also promotes innovation and market competition, as demonstrated in the European Union and Japan.

Achieving circularity in India's lubricants industry requires integrating the large informal waste collection sector into formal systems (Sharma, 2025), adopting advanced re-refining technologies, aligning EPR with broader sustainability policies, and raising consumer awareness for proper disposal.

Internationally, the European Union has achieved 70–80% recovery rates through strict EPR enforcement, while Japan has developed closed-loop systems via industrial symbiosis (European Commission, 2023). In contrast, India currently re-refines only about 25% of used lubricating oil, highlighting significant room for improvement through stronger enforcement and infrastructure development.

3. Research Gaps

Despite the expanding body of research on Extended Producer Responsibility (EPR), critical gaps persist in the Indian context. Empirical studies that quantify the precise economic impacts of EPR on the lubricants sector remain scarce, with most existing literature emphasising environmental benefits while largely overlooking detailed cost–benefit analyses and the long-term effects on industry competitiveness, pricing strategies, and innovation. Therefore, targeted, India-specific empirical studies are urgently required to validate these trade-offs and to design effective, evidence-based circular-economy pathways for the used oil management ecosystem in India.

4. Research Methodology

This study adopts a desk-based mixed-methods approach combining cost-benefit analysis (CBA) with scenario analysis to assess the economic impacts of Extended Producer Responsibility (EPR) on India's lubricating oil industry and identify pathways to circularity. The quantitative component consists of a multi-period CBA in which relevant costs and benefits across the value chain are identified and monetised using data from the FICCI-RECEIC-Deloitte (2025) report and CPCB statistics. Scenario analysis compares different compliance pathways aligned with regulatory requirements. Secondary data from the CPCB EPR portal, industry reports, and official statistics were triangulated. Sensitivity analysis was performed to ensure robustness. This framework delivers actionable insights on compliance costs, economic benefits, and circularity pathways for the sector.

5. Regulatory Framework

The EPR obligations apply to producers (manufacturers/importers of base or lubricating oil for domestic sale) and importers of used oil (Ministry of Environment, Forest and Climate Change, 2023). Exemptions exist for products such as white oils, process oils, and greases that do not generate reclaimable used oil (entities must still register to claim exemption). Targets are calculated on sales two years prior and increase progressively (Central Pollution Control Board, n.d.).

Table 1. EPR Recycling Targets for Used Lubricating Oil

EPR Year (Y)	Recycling Target	Base Year for Calculation
2024–2025	5%	2022–2023
2025–2026	10%	2023–2024
2026–2027	20%	2024–2025
2027–2028	20%	2025–2026
2028–2029	40%	2026–2027
2029–2030	40%	2027–2028
2030–2031	50%	2028–2029

Note: Adapted from Ministry of Environment, Forest and Climate Change (2023) and CPCB guidelines. "Base Year for Calculation" is the official term used in India's Used Oil EPR Rules for the financial year two years prior to the EPR compliance year (Y-2). Bulk generators (>10 MT/year) must report but are not directly responsible for EPR targets. Non-compliance attracts environmental compensation and penalties.

6. Projected EPR Certificate Demand

Projected EPR certificate demand (MMT) is presented in Table 2, based on conservative 2–4% CAGR lubricant market growth and 35–40% net recoverable used oil (after operational losses, burn-off, and non-recoverable fractions).

Table 2. Projected EPR Certificate Demand for Used Oil in India (MMT)

EPR Year (FY)	Lubricant Market (Y-2) (MMT)	Net Used Oil Generated (MMT)	EPR Certificates Required (MMT)	Target % of Y-2 Sales
2024–2025	4.2–4.4	1.50–1.55	0.08–0.09	5
2025–2026	4.3–4.6	1.50–1.60	0.15–0.17	10
2026–2027	4.4–4.7	1.55–1.70	0.31–0.34	20
2027–2028	4.5–4.9	1.60–1.75	0.32–0.36	20

2028–2029	4.6–5.1	1.60–1.80	0.65–0.73	40
2029–2030	4.7–5.3	1.65–1.90	0.67–0.76	40
2030–2031	4.8–5.6	1.70–2.00	0.85–1.00	50

Source. Adapted from FICCI et al. (2025).

Note: *Y-2 refers to the financial year two years prior to the EPR compliance year (Y). All recycling targets are applied to the volume of lubricant placed on the market in Y-2, as mandated by the 2023 EPR Rules.*

7. Economic Impact Analysis

7.1 Costs Certificate purchase at an indicative price of INR 20/kg implies additional costs of ~INR 1.00–1.20 per litre of lubricant at 10% target and INR 5.00–6.00 per litre at 50% target; these are expected to be partially passed to consumers (FICCI et al., 2025). Administrative and compliance costs (registration, reporting, audits) are estimated at ₹5–15 lakh annually for SMEs. Current re-refining capacity stands at ~2,600 KT across 565 facilities, but <25% meets BIS standards for high-grade RRBO. Achieving FY 2030–31 targets requires 600–700 KT additional advanced capacity (solvent extraction or hydrogenation plants costing INR 400–900 crore each for 50 KTPA capacity). RRBO remains 5–10% costlier than virgin base oil, limiting voluntary uptake without incentives.

7.2 Benefits Resource and forex savings are significant: India imports 60–80% of its base-oil requirement; recycling 500 KT of used oil could save >₹5,000 crore in crude imports annually. Re-refining consumes only one-third the energy of virgin refining. Full EPR compliance by FY 2030–31 is projected to avoid ~1.5 MMT CO_2e annually (equivalent to carbon sequestration by ~60 million mature trees). Every litre of RRBO lubricant reduces ~2 kg GHG. The policy drives formalisation of the informal collection sector (35–45% of volume) and generates substantial direct and indirect jobs in logistics, processing, and quality testing (FICCI et al., 2025). Overall, long-term societal and sectoral gains outweigh short-term compliance costs.

Table 3. Economic Costs and Benefits of Extended Producer Responsibility (EPR) for Used Lubricating Oil in India (All figures calculated at full implementation scale: FY 2030–31, when the EPR recycling target reaches 50%)

Category	Description	Annual Impact	Impact Type
Benefits			
Foreign Exchange Savings	Reduced dependence on imported crude oil and base oil through re-refining	+5,000 crore[1] (≈ US$ 600 million)	Benefit

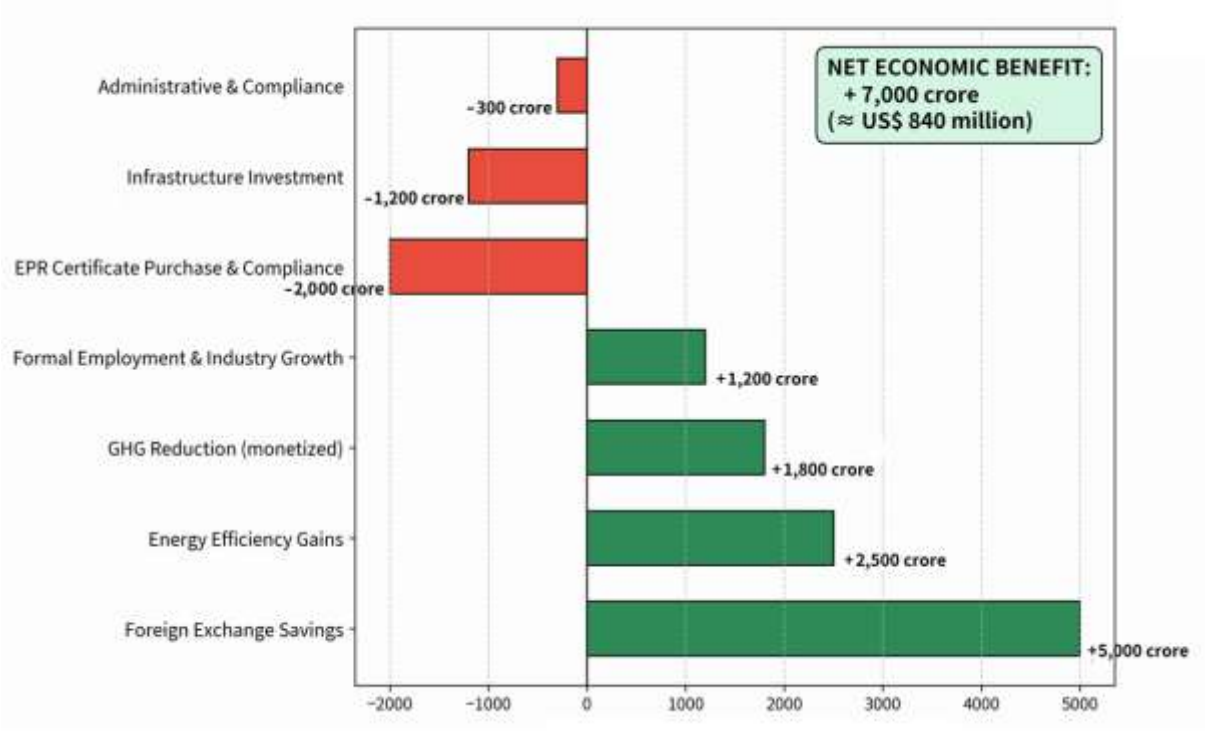
Energy Efficiency Gains	Re-refining consumes only ~1/3 the energy of virgin base-oil production	+2,500 crore[1] (≈ US$ 300 million)	Benefit
GHG Reduction (monetized)	Monetized social benefit of ~1.5 MMT CO_2e avoided annually	+1,800 crore[1] (≈ US$ 216 million)	Benefit
Formal Employment & Industry Growth	New jobs in collection, logistics, re-refining and RRBO market expansion	+1,200 crore[1] (≈ US$ 144 million)	Benefit
Sub-total Benefits		**+10,500 crore[1]** (≈ US$ 1.26 billion)	
Costs			
EPR Certificate Purchase & Compliance	Purchase of EPR certificates + reporting and administrative burden	–2,000 crore[1] (≈ US$ 240 million)	Cost
Infrastructure Investment	Annualised capital cost for 600–700 KT new advanced re-refining capacity	–1,200 crore[1] (≈ US$ 144 million)	Cost
Administrative & Compliance	Portal registration, audits and system integration	–300 crore[1] (≈ US$ 36 million)	Cost
Sub-total Costs		**–3,500 crore[1]** (≈ US$ 420 million)	
Net Economic Impact		**+7,000 crore[1]** (≈ US$ 840 million)	**Net Positive**

[1] One crore = 10 million (10,000,000). All values in Indian rupees (₹). Approximate USD conversion at ₹83 = 1 USD (March 2026 rate).

Notes: All values are rounded annual projections. Short-term costs are lower in early years and rise progressively. Grease segment remains exempt.

Source. Author's compilation based on FICCI, Resource Efficiency and Circular Economy Industry Coalition, & Deloitte (2025).

Figure 1. Economic Impacts of Extended Producer Responsibility (EPR) on India's Lubricating Oil Industry: Costs versus Benefits (Annual at Full Implementation Scale, FY 2030–31)



Projected annual economic costs (red bars) and benefits (green bars) of EPR at the 50% recycling target. The net result is +₹7,000 crore[1] (≈ US$ 840 million) per year. Benefits are dominated by foreign-exchange savings (+₹5,000 crore[1] / ≈ US$ 600 million). Costs are transitional. The grease segment is exempt.

[1] One crore = 10 million (10,000,000). Approximate USD conversion at ₹83 = 1 USD. *Source: Author's compilation based on FICCI, Resource Efficiency and Circular Economy Industry Coalition, & Deloitte (2025).*

8. Impacts on the Grease Segment

Grease (a semi-solid lubricant) is explicitly excluded from EPR recycling targets because it does not generate reclaimable "used oil" under Schedule V of the Hazardous and Other Wastes Rules. Manufacturers of greases must register on the CPCB portal to claim exemption but face no recycling obligations (Central Pollution Control Board, n.d.). Economic impacts are therefore indirect and limited to general hazardous-waste handling costs and marginal packaging EPR requirements. Emerging niche opportunities in upcycling spent grease remain negligible compared with liquid oils. The grease sub-sector experiences minimal direct cost or investment pressure under the current EPR regime.

9. Challenges

Key challenges include fragmented collection (heavy reliance on informal networks), quality and capacity gaps in re-refining, absence of mandatory RRBO uptake or differential incentives, interstate transport restrictions, and enforcement and free-rider risks in the early implementation phase (FICCI et al., 2025).

10. Recommendations

- Establish a National Used Oil Management Association operating on the Producer Responsibility Org-

anisation (PRO) model for centralised governance, digital track-and-trace, and collector incentives.
- Introduce RRBO-specific incentives: GST reduction, public-procurement mandates, and higher certificate weightage for high-grade RRBO.
- Phased formalisation of collection networks (organised sector first, then unorganised via training and pricing benchmarks).
- Capital support (grants/soft loans) and regional testing labs for advanced re-refining.
- Pilot projects in high-consumption states to demonstrate scalable economics.

11. Conclusion

EPR for used lubricating oil is a landmark policy that internalises environmental externalities while unlocking substantial economic value in India. Short-term cost pressures on producers are real but modest and transitional; long-term benefits in forex savings, energy efficiency, emission reductions, and formal employment creation position the industry for sustainable growth. With targeted policy refinements and industry collaboration, the lubricating oil sector can achieve 50% recycling by FY 2030–31, advancing Atmanirbhar Bharat and circular-economy goals. Grease remains largely unaffected, allowing focus on liquid-oil transformation. Continuous monitoring via the CPCB portal and periodic impact assessments will be essential to maximise net economic gains.

Declaration of Competing Interest

The author declares that he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability Statement

This manuscript does not contain any associated data. The study is based entirely on secondary sources and publicly available reports (FICCI-RECEIC-Deloitte 2025, CPCB statistics, and government notifications), all of which are cited in the text and reference list. No new primary data were collected or generated during this research.

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