BASELINE REPORT

Green Transition in Haryana
(Evidence-Based Baselines and
Indicative Sectoral Pathways for Green Growth)

Submitted by

SDGCAC
SUSTAINABLE DEVELOPMENT GOALS
COORDINATION AND ACCELERATION CENTRE

OUTPUT- 4 : Green Economy & Climate Friendly Transition

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Abbreviations and Glossary

Abbreviation	Full Form
ACP	Annual Credit Plan
BAU	Business as Usual
CAPEX	Capital Expenditure
CBAM	Carbon Border Adjustment Mechanism (EU)
CBF	Common Boiler Facility
CBG / Bio-CNG	Compressed Bio-Gas / Biomass-based Compressed Natural Gas
CETP	Common Effluent Treatment Plant
CGTMSE	Credit Guarantee Fund Trust for Micro and Small Enterprises
CGWB	Central Ground Water Board
CRM	Crop Residue Management
DG Set	Diesel Generator Set
DISCOM	Distribution Company (electricity)
DPR	Detailed Project Report
DSM	Demand-Side Management
EMS	Energy Management System
ESCO / RESCO	Energy Service Company / Renewable Energy Service Company
ESG	Environmental, Social & Governance
EV	Electric Vehicle
FLDG	First Loss Default Guarantee
GGH	Green Growth Hub
GPS	Green Portfolio Standard
GRAP	Graded Response Action Plan
GSDP	Gross State Domestic Product
GSVA	Gross State Value Added
GSTN	Goods and Services Tax Network
H-GTF	Haryana Green Transition Fund

Abbreviation	Full Form
HAREDA	Haryana Renewable Energy Development Agency
HEEP	Haryana Enterprises & Employment Policy
HSIIDC	Haryana State Industrial & Infrastructure Development Corporation
HSPCB	Haryana State Pollution Control Board
HWRA	Haryana Water Resources Authority
ICE	Internal Combustion Engine
IGBC	Indian Green Building Council
IMC / IMT	Integrated Manufacturing Cluster / Industrial Model Township
kgCO?e	Kilograms of CO? equivalent
KPI	Key Performance Indicator
MLD	Million Litres Daily
MRF	Material Recovery Facility
MRV	Measurement, Reporting & Verification
MSME	Micro, Small & Medium Enterprises
MtCO?	Million Tonnes of CO?
MVA	Manufacturing Value Added
NCR	National Capital Region
NPA	Non-Performing Asset
NSQF	National Skills Qualifications Framework
OEM	Original Equipment Manufacturer
OPEX	Operational Expenditure
PAT	Perform, Achieve & Trade scheme (BEE)
PHED	Public Health Engineering Department
PMU	Project Management Unit
PWD	Public Works Department
RE	Renewable Energy
RDF	Refuse Derived Fuel

Abbreviation	Full Form
RIA	Regulatory Impact Assessment
RPO	Renewable Purchase Obligation
SCAP / SCCC	State Climate Action Plan / State Council on Climate Change
SEEAP	State Energy Efficiency Action Plan
SEP	State Environment Plan
SGT-PMU	State Green Transition Project Management Unit
SLBC	State Level Bankers' Committee
SPV	Special Purpose Vehicle
STP	Sewage Treatment Plant
SVSU	Shri Vishwakarma Skill University
TPD / TPH	Tonnes Per Day / Tonnes Per Hour
UEI	Unified Energy Interface
ULB	Urban Local Body
VPP	Virtual Power Plant
ZLD	Zero Liquid Discharge

Key Glossary Terms

Terms	Definition
Carbon Border Adjustment Mechanism (CBAM)	EU regulation effective 2026 imposing a carbon tax on imports of carbon-intensive goods (steel, cement, textiles, etc.) proportional to embedded emissions.
Cluster RESCO	A Renewable Energy Service Company aggregating renewable energy demand from multiple MSMEs in an industrial cluster to finance and operate a shared solar asset.
Green Growth Hub (GGH)	Proposed lean SPV the housing a State Project Management Agency and Green Finance Cell, to coordinate and execute the green transition.
Green Open Access	Mechanism permitting energy consumers above a threshold (currently 1 MW) to source renewable power directly. Reform proposed to reduce threshold to 100 kW.
Haryana Vision 2047	State strategic document targeting a USD 1 trillion-plus economy and positioning Haryana as the 'Non-Stop Life Force of Viksit Bharat'.
Stranded Asset	An asset that loses value prematurely due to regulatory change, market shifts, or resource constraints — e.g., a coal boiler that becomes illegal to operate before end of financial life.
Unified Energy Interface (UEI)	Proposed digital platform that aggregates smart meter, GSTN fuel, and STP sensor data to generate real-time carbon intensity scores and Green Passports for enterprises.
Zero Liquid Discharge (ZLD)	Water treatment standard under which all effluent is treated and reused, with zero discharge to external water bodies.

Chapter 1: EXECUTIVE SUMMARY

1.1 State Economic and Transition Context

Haryana enters the green transition from a position of relative economic strength, with a diversified economy led by services, industry and agriculture, a strong industrial base, and a high degree of integration with national and export markets.[1] At the same time, this growth model is increasingly exposed to transition-related pressures arising from energy dependence, industrial pollution control requirements, groundwater stress, tightening environmental norms, and changing market expectations around low-carbon production and resource efficiency. In this context, green transition in Haryana should be viewed not only as an environmental agenda, but as an economic competitiveness, infrastructure modernization, and long-term resilience agenda aligned with Haryana Vision @2047.

1.2 Scope and Purpose of the Report

This report should be read as a Baseline & Pathways Report. It presents a structured assessment of Haryana's transition-relevant landscape, current-state implications, and sectoral pathway options. The analysis highlights the importance of industrial clusters and MSME ecosystems as the practical centre of transition planning, especially in sectors such as automotive, textiles, engineering, agro-processing, and allied manufacturing. The conceptual framing for transition is set out in Chapter 3, the State baseline and its implications are presented in Chapter 4, and sector-specific baselines, transition considerations, and indicative pathways are set out in Chapter 5. Transition finance is discussed in Chapter 6, cross-cutting enablers including governance, skills, and digital MRV in Chapter 7, consolidated recommendations in Chapter 8, and next steps for validation and action in Chapter 9.

1.3 Headline Baseline Messages

The baseline presented in this report points to five broad messages for Haryana's green transition:

- Economic strength provides a platform for transition, but current growth patterns remain exposed to resource stress, environmental compliance pressure, and changing market conditions.
- Industrial and export activity is geographically concentrated, which creates

[1] Economic Survey of Haryana 2024-25

both a practical basis for cluster-focused action and a concentration of transition risk.

- **Power transition remains incomplete,** with renewable energy capacity growing but still not fully reflected in the effective supply mix.
- **Water stress is emerging as a structural economic constraint,** particularly for urban and industrial systems dependent on groundwater and weak wastewater reuse.[2]
- **Finance is available in aggregate, but transition-oriented finance remains under-defined,** weakly tagged, and insufficiently linked to cluster-level implementation needs.
- The detailed discussion and supporting evidence for these issues are presented across Chapter 4: Haryana's Current State and Implications and Chapter 5: Sector Baselines, Transition Considerations & Indicative Pathways.

1.4 Priority Transition Domains

Taken together, the evidence suggests that Haryana's transition challenge is concentrated in a set of interlinked domains:

- clean power access and industrial energy efficiency;
- industrial process modernization and emissions reduction;
- water security, wastewater reuse, and pollution compliance;
- MSME competitiveness and supply-chain readiness; and
- finance, governance, and digital monitoring systems needed to support scale.

These domains are examined in greater detail through sector chapters and cross-cutting enabler sections later in the report.

1.5 Sector and System Lens of the Report

To maintain an implementation-oriented perspective, the report adopts a sector-pathway approach covering key transition domains such as MSMEs, power, automotive, steel, textiles, water-linked infrastructure, and associated enabling systems. For each area, the report combines current baseline evidence with key risks and gaps, indicative transition priorities for 2026–2030, longer-term direction to 2047, and indicative KPIs, MRV, financing, and institutional considerations. Detailed sector analysis is presented in Chapter 5, with transition finance and cross-cutting enablers covered in Chapters 6 and 7 respectively.

[2] State Environment Action Plan ad HWRA related data

1.6 Strategic Direction

The report suggests that Haryana's green transition should proceed as a phased competitiveness and resilience agenda. In the near term, priority should be placed on strengthening the baseline, identifying first-priority districts and clusters, improving transition-relevant data systems, and initiating action in high-impact areas such as MSME decarbonisation, renewable energy integration, wastewater reuse, and cleaner industrial infrastructure. Over time, this will require stronger coordination across departments, finance institutions, and implementation agencies to move toward a whole-of-government transition approach.

1.7 How This Report Should be Read

This report is intended to function as an evidence-based planning and consultation document. It is not a statement of approved policy or a final departmental roadmap. Rather, it provides a structured starting point for validation, prioritization, and phased action aligned with Haryana Vision @2047. Readers seeking the conceptual framing for why transition is needed and how it should be understood should refer to Chapter 3. Readers seeking detailed State baseline evidence and its implications should refer to Chapter 4. Those seeking sector-specific transition analysis and indicative pathways should refer to Chapter 5, while those reviewing transition finance, cross-cutting enablers, consolidated recommendations, and next steps should refer to Chapters 6, 7, 8, and 9 respectively.

Chapter 2: METHODOLOGY & EVIDENCE APPROACH

2.1 Purpose and Analytical Approach

This report has been prepared as an evidence-based assessment of Haryana's green transition landscape, with the dual purpose of:

i. establishing a credible baseline across key transition-relevant sectors and systems; and

ii. identifying indicative sectoral pathways, institutional needs, and implementation priorities that may guide near- to medium-term policy action.

The analysis is based primarily on a synthesis of authoritative state and national sources, including the Economic Survey of Haryana 2024-25, State Energy Efficiency Action Plan (SEEAP) 2023, State Environment Plan (SEP), HWRA-related data, and other official reference documents used in the report. The overall analytical framing is aligned with Haryana Vision 2047, so that green transition is interpreted not as a stand-alone environmental theme, but as a cross-cutting economic, industrial, infrastructure, and resilience agenda relevant to the State's long-term development pathway.

2.2 Evidence Hierarchy

To ensure consistency, reliability, and policy relevance, the report applies an evidence hierarchy for the use of data, baselines, and comparative references. The draft already identifies a three-tier structure, which may be retained in refined form as follows:

Tier 1: Primary State-Level Evidence: This includes core Haryana-specific documents such as Haryana Vision 2047, the Economic Survey of Haryana 2024-25, Statistical Abstract of Haryana 2023-24, the State Environment Plan, SEEAP 2023, HWRA-related datasets, and other official state records. These sources should form the basis for all state-specific numeric baselines and key factual claims.

Tier 2: Official National Evidence: This includes official national datasets, guidelines, and benchmarks such as those from the Central Electricity Authority (CEA), Bureau of Energy Efficiency (BEE), Central Ground Water Board (CGWB), CGTMSE, and other Government of India sources. These should be used for benchmarking, regulatory context, national comparison, and interpretation of sectoral standards, but should not substitute for Haryana-specific baseline data where state-level evidence is available.

Tier 3: Reference and Best-Practice Sources: This includes policy reports, multilateral studies, and comparative references such as NITI Aayog reports, just transition models from other states, and selected international or institutional studies. These sources are useful for qualitative framing, pathway design, institutional options, and comparative learning, but should not be used as substitutes for verified Haryana-specific evidence.

2.3 Data Classification Protocol

For clarity of interpretation, all figures, claims, and tables in the final report should be read through the following data classification categories:

Official Baseline: directly traceable to an official state or national source.

Derived Calculation: computed from official source data and clearly labelled as such.

Official Benchmark: national or regulatory benchmark used for comparison.

2.4 Scope and Interpretation of the Report

This document should be read as a Baseline & Pathways Report, rather than as a pure baseline compendium. It combines:

- current baseline evidence on Haryana's transition-relevant sectors and systems;
- identification of key transition risks, constraints, and enabling gaps;
- indicative sectoral pathways for 2026–2030;
- longer-term directional outlooks aligned with the Vision 2047 horizon; and
- proposed KPI, MRV, governance, and financing considerations for further consultation.

Each sector chapter is structured to present: (i) sector context and relevance; (ii) baseline status and transition constraints; (iii) indicative transition directions and enabling considerations; and (iv) illustrative KPIs and MRV considerations, to be refined through subsequent consultation.

The purpose of this structure is to distinguish clearly between what is already evidenced in the current baseline, what risks and constraints are emerging, and what transition directions may merit further policy and programmatic consideration. At this stage, the report should be read as a consultation-oriented analytical document rather than as a final implementation blueprint or allocation framework.

2.5 Limitations and Need for Validation

The report recognizes that evidence depth is not uniform across all sectors. Some indicators are directly traceable to official Haryana sources, while others may currently rely on proxy evidence, analytical estimates, or indicative assumptions due to limitations in available datasets, absence of sector-specific green taxonomies, or lack of a consolidated state-level MRV architecture.

Accordingly, all non-official estimates, scenario values, financing assumptions, and proposed interventions should be treated as indicative for consultation purposes unless separately validated and adopted by the concerned department or agency. This is especially important in sections relating to transition finance, sectoral investment assumptions, cluster-level opportunity estimates, and proposed governance mechanisms.

This report is intended to function as:

- an evidence-based baseline for transition planning;
- a structured input for interdepartmental consultation;
- a basis for identifying priority districts, sectors, and clusters;
- a reference point for designing future programmes, pilots, and investment strategies; and
- an analytical support document for aligning green transition priorities with Haryana Vision 2047.

It should not be interpreted, in its current form, as a statement of approved policy or as a final departmental roadmap. Rather, it is best understood as a structured evidence base and planning document to support further validation, prioritization, and phased action.

Chapter 3: Transition Imperative and Relevance for Haryana

3.1 Why Transition is Needed?

Over the past decade, the imperative for transition has strengthened not only because of climate and environmental risk, but also because market, investment, and supply-chain conditions are changing rapidly. Sustainability performance is increasingly becoming relevant to investor preference, buyer expectations, export competitiveness, and long-term business resilience. For production systems, infrastructure, and MSME-linked value chains, transition can no longer be viewed only as a voluntary environmental improvement. It is increasingly connected to market access, resource security, technology modernisation, and future competitiveness.

For a state such as Haryana, this transition imperative arises from a combination of structural pressures: industrial growth, rising energy demand, water stress, air-quality concerns, changing buyer-side expectations, and the growing importance of disclosure, traceability, and environmental performance in production ecosystems. The policy relevance of transition therefore lies not only in reducing emissions or pollution, but in ensuring that growth remains viable, efficient, and resilient over the long term.

3.2 What is Transition?

In the context of this report, transition refers to the gradual movement of economic systems, sectoral production structures, infrastructure, and institutions toward lower-emission, more resource-efficient, and more resilient pathways. From an emissions perspective, this direction is aligned with the broader global climate framework under the Paris Agreement, which has reinforced the need for progressive reduction in greenhouse-gas intensity, cleaner energy systems, improved efficiency, and more sustainable patterns of production and consumption.

At the state level, transition should therefore be understood as a structural economic process rather than as a stand-alone environmental programme. It affects how energy is produced and consumed, how industries respond to resource and compliance pressures, how water and waste are managed, how technology choices evolve, and how labour markets and enterprise systems adjust over time. In this sense, green transition is simultaneously a question of competitiveness, resilience, and environmental sustainability.

3.3 Just Transition and Haryana's Relevance

A central principle within this broader transition is that it should be just, inclusive, and socially responsible. A just transition seeks to ensure that the shift towards lower-carbon and more sustainable systems does not impose disproportionate burdens on workers, smaller enterprises, or vulnerable communities. It places emphasis on safeguarding livelihoods, supporting phased adaptation, enabling skilling and re-skilling, and ensuring that the benefits of transition are shared more broadly.

In the Indian context, just transition extends beyond decarbonisation alone and also includes access, resilience, and the ability of smaller firms and vulnerable communities to participate in emerging green opportunities. For Haryana, this is especially relevant in MSME clusters, export-linked supply chains, resource-intensive industrial areas, and sectors undergoing technological and compliance shifts. A just transition lens is therefore important not only for social protection, but also for ensuring that enterprise adjustment remains feasible and that smaller actors are not excluded from evolving market systems.

3.4 What Happens if Transition is Delayed?

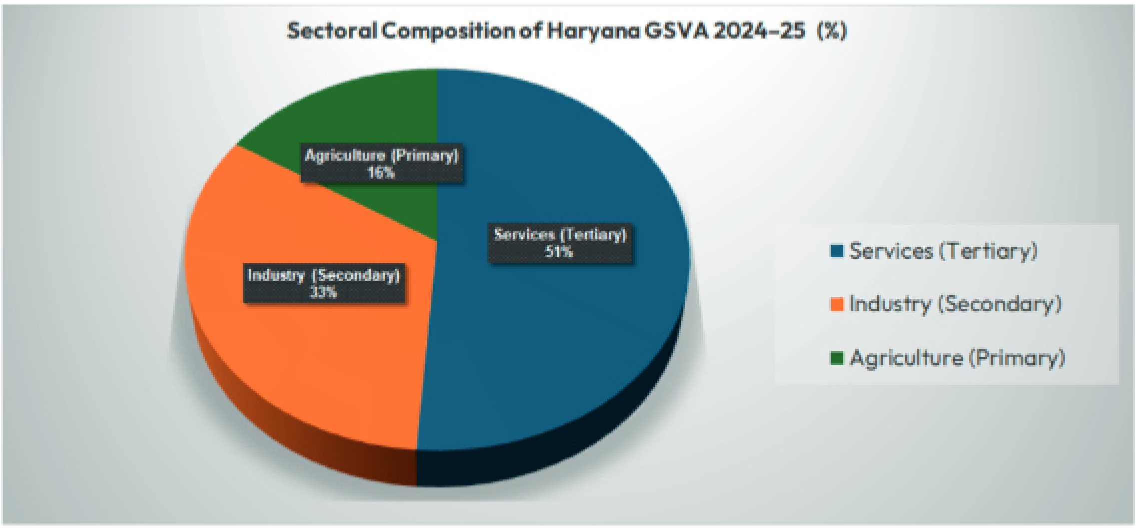
If transition is delayed, the risks are likely to extend beyond environmental stress alone. Enterprises and sectors may face rising compliance costs, reduced competitiveness in changing markets, growing exposure to buyer-side sustainability requirements, and the danger of technological or asset obsolescence. For MSMEs in particular, delayed transition may increase vulnerability because sustainability investments often compete with working-capital needs, while awareness, support systems, and common standards remain limited.

At the state level, delayed transition may also deepen pressures related to pollution, water stress, inefficient energy use, and industrial compliance. It may reduce the preparedness of key sectors to respond to changing procurement norms, disclosure expectations, and future trade-linked sustainability requirements. In that sense, transition is not only about managing environmental risk; it is also about avoiding future competitiveness loss and ensuring that Haryana's growth model remains aligned with emerging national and global directions.

Chapter 4: Haryana's Current State and Implications

4.1 Economic Structure

Haryana's economy is led by services (51.2 percent of Gross State Value Added, GSVA), followed by industry (32.9 percent) and agriculture (15.9 percent) at current prices in 2024-25.[3] The State's GSDP grew at 11.8 percent (current prices) in 2024-25. Per-capita income at ₹3,53,182 stands at approximately 1.7 times the national average.



[3] Economic Survey of Haryana 2024-25

4.2 Industrial and Export Geography

As of the Actuals for FY 2023-24, Haryana's industrial (merchandise) exports stood at ₹1,63,430 Crore. For the ongoing FY 2024-25 (Advance Estimates), this figure is projected to reach ₹1,83,041 Crore (Source: Economic Survey of Haryana 2024-25). This trade volume is geographically concentrated in an "Export Quad" of four districts, which collectively drive over 70% of the state's total outbound trade. This concentration creates a systemic vulnerability to international carbon tariffs, particularly as the EU-CBAM enters its definitive phase in 2026.

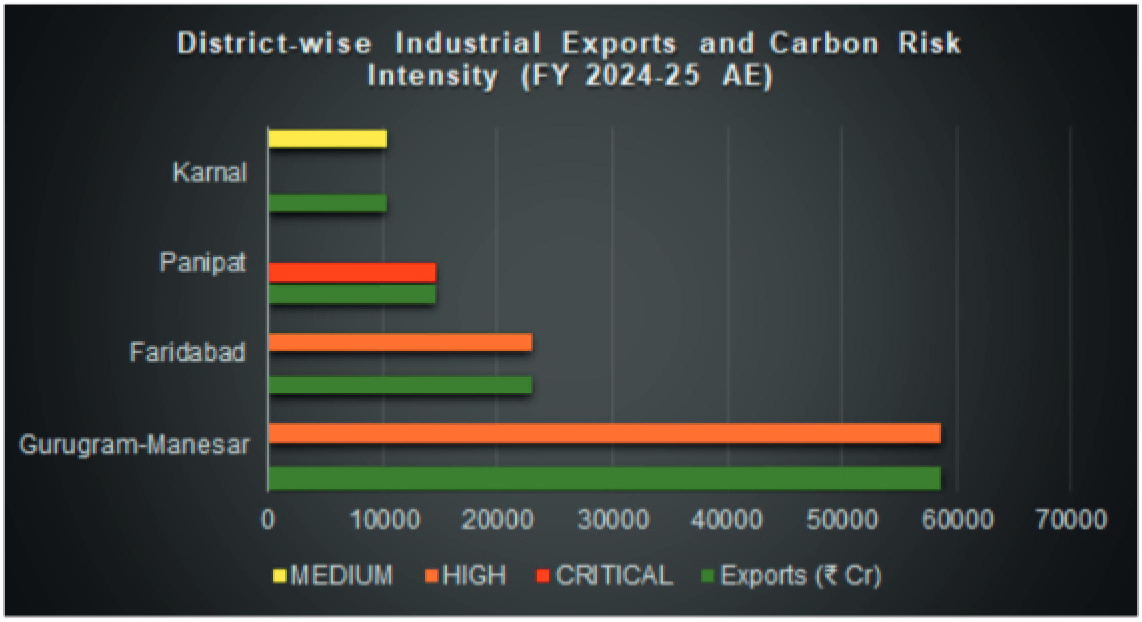


Figure 2: District-wise Industrial Exports and Carbon Risk Intensity —
Source: Statistical Abstract of Haryana 2023-24

Table 4.1: Export Cluster Baseline & CBAM Vulnerability (FY 2023-24 Actuals Vs. 2024-25 AE)

Cluster / District	Primary Sector	FY 2023-24 (Actuals - ₹ Cr)	FY 2024-25 (AE - ₹ Cr)	CBAM Risk Level	Primary Risk Driver
Gurugram-Manesar	Auto Components/ IT	52,450	**58,639**	**HIGH (Scope 3)**	OEM net -zero mandates; Tier-2 vendor delisting risk.
Faridabad	Engineering/ Forging	20,422	**22,873**	**HIGH**	Fossil-fuel furnaces; carbon tax on steel/iron products.
Panipat	Textiles / Dyeing	12,968	**14,498**	**CRITICAL**	High thermal energy from coal boilers; 15-20% border tax risk.
Karnal	Agro-processing / Rice	9,121	**10,215**	**MEDIUM**	Methane intensity; "Green Basmati" certification needs.
STATE TOTAL	All Industrial	**1,63,430**	**1,83,041**	**——**	**70% concentration in these 4 districts.**

* Source: Export values for FY 2023-24 (Actuals: ₹1,63,430 Cr) and FY 2024-25 (Advance Estimates: ₹1,83,041 Cr) are sourced from the Economic Survey of Haryana 2024-25. CBAM risk ratings are qualitative assessments based on sector characteristics

4.3 Power and Energy Baseline

Haryana's total installed power capacity stands at 15,936.65 MW as of 31 December 2024, of which renewable installed capacity is 2,912.13 MW, comprising 2,512.96 MW solar, 325.67 MW bio-power, and 73.50 MW small hydro. Despite this growing renewable base, the actual renewable share in grid supply stands at approximately 4.62 percent, reflecting the gap between installed capacity and effective contribution to power supply. Total units sold in FY 2024–25 (up to December 2024) are 48,489.5 MkWh, with per-capita consumption at 2,289 kWh.[3]

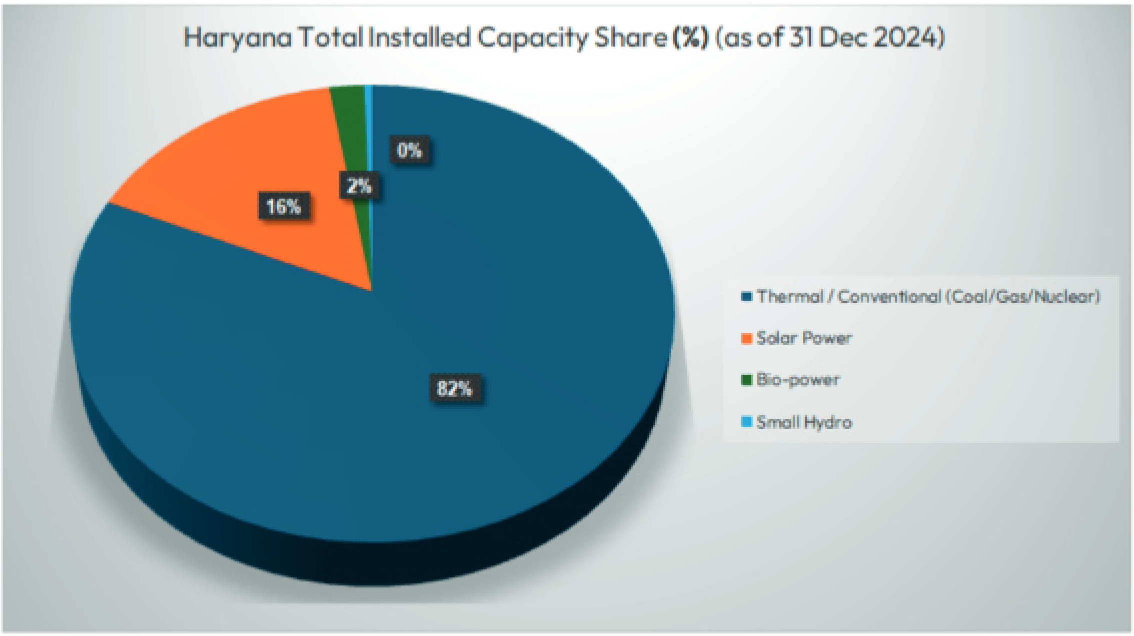


Figure 3: Haryana Total Installed Capacity Share (%) —
Source: Economic Survey of Haryana 2024-25 (Table 4.6) and Ministry of New & Renewable Energy (MNRE) State-wise reports

4.4 Water and Environment Baseline

Haryana's groundwater extraction ratio stands at 136.75 percent of annual recharge, making it one of India's most water-stressed states. Of 143 assessed groundwater blocks, 88 are classified as over-exploited (CGWB / HWRA 2025). Treated wastewater generated stands at 1,487 MLD, of which only 281 MLD (18 percent) is currently reused, leaving an untapped reuse potential of approximately 1,206 MLD.[4]

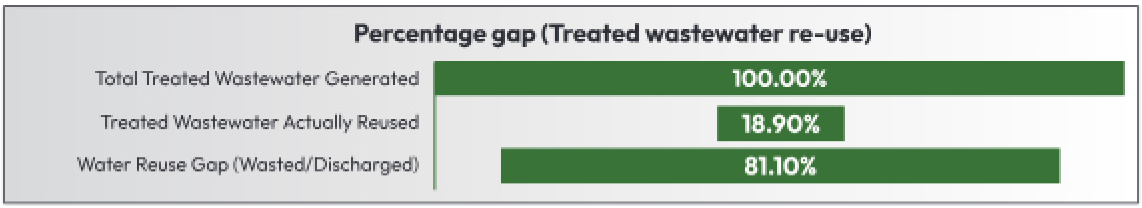


Figure 4: Water Reuse Gap — Generated vs. Reused Treated Wastewater in MLD — Source: SEP 2025

[3] Economic Survey of Haryana 2024-25
[4] State Environment Plan 2025

4.5 MSME and Credit Landscape

Haryana has over 14.14 lakh registered MSME units, concentrated in major industrial districts. The State's MSME credit flow under the Annual Credit Plan reached ₹1,21,516 crore in 2024-25, representing 144 percent of the target of ₹84,278 crore. However, the share of explicitly green credit within this flow remains low, and current official banking data does not separately track green MSME credit in a formal manner. This suggests that, despite strong overall MSME credit flow, the State does not yet have a sufficiently developed framework for tagging, monitoring, and scaling transition-oriented finance within the MSME ecosystem

In contrast, the capital required to catalyze the state's overall transition is highly grounded. While the State Energy Efficiency Action Plan (SEEAP) quantifies the bankable investment potential for industrial efficiency at ₹6,610 Crore through 2031.[5]

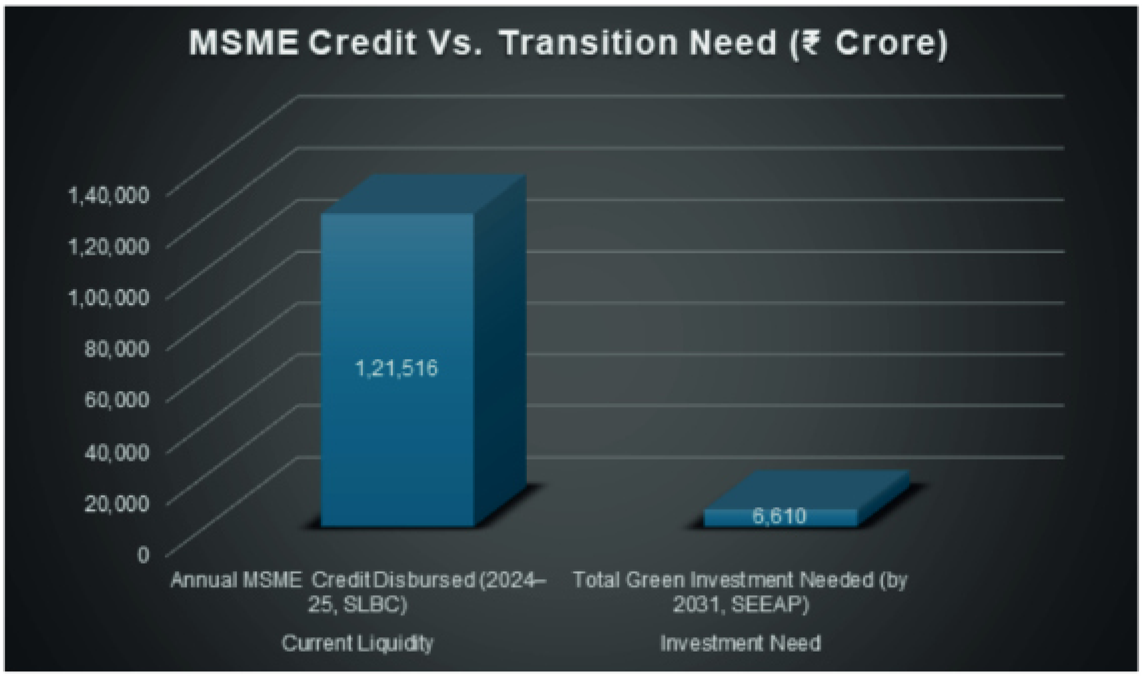


Figure 5: Liquidity Vs. Transition Need — Source: SLBC Haryana Annual Credit Plan Data (2024-25)

4.6 Air Quality & Industrial Emissions Baseline

Air pollution has evolved from a public health crisis into a critical economic constraint for Haryana's industrial competitiveness. The rigorous enforcement of the Graded Response Action Plan (GRAP) by the Commission for Air Quality Management (CAQM) triggers mandatory, periodic shutdowns of diesel generators and coal-reliant industries during high-AQI periods. Consequently,

[5] State Energy Efficiency Action Plan (SEEAP)

industry estimates indicate that MSMEs in key NCR hubs, specifically Faridabad, Sonipat, and Bahadurgarh, now face 30-45 lost operating days annually, disrupting production cycles and paralyzing supply chains.

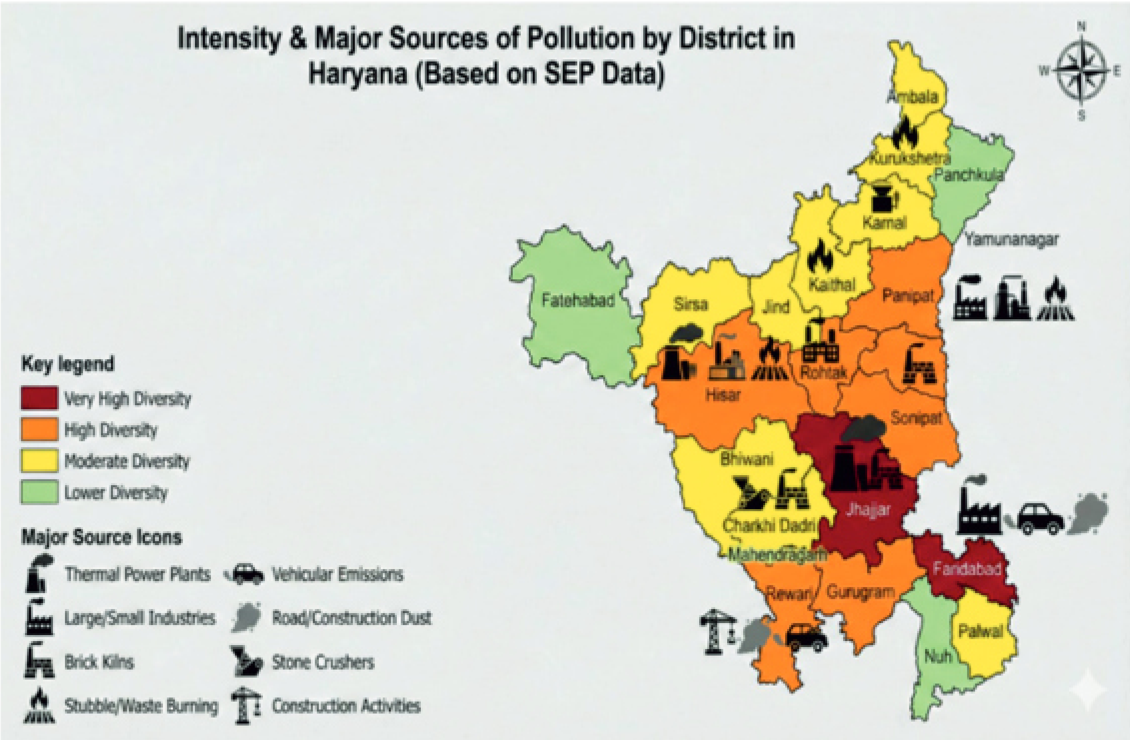


Figure 6: Intensity & Major Sources of Pollution by District in Haryana (Based on State Climate Action Plan Data)

4.7 Implications of the Current State

The assessment presented in this chapter indicates that Haryana's transition challenge is not confined to one sector or one environmental issue. Rather, it is structural and cross-sectoral, touching industrial competitiveness, energy affordability, water security, environmental compliance, export readiness, and long-term investment viability.

The evidence suggests that several of the State's key growth systems are already exposed to transition-related pressures. Industrial clusters face rising energy costs, evolving buyer-side sustainability expectations, and increasing pressure to modernise production systems. Water stress, groundwater depletion, and low levels of treated-wastewater reuse point to growing resource constraints with implications for agriculture, urban systems, and industry alike. At the same time, smaller enterprises and local production ecosystems continue to face barriers relating to finance, technology access, common infrastructure, digital readiness, and compliance support.

Taken together, these trends imply that Haryana's green transition will require more than isolated technical interventions. It is likely to depend on coordinated action across sectors, stronger enabling systems, phased implementation, and improved alignment between policy direction, institutional support, financing access, and monitoring architecture. In this sense, the transition challenge is also a development-planning challenge: one that affects how the State manages competitiveness, resilience, and resource efficiency over the medium to long term.

The assessment also suggests that delayed transition may increase future adjustment costs. If current structural pressures remain unaddressed, Haryana could face deeper exposure to resource stress, compliance burdens, carbon-linked market risks, and fragmented sectoral responses. Conversely, a phased and consultation-led transition approach could help the State align growth, resilience, and environmental sustainability more effectively with the Vision 2047 horizon.

CHAPTER 5: SECTOR BASELINES, TRANSITION CONSIDERATIONS & INDICATIVE PATHWAYS

The sectoral risks, constraints, enabling gaps, and pathway options presented in this chapter are derived from the report's baseline analysis, evidence hierarchy, and sector review process. These have been identified through a triangulation of Haryana-specific baseline evidence, relevant state and national policy and regulatory references, stakeholder inputs and implementation discussions, and selected comparative references used only for directional learning.

Accordingly, the findings in this chapter should be read as analytical and indicative, and not as definitive sector diagnoses or approved departmental positions. The transition priorities, financing considerations, institutional options, and long-term directions presented here are intended to support validation, interdepartmental consultation, prioritisation, and phased planning. They should not be interpreted as final policy commitments, binding targets, or mandatory implementation prescriptions unless separately adopted by the concerned department or agency.

5.1 SECTOR 1: MSMEs (CLUSTER LENS)

5.1.1 Where We Are

This section sets out the current MSME transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.1.1.1 Sector Context

Haryana's MSME ecosystem is a foundational pillar of the State's industrial economy and a key carrier of manufacturing employment, export competitiveness, and local value addition. The baseline indicates that Haryana has over 14.14 lakh registered MSME units[6], with a strong concentration in a few high-density industrial districts and corridors. This makes MSMEs central not only to the State's current economic structure, but also to the practical implementation of green transition pathways.

The analysis in the report supports a cluster-first approach to MSME transition. Rather than treating MSMEs as isolated units, it identifies industrial clusters as the

[6] Open Govt. Data Platform

primary operational unit for decarbonisation, shared infrastructure, aggregation of demand, and financing. This is particularly relevant in Haryana, where the State Energy Efficiency Action Plan (SEEAP) identifies 56 priority MSME clusters across 21 districts, with especially high relevance in Gurugram, Faridabad, Panipat, Sonipat, Karnal, and Hisar.

At the same time, Haryana's MSMEs face rising transition pressure from multiple directions: stricter air-quality enforcement in NCR-linked districts, evolving supply-chain disclosure requirements, increasing energy and compliance costs, and the absence of a clearly tagged green finance architecture. These factors make MSME transition a matter of competitiveness and business continuity, not only environmental compliance.

5.1.1.2 Current Baseline

Haryana's MSME baseline indicates a large, geographically concentrated, and financially active industrial ecosystem, but one that remains at an early stage of green transition readiness. The report records 14,14,352 registered MSME units statewide, with the largest concentrations in Gurugram (1.78 lakh) and Faridabad (1.46 lakh). At a structural level, the top industrial districts account for a disproportionately large share of the State's MSME base, reinforcing the case for corridor- and cluster-based interventions rather than a fully dispersed statewide strategy.

The SEEAP identifies 56 MSME clusters across 21 districts, including 451 rice milling units in priority clusters, which is an important indicator of the scale and diversity of the sector's transition challenge. The district concentration data in the report further highlights Gurugram, Faridabad, Karnal, Panipat, Hisar, and Sonipat as the most important transition corridors from an MSME perspective.

The physical readiness baseline remains limited. The analysis highlights low rooftop solarisation, estimated at below 5 percent, widespread use of IE1 standard motors, continued dependence on diesel generator (DG) sets, and low levels of digital metering or structured energy data systems in MSME operations. These characteristics suggest that a large share of Haryana's MSME base remains reliant on conventional and relatively inefficient energy systems.

From a financial perspective, Haryana's MSME sector demonstrates strong credit absorption. During FY 2024-25, MSME credit disbursement under the State Annual Credit Plan reached ₹1,21,516 crore, representing 144 percent of target achievement. However, the report also highlights an important systemic gap: current official banking data does not separately track green MSME credit in a formal manner. This suggests that, despite strong overall MSME credit flow, the State does not yet have a sufficiently developed framework for tagging, monitoring, and scaling transition-oriented finance within the MSME ecosystem.

The current incentive framework also shows that a partial policy base already exists. Current evidence suggests availability of a State Green CAPEX subsidy of 50 percent of equipment cost (up to ₹20 lakh per MSME) and energy audit reimbursement of 75 percent of audit cost (up to ⊠2 lakh per MSME) under the Haryana Revised Energy Conservation Scheme and related departmental support. These measures provide an initial enabling platform, but do not yet amount to a full transition ecosystem.

An additional dimension of Haryana's MSME transition baseline is the emergence of buyer-side sustainability expectations and ESG-linked reporting pressures. Evidence from MSME-focused transition studies suggests that awareness of broader ESG frameworks remains limited among many smaller enterprises and is often confined to a few more familiar certification systems. At the same time, the direction of market pressure is becoming clearer: MSMEs linked to larger firms and organised value chains are increasingly likely to face expectations relating to energy use, emissions, water, waste, occupational safety, and broader reporting discipline.

Available transition-readiness evidence also indicates that MSMEs often respond more readily to market pressures than to regulation alone, but current market signals remain uneven and fragmented. Smaller enterprises face uncertainty in buyer demand, lack of clarity on common sustainability requirements, and practical difficulty in prioritising compliance-related investments when these compete with working-capital needs. In this context, transition readiness is not only about cleaner technology adoption; it is also about the capacity of enterprises to understand, document, and gradually respond to evolving compliance and disclosure expectations.

Table 5.1: Haryana MSME Sector Baseline Indicators

Indicator	Value	Source	Remarks
Registered MSME Units	**14,14,352 units**	Government Open Source Data Portal	Highest c oncentrations in the Gurugram and Faridabad industrial corridors.
Priority MSME Clusters	**56 Clusters**	SEEAP 2023	Identified across 21 districts; serves as the primary unit of transition.
Rice Milling Units	**451 units**	SEEAP 2023	Key agro -industrial subsecto r; high biomass and thermal energy potential.
MSME Credit Disbursed	**₹1,21,516 Crore**	Economic Survey 2024-25	144% of target achieved; indicates high liquidity in the banking system.
MSME Solarisation Rate	**< 5%**	SEP / SEEAP	Significant untapped potential for rooftop solar and open-access green power.
Motor Efficiency Standard	**IE1**	Energy Audit Baseline	Predominant use of inefficient motors; represents a major "low-hanging fruit" for EE.
Green CAPEX Subsidy	**50% of Cost**	HR-ECS for MSMEs	State incentive capped at ₹20 Lakh to support energy-efficient equipment.
Energy Audit Support	**75% of Cost**	Dept. of Renewable Energy	Reimbursement capped at ₹2 Lakh to encourage industrial diagnostics.

5.1.1.3 Key Transition Risks, Constraints and Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the MSME baseline presented in this report, read together with the broader state transition baseline in Chapter 3, relevant state and national policy and regulatory references, and comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions.

The analysis suggests that Haryana's MSME transition challenge is not confined to technology adoption alone, but is shaped by a combination of regulatory exposure, energy-system dependence, compliance readiness, financing architecture, and implementation capacity.

A first important transition risk appears to arise from air-quality related regulatory exposure, particularly in NCR-linked industrial districts. The report baseline indicates that GRAP-related enforcement and restrictions on diesel-generator use and coal-based operations may create significant business continuity pressure for fossil-fuel-dependent MSMEs in districts such as Gurugram, Faridabad, and Sonipat. In this sense, environmental regulation is becoming a practical competitiveness and operations issue, not merely a compliance matter.

A second transition risk relates to asset vulnerability and potential stranding of conventional equipment. The continued use of fossil-fuel-based boilers, inefficient motors, diesel backup systems, and conventional process equipment may expose a section of the MSME base to rising compliance costs, future regulatory tightening, and declining commercial viability of older technologies. This may also have implications for credit portfolios where financing remains linked to assets that could lose relevance prematurely under changing market and regulatory conditions.

A third gap emerging from the analysis concerns supply-chain and Scope 3 readiness. MSME suppliers linked to larger OEM ecosystems, especially in Gurugram-Manesar and Faridabad, are increasingly likely to face expectations relating to energy traceability, carbon disclosure, and broader ESG-linked reporting. However, the baseline suggests that enterprise-level smart metering, digital data systems, and practical carbon-accounting capacity remain weak. This may reduce the readiness of Haryana's MSME suppliers for future buyer-side sustainability requirements and export-facing compliance expectations.

A fourth enabling gap appears to lie in the absence of a formal state green taxonomy or positive list of eligible MSME transition technologies. Without such an architecture, strong aggregate credit flow does not automatically translate into transition-oriented lending. The current situation may therefore limit the ability of banks and public institutions to systematically tag, structure, monitor, and incentivise finance for cleaner equipment, energy efficiency, renewable integration, and related transition measures.

A fifth constraint relates to audit, facilitation, and implementation capacity. The report points to a shortage of certified auditors and a broader gap in scalable technical handholding relative to the size of Haryana's MSME base. This may constrain diagnostics, prioritisation of interventions, compliance readiness, and the ability to move from isolated schemes toward a more structured cluster-based transition programme.

Taken together, the evidence suggests that the MSME transition challenge in Haryana is best understood as a combined issue of compliance resilience, cluster infrastructure, cleaner energy access, enterprise data systems, technical support, and climate-aligned finance, rather than as a narrowly defined equipment-upgradation problem alone.

For clarity, the key green transition challenges emerging from the MSME baseline may be summarised as follows:

- limited physical readiness, including low solarisation, inefficient motors, and continued dependence on conventional energy systems;
- weak enterprise-level awareness of emerging ESG and supply-chain compliance expectations;
- uncertainty in market signals and lack of common clarity on future reporting and buyer requirements;
- inadequate green-finance tagging and weak translation of aggregate credit flow into transition-oriented lending; and
- shortage of scalable audit, facilitation, and handholding capacity required for cluster-based transition.

5.1.2 Where We Want to Go

This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

5.1.2.1 Medium-Term Indicative Transition Direction (2026-2030)

In view of the above, the report points toward a set of indicative medium-term transition directions for the 2026–2030 period, centred on aggregation, efficiency improvement, cleaner energy access, supply-chain readiness, and enterprise traceability. These should be read as possible areas for phased action and further validation rather than as predetermined commitments.

One important transition direction may be the development of cluster-based renewable-energy access models, under which rooftop demand from multiple MSMEs in industrial estates or cluster settings can be aggregated into larger solar procurement or shared clean-energy structures. Such an approach could help reduce transaction costs, lower individual credit barriers, and improve cleaner power access without requiring each enterprise to develop stand-alone projects.

A second direction may be a motor-efficiency modernisation drive, especially targeting older inefficient motors through aggregation, standardised diagnostics, and financing support. Given the present baseline of low-efficiency equipment use, this appears to be one of the more practical and scalable demand-side opportunities within the MSME landscape.

A third transition direction may be the development of a green vendor-readiness and certification framework for MSMEs linked to larger OEM ecosystems, particularly in industrial corridors such as Gurugram–Manesar and Faridabad. This could be aligned with enterprise audits, cleaner power adoption, and improved disclosure preparedness among Tier-1 and Tier-2 suppliers. The broader sector evidence in the report already highlights strong Scope 3 and supplier-readiness pressures in export-linked industrial ecosystems.

A fourth direction that may warrant phased examination is the development of enterprise traceability and carbon-accounting systems, especially for export-linked or compliance-sensitive MSME supply chains. Over time, such systems may help improve documentation, supplier visibility, and readiness for increasingly data-intensive market requirements.

Taken together, the medium-term direction is not toward uniform statewide transformation in a short period, but toward the gradual emergence of cluster-based, better-documented, cleaner, and more transition-ready MSME ecosystems.

5.1.2.2 Long-Term Indicative Direction (2031–2047)

Over the longer term, Haryana's MSME transition pathway may involve the gradual evolution of industrial estates from passive energy users into more efficient, digitally enabled, and lower-carbon production ecosystems. This direction could include the emergence of prosumer MSMEs, wider deployment of onsite storage and intelligent energy-management systems, progressive movement toward higher motor-efficiency standards, and greater use of data-enabled optimisation and cleaner industrial infrastructure. These elements should be treated as directional rather than as immediate commitments.

In parallel, the longer-term transition would need to remain aligned with just transition considerations so that smaller enterprises, workers, and supply-chain actors are able to adapt without disproportionate disruption. This would imply continued attention to green skilling, re-skilling, technical workforce development, and phased adjustment pathways to support compliance readiness, advanced manufacturing needs, and evolving digital traceability systems. The broader report already recognises skills and just transition as a cross-cutting enabler of state transition readiness.

5.1.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

Progress toward the above transition direction will depend not only on enterprise-level action, but also on the enabling ecosystem, including policy support, finance, technical assistance, cluster-level infrastructure, skilling, and systems for monitoring and verification.

5.1.3.1 Enabling Policies, Finance and Institutional Support

Haryana's MSME transition is likely to require a stronger enabling framework for finance, incentives, technical facilitation, and institutional convergence than is presently available. The baseline suggests that existing support measures such as equipment subsidy and energy-audit reimbursement provide a useful entry point, but are not by themselves sufficient to support a wider cluster-based transition process.

The report points to several indicative instruments that may merit further examination, including green interest subvention, a credit-guarantee-linked green window, improved green tagging within the MSME credit architecture, and stronger convergence across industry, energy, pollution control, finance, and skill-development systems. These should be read as options for consultation and future design rather than as part of the current approved policy framework.

A further enabling requirement is likely to be the development of practical implementation tools for MSME transition. In this context, a Transition SOP for MSMEs may serve as a useful operational instrument to guide enterprise- and cluster-level planning. Such an SOP could cover baseline diagnostics, audit protocols, eligible transition technologies, financing pathways, compliance-readiness steps, monitoring formats, and institutional handholding arrangements.

Shared infrastructure and collective solutions may also be important in cluster environments where individual MSMEs face hard constraints of scale, location, space, or cost. Evidence from MSME transition studies suggests that certain sustainability and compliance barriers cannot always be addressed through enterprise-level action alone, and may instead require common facilities, common guidance, and coordinated support architecture.

5.1.3.2 Indicative KPIs and MRV for Consultation

To support phased implementation and future monitoring, the report retains a small set of indicative KPIs focused on physical transition progress, energy impact, compliance readiness, and finance mobilisation. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets.

Currently available baseline indicators and future programme-oriented indicators may need to be distinguished more explicitly in the final report. In particular, certain metrics such as enterprise traceability records, tagged green lending, and large-scale cluster solar aggregation are better treated as future design or programme indicators unless they are formally adopted and institutionally tracked.

Key indicators that may be retained in indicative form include:

- Cluster RESCO Solarization/ MSME Solar Penetration
- IE3 / IE4 Motor Phase-in
- Verified Energy Impact, including energy savings and clean generation
- Digital Carbon Passports or enterprise traceability records issued
- Green Finance Mobilization within the MSME credit architecture

Note: The KPIs presented below are illustrative and have not been approved as final targets. Specific baselines, thresholds, timelines, and quantified targets will need to be refined through subsequent consultation with relevant departments and stakeholders.

Table 5.2: Indicative KPIs for MSME Green Transition

KPI	Unit of Measurement	Current Baseline (Latest Available)	Illustrative Transition Direction (to be refined through consultation)	MRV Data Source / Verification Agency
Cluster RESCO Solarization / MSME Solar Penetration	% of eligible cluster rooftop base	< 5% penetration	Track progressive scaling of aggregated and cluster-based renewable energy uptake across eligible MSME rooftops; any numeric scale or milestone to be defined through subsequent consultation.	State Load Despatch Centre (SLDC) / DISCOM Net-metering portal
IE3/IE4 Motor Phase-in	Number of units replaced	Negligible formal replacement baseline; market dominated by rewound IE1/IE2 motors	Track progressive phase -in of efficient motor replacement in relevant unit categories; numeric threshold to be determined through consultation.	EESL National Motor Replacement Program (NMRP) MIS
Verified Energy Impact (Savings & Clean Generation)	MWh / year	No formal baseline currently tracked	Monitor progressive increase in audited energy savings and clean generation over time through programme -linked reporting.	Certified Level-2 Energy Audits + DISCOM On-Bill data
Digital Carbon Passports Issued	Number of compliant MSMEs	0	Progressive scale -up in export-linked and compliance-sensitive clusters, subject to adoption of an institutional digital registry framework.	Digital Carbon Registry / Unified Energy Interface (UEI)
Green Finance Mobilization	% share of MSME ACP	Not Officially Tracked	Indicative expansion through tagged green lending and improved reporting within the MSME credit architecture; thresholds to be defined subsequently.	SLBC Quarterly Reports (Post - Taxonomy integration)

Note: KPI items relating to digital carbon passports, tagged green lending, and large-scale cluster solar aggregation are programme-oriented and illustrative. They should be read as possible future monitoring variables for consultation and design purposes, rather than as approved baseline indicators or committed targets. Specific thresholds, reporting logic, and timelines would need to be finalised subsequently through departmental and stakeholder consultation

SECTOR 2: POWER & ENERGY

5.2 Sector 2: Power & Energy

The power and energy sector is examined here through a three-part transition lens. The section first sets out the present baseline and emerging risks, then outlines the indicative transition direction, and finally identifies the enabling measures that may support phased progress.

5.2.1 Where We Are

This section sets out the current power and energy transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.2.1.1 Sector Context

Power and energy constitute a foundational pillar of Haryana's green transition, with direct implications for industrial competitiveness, export readiness, public infrastructure, urban mobility, and overall resource efficiency. The State's wider transition challenge cannot be addressed without a parallel transition in how electricity is generated, supplied, accessed, and used across industrial, public, and infrastructure systems.

The relevance of this sector is reinforced by the broader framing of the report, which identifies clean power access and energy efficiency as one of the principal transition domains for Haryana. In this sense, power transition is important not only from the standpoint of emissions reduction, but also in relation to energy security, industrial cost competitiveness, compliance readiness, and the State's longer-term development pathway.

At the same time, Haryana's current power system continues to be shaped by significant dependence on conventional power sources, while renewable deployment, though expanding, remains limited in relation to total electricity demand and the wider requirements of industrial decarbonisation. The sector must therefore be viewed not as a stand-alone environmental domain, but as a core enabling system for Haryana's future growth, resilience, and competitiveness.

5.2.1.2 Current Baseline

Haryana's power and energy baseline reflects a system characterised by high overall electricity demand, a large installed power base, and growing renewable capacity, but one in which the effective role of cleaner power in actual supply remains relatively limited. This has direct implications for industrial competitiveness, emissions intensity, energy security, and the wider transition pathway.

As per the latest baseline used in this report, Haryana's total installed power capacity stands at 15,936.65 MW as of 31 December 2024. Within this, renewable installed capacity is recorded at 2,912.13 MW, comprising 2,512.96 MW of solar capacity, 325.67 MW of bio-power, and 73.50 MW of small hydro. Renewable energy is therefore an expanding component of the State's power profile, with solar accounting for the dominant share of the renewable base.

At the same time, the renewable share of the grid is reported at approximately 4.62 percent, indicating that the actual contribution of renewable energy to Haryana's overall power supply remains limited relative to total demand. This distinction is important because installed renewable capacity does not automatically translate into an equivalent share in effective grid supply. The baseline therefore suggests that while renewable capacity addition has progressed, the cleaner power share in actual electricity supply remains at an early stage in relation to the State's broader transition requirements.

Electricity demand in the State also remains substantial. Total units sold during FY 2024–25 (up to December 2024) are reported at 48,489.5 MkWh, while per-capita electricity consumption stands at 2,289 kWh. These indicators point to a high and expanding energy-use profile, reinforcing the need to address Haryana's transition challenge through both supply-side and demand-side measures.

Taken together, the current baseline highlights three broad features of Haryana's power and energy landscape. First, the State operates at a high scale of installed capacity and electricity consumption. Second, renewable capacity is expanding, with solar as the dominant renewable source. Third, the effective renewable share in actual supply remains relatively low, underlining the need for stronger attention to renewable integration, grid readiness, energy efficiency, and cleaner energy access.

Table 5.3: Haryana Power and Energy Baseline

Indicator	Value	Source cited in report	Remarks
Total Installed Power Capacity	15,936.65 MW	Economic Survey of Haryana 2024-25 (Table 4.6)	Official Audited Data as of 31 December 2024.
Renewable Installed Capacity	2,912.13 MW	MNRE / ICED State Profile (2025)	Includes Solar, Bio-power, and Small Hydro.
Solar Capacity	2,512.96 MW	ICED / MNRE Physical Progress (2024-25)	Major component (~86%) of state's RE base.
Bio-power Capacity	325.67 MW	ICED / HAREDA Physical Achievements	Includes biomass and bagasse-based power.
Small Hydro Capacity	73.50 MW	MNRE / ICED State Profile	Consistent baseline for small hydro units.
Renewable Share of Grid	~4.62%	ICED Haryana Supply Profile (2024-25)	Actual renewable contribution to the state grid.
Total Units Sold	48,489.5 MkWh	Economic Survey of Haryana 2024-25	Total for FY 2024 -25 (up to Dec 2024).
Per-Capita Consumption	2,289 kWh	Economic Survey / CEA Baseline	Latest per-capita demand metric for the state.

Note: Renewable share of grid reflects actual contribution to supply. Renewable installed capacity reflects the physical renewable asset base. Both indicators should be read together for a balanced understanding of the energy transition status.

5.2.1.3 Key Transition Risks, Constraints and Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the power and energy baseline presented in this report, read together with the broader state transition baseline in Chapter 3, relevant state and national policy and regulatory references, and selected comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions or approved policy positions.

The analysis suggests that Haryana's power transition challenge is not limited to renewable capacity addition alone, but is also shaped by questions of regulatory design, utility incentives, infrastructure readiness, and access conditions for industrial and commercial consumers.

A first important transition constraint appears to arise from the tension between clean power transition and existing DISCOM revenue structures. The report notes that industrial and commercial consumers continue to provide an important cross-subsidy base within the power system. In such a setting, wider adoption of open access solar by industrial consumers, including MSMEs, may be perceived as a potential loss of utility revenue. This can create friction in the form of surcharge-related barriers, administrative hesitation, or slower adoption of decentralised renewable procurement pathways.

A second gap emerging from the analysis relates to the scale of renewable penetration relative to future demand and transition requirements. Although the renewable asset base has expanded, the effective renewable share in actual supply remains limited. This may become increasingly material for sectors that require cleaner electricity to align with renewable purchase obligations, buyer-side sustainability expectations, or evolving supply-chain and carbon-disclosure requirements. In this sense, the issue is not only one of capacity creation, but also of the adequacy of clean power availability in relation to future economic demand.

A third enabling gap appears to concern infrastructure and land coordination for utility-scale renewable expansion. The report indicates that renewable scale-up may require more effective alignment across land identification, project facilitation, and interdepartmental approvals, especially where Revenue, Forest, Industry, Irrigation, and power-sector institutions must work in coordination. Delays or fragmentation in this process may affect both the pace and the bankability of renewable projects.

A fourth barrier identified in the draft is the limited access of a large share of MSMEs to green open access, owing to existing load thresholds and associated restrictions. This may constrain the ability of smaller industrial users to participate in decentralised renewable procurement and reduce the practical reach of clean power transition across industrial clusters. As a result, the renewable transition may remain concentrated among larger consumers unless enabling reforms are considered.

A fifth transition challenge lies in the need to strengthen the system-level link between clean power supply and emerging demand from public assets, industrial estates, urban infrastructure, and electric mobility. Without better alignment between renewable-energy planning and these future demand centres, the power transition may remain fragmented and less effective than required for Haryana's longer-term green transition pathway.

Taken together, these findings suggest that the power transition challenge in Haryana is best understood as a combined issue of renewable integration, regulatory design, industrial access, grid and land coordination, and institutional alignment, rather than as a simple question of adding more renewable assets.

For clarity, the key green transition challenges emerging from the power and energy baseline may be summarised as follows:

- limited effective renewable penetration in actual power supply relative to overall demand;
- tension between clean power transition and existing DISCOM revenue structures;
- infrastructure, land, and coordination bottlenecks affecting renewable scale-up;
- constrained access of MSMEs and smaller industrial consumers to open-access clean power; and
- insufficient integration between renewable expansion and emerging demand from industry, public assets, and cleaner mobility.

5.2.2 Where We Want to Go

This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

The future direction for Haryana's power and energy transition may be understood across two horizons: a medium-term pathway focused on practical transition priorities during 2026–2030, and a longer-term direction aligned with the Vision 2047 horizon.

5.2.2.1 Medium-Term Indicative Transition Direction (2026-2030)

In view of the above, the report points toward a set of indicative medium-term transition directions for the 2026–2030 period that could strengthen Haryana's clean-energy readiness while addressing industrial, public-sector, and infrastructure-related demand. These should be read as possible areas for phased action and further validation rather than as predetermined commitments.

One important transition direction may be reform of the green open-access framework so that smaller industrial consumers, including MSMEs, can participate more effectively in decentralised renewable procurement. A lowering of threshold barriers and reduction of disincentives could materially widen access to clean power and improve the practical reach of renewable transition across industrial clusters.

A second direction may be the development of land-efficient and context-appropriate renewable models, including canal-top solar and other forms of distributed or semi-distributed renewable deployment. Such approaches may be especially relevant in a state context where land-use coordination, infrastructure optimisation, and resource efficiency are important considerations.

A third medium-term direction may be the bundling of energy-efficiency retrofits with rooftop solar and related clean-energy measures on government buildings and public assets through performance-based delivery models. This could help reduce public energy costs, generate demonstration value, and deepen the market for scalable energy-service delivery within the State.

A fourth direction that may warrant phased examination is the piloting of feeder-level renewable readiness and demand aggregation in priority industrial areas. Such pilots could help test technical integration models, localised clean-power access strategies, and more practical approaches to industrial decarbonisation before wider scaling.

A fifth direction may be the closer integration of the power transition with the transport sector, especially through cleaner electricity access for bus electrification, charging ecosystems, and associated public-energy infrastructure. This underscores that the energy transition is not confined to electricity generation alone, but also extends to the decarbonisation of public service delivery and the shaping of future electricity demand patterns.

Taken together, the medium-term direction is not simply toward more renewable capacity, but toward a more accessible, better-integrated, and more transition-responsive energy system capable of supporting industrial and public-sector decarbonisation.

5.2.2.2 Long-Term Direction (2031–2047)

Over the longer term, Haryana's power transition may move toward a progressively cleaner, more flexible, and more integrated energy system aligned with the Vision 2047 horizon. This long-term direction may include a substantially greener supply mix, stronger renewable integration, improved balancing capability, and more intelligent coordination between generation, distribution, storage, and end-use demand.

Over time, the State may also see the emergence of new clean-energy opportunities within its economy, including grid-scale storage, stronger balancing systems, and the potential to position Haryana as a regional node for selected clean-energy technologies and services such as advanced energy management, storage-linked solutions, and other emerging transition-related sectors. These elements should be viewed as directional rather than as immediate commitments.

The report also suggests that more decentralised and digitally enabled energy models may become increasingly relevant over time, including peer-to-peer transactions, virtual aggregation arrangements, and more intelligent energy-management systems for industrial clusters and large consumers. These ideas are best understood as longer-term strategic possibilities that help position the power sector within Haryana's future economic and industrial landscape.

5.2.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

Progress toward the above transition direction will depend not only on generation-side action, but also on the enabling ecosystem, including regulatory design, financing support, grid readiness, technical facilitation, cross-departmental coordination, and systems for monitoring and verification.

5.2.3.1 Enabling Policies, Finance and Institutional Support

Haryana's power transition is likely to require not only technical interventions but also a more enabling framework for policy coordination, regulatory design, and financing support. One important area is the design of an open-access architecture that more effectively balances the transition needs of industrial consumers with the financial realities of DISCOMs. Future policy work may therefore need to focus on transition-compatible access rules that widen clean-power access without destabilising the underlying revenue structure of the power system.

The report also indicates the relevance of feeder solarisation, public-asset energy retrofits, distributed renewable approaches, and scalable ESCO-type delivery models that can support local generation while easing pressure on conventional supply. These should be read as indicative policy and programme options for further examination rather than as part of an already approved implementation package.

A further enabling requirement is likely to be stronger convergence across the power sector and related departments where renewable integration intersects with industrial estates, irrigation infrastructure, public assets, transport electrification, and financing structures. In this sense, the challenge is not only one of energy policy, but also one of cross-sector coordination and implementation design.

5.2.3.2 Indicative KPIs and MRV for Consultation

To support phased implementation and future monitoring, the report may retain a set of indicative KPIs for the power and energy sector. These focus on renewable penetration, industrial access to cleaner power, public-sector energy transition, and broader demand and efficiency trends. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets. Their purpose is to indicate possible areas for future tracking, while recognising that specific baselines, thresholds, timelines, and quantified targets would need to be refined through subsequent consultation with relevant departments and stakeholders.

The renewable installed-capacity share and renewable share in actual supply should be treated as separate indicators, since they reflect different dimensions of transition progress. Similarly, some indicators may function as current baseline metrics, while others are better understood as programme-oriented indicators that would become meaningful only if formal transition interventions are adopted and institutionally tracked.

Indicative KPIs that may be retained in the report include:

- Renewable Installed Capacity Share
- Renewable Share in Actual Power Supply / Power Purchased
- Number of MSMEs on Open Access Solar
- Canal-Top Solar Capacity Commissioned
- State Bus Fleet Electrification Rate
- Total Electricity Supplied / Demand Trend

Table 5.4: Indicative KPIs for Power and Energy Transition

KPI	Unit	Current Baseline (2024/25)	Illustrative Transition Direction (to be refined through consultation)	MRV Data Source / Verification Agency
RE Share of Grid/ Actual Renewable Contribution to Supply	% of total supply	~4.62%	Monitor progressive expansion in the share of cleaner and renewable electricity within the State's supply mix; any quantified milestone to be refined through consultation.	HAREDA / ICED
MSMEs on Open Access Solar	Number of units/ PPAs	Near zero (constrained by existing 100 kW load threshold)	Track broader uptake of open - access or other cleaner power pathways among eligible MSMEs, subject to policy and regulatory conditions; numeric threshold to be defined subsequently.	DISCOM / HERC
Canal-top Solar Commissioned	MW Capacity	0 MW	Track phased commissioning of canal-top solar capacity where technically and financially viable; scale and timeline to be refined through consultation.	HAREDA / Irrigation Dept.
State Bus Fleet Electrification	% of operation al fleet	Initial stage (<2% of operational fleet; based on current pilot -scale deployment)	Monitor progressive increase in electrification of the operational public transport fleet, subject to procur ement, charging, and fiscal readiness.	Transport Dept.
Total Electricity Sold / Demand Proxy	MkWh	48,489.5 MkWh (sold up to Dec 2024)	Track annual demand and supply trends as a contextual monitoring indicator for power-system transition planning, rather than as a stand-alone performance target	Economic Survey

Note: The indicators presented above combine both currently available baseline metrics and future programme-oriented monitoring variables. They should be interpreted as illustrative monitoring directions for consultation purposes, rather than as approved targets or implementation commitments. Specific thresholds, timelines, and target values would need to be finalised subsequently through departmental and stakeholder consultation.

SECTOR 3: STEEL

5.3 Sector 3: Steel

The steel sector is examined here through a three-part transition lens. The section first sets out the present baseline and emerging risks, then outlines the indicative transition direction, and finally identifies the enabling measures that may support phased progress.

5.3.1 Where We Are

This section sets out the current steel transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.3.1.1 Sector Context

Haryana's steel ecosystem forms an important part of the State's industrial and engineering base, with relevance for manufacturing value chains, downstream exports, and future green industrialisation. The sector is geographically anchored in Hisar, where legacy rolling-mill and stainless-steel activity coexists with a major greenfield opportunity in the form of the upcoming Integrated Manufacturing Cluster (IMC) Hisar, spanning 2,988 acres. Faridabad, meanwhile, remains a significant downstream node linked to secondary steel, forging, and foundry activity. This creates a dual transition context for Haryana: one part of the sector is shaped by legacy industrial assets, while another presents an opportunity to embed lower-carbon design principles from the outset.

The steel sector is strategically important because it sits at the intersection of industrial competitiveness, export exposure, and emissions intensity. The Faridabad engineering cluster is already a major export node, while energy costs in secondary steel, forging, and foundry operations remain a significant component of operating expenditure. In that sense, the sector is particularly sensitive to energy-price volatility, carbon-linked trade measures, and evolving compliance expectations associated with lower-carbon production systems.

This makes steel transition relevant not only from the standpoint of emissions reduction, but also in relation to export resilience, industrial upgrading, and the future positioning of Haryana's manufacturing base within greener value chains.

5.3.1.2 Current Baseline

Haryana's steel transition baseline is defined by a combination of legacy industrial assets, relatively high energy intensity, and a major emerging greenfield opportunity. Hisar represents the State's most important strategic location for future low-carbon steel and metallurgical industrial development, especially with the proposed IMC Hisar. Faridabad, by contrast, is characterised by an existing concentration of downstream engineering, forging, and foundry units that remain dependent on conventional production systems and fossil-fuel-intensive energy use.

The baseline further indicates that Haryana's secondary steel and forging clusters rely heavily on grid electricity with a relatively high thermal emission factor, together with direct fossil fuels such as coal and furnace oil. This contributes to elevated Scope 1 and Scope 2 carbon exposure, particularly in clusters linked to export markets and therefore more likely to face future climate-trade and buyer-side sustainability pressures.

The sector baseline highlights several important reference points. IMC Hisar covers 2,988 acres, making it one of the State's most significant future industrial-development sites. The Faridabad engineering cluster accounts for ₹22,873 crore in exports, underlining the sector's economic importance and international market exposure. Energy cost in forging units is reported at roughly 22–30 percent of operating expenditure, indicating strong cost sensitivity to electricity and fuel prices. The State steel specific energy consumption benchmark is noted at 5.8–6.4 Gcal/tonne, while a global best-reference range of 4.5–5.0 Gcal/tonne suggests a visible efficiency gap.

The baseline also indicates that iron and steel account for the highest sectoral share in IPPU emissions, reinforcing the significance of the sector from an industrial-emissions perspective. Taken together, the current position suggests that Haryana's steel transition challenge is not confined to one cluster or one technology pathway. It includes both the need to improve efficiency and reduce carbon intensity in existing downstream and secondary-steel ecosystems, and the opportunity to shape new industrial infrastructure in a more future-ready and lower-carbon manner.

Table 5.5: Haryana Steel Sector Baseline

Indicator	Value	Source cited in report	Remarks
IMC Hisar Area	2,988 Acres	NICDC / PIB (Feb 2026)	Largest greenfield project under the Amritsar–Kolkata Industrial Corridor (AKIC)
Faridabad Engineering Exports	₹22,873 Crore	Economic Survey 2024-25 (AE)	Reflects a ~12% growth over FY24; primary hub for forging/casting clusters.
Energy Cost in Forging Units	22–30% of OPEX	SEEAP 2025 / Industry Survey	High sensitivity to PNG pricing and electricity tariffs; core focus for EE.
State Steel SEC Benchmark	5.8–6.4 Gcal/tonne	BEE PAT Cycle / SEEAP 2025	Baseline for induction furnaces and mini-mills prevalent in the state.
Global Best SEC Benchmark	4.5–5.0 Gcal/tonne	World Steel Association (2025)	Represents the "Efficiency Gap" of ~25% that the state transition must bridge.
IPPU Emissions Contribution	Highest Sectoral Share	GHG Platform / HSPCB 2025	Iron & Steel remains the primary driver of industrial process emissions in the state.

5.3.1.3 Key Transition Risks, Constraints and Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the steel baseline presented in this report, read together with the broader State transition baseline, relevant policy and regulatory references, stakeholder discussions, and selected comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions or approved policy positions.

The baseline suggests that several transition constraints are emerging in Haryana's steel ecosystem, particularly in relation to export competitiveness, energy intensity, technology lock-in, infrastructure design, and the absence of a clearer low-carbon industrial framework.

A first important transition risk arises from carbon-linked trade and market exposure, particularly in the Faridabad engineering and forging cluster. Export-linked steel and forged products may face increasing pressure in markets where carbon intensity, energy source, and embedded emissions are becoming more material to procurement and compliance decisions. Where production remains dependent on fossil-fuel-based process heat and carbon-intensive electricity, this may increasingly affect competitiveness, especially in segments already operating under cost pressure.

A second transition risk concerns greenfield infrastructure lock-in in IMC Hisar. If new industrial infrastructure is developed on conventional utility designs, the State may risk embedding higher-carbon assets, less efficient layouts, and less flexible utility systems into a strategic industrial zone expected to operate over the long term. This could reduce future transition flexibility and increase retrofit costs later.

A third enabling gap appears to be the absence of a clearer state-level green steel framework and more explicit “Born Green” design standards for new industrial infrastructure. At present, there does not appear to be a sufficiently standardised low-carbon infrastructure framework through which new entrants can be guided toward cleaner technologies, lower-carbon utility design, renewable-linked production systems, and more resource-efficient industrial layouts. In the absence of such an architecture, public agencies, financial institutions, and industrial developers may lack a clearer basis for differentiated support and transition-oriented planning.

A fourth challenge concerns the sector's underlying energy-intensity gap. The reported specific energy consumption values remain above international best-reference ranges, suggesting scope for efficiency improvement, process modernisation, waste-heat optimisation where relevant, and cleaner energy substitution. This appears especially material in forging and foundry segments where energy cost already accounts for a substantial share of operating expenditure.

A fifth constraint relates to access to credible low-carbon finance and pooled infrastructure support. Steel transition, especially in clustered and greenfield settings, may require financing for shared utilities, common infrastructure, cleaner energy systems, and efficiency upgrades that are difficult to mobilise through fragmented enterprise-level investment alone.

Taken together, these findings suggest that steel transition in Haryana is not only a matter of emissions reduction. It is also a question of export resilience, industrial design standards, infrastructure planning, technology choice, and access to credible financing and transition-support architecture.

For clarity, the key green transition challenges emerging from the steel baseline may be summarised as follows:

- rising export and market exposure linked to carbon intensity and cleaner-production expectations;
- risk of greenfield carbon and infrastructure lock-in in new industrial zones such as IMC Hisar;
- absence of a clearer state-level green steel or “Born Green” industrial design framework;
- persistent energy-intensity gaps in downstream and secondary steel processes; and
- limited access to structured low-carbon finance and shared transition infrastructure.

5.3.2 Where We Want to Go

This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

The future direction for Haryana's steel transition may be understood across two horizons: a medium-term pathway focused on practical transition priorities during 2026–2030, and a longer-term direction aligned with the Vision 2047 horizon.

5.3.2.1 Medium-Term Transition Direction (2026-2030)

In view of the above, the report points toward a set of indicative medium-term transition directions for the 2026–2030 period focused on greenfield standards, shared infrastructure, efficiency improvement, and lower-carbon industrial positioning. These should be read as possible areas for phased action and further validation rather than as predetermined commitments.

One important transition direction may be the adoption of “Born Green” design principles for IMC Hisar so that new industrial sheds, common utilities, water systems, and supporting infrastructure are designed to higher sustainability standards from the outset. This is especially relevant because IMC Hisar represents a relatively rare opportunity to embed lower-carbon and more resource-efficient industrial design before conventional patterns become locked in.

A second medium-term direction may be the mobilisation of pooled or structured finance for shared green infrastructure in new or transitioning industrial clusters.

This may include common utility systems, resource-efficiency infrastructure, renewable-linked industrial assets, and other cluster-scale facilities that individual firms may find difficult to finance on a stand-alone basis.

A third direction may be targeted efficiency improvement in Faridabad's forging, foundry, and related downstream industrial segments through process modernisation, equipment upgrades, and cleaner-energy integration. Rather than presenting a fixed numerical target at this stage, the report may frame this as an indicative improvement direction subject to audited baseline validation and consultation with industry stakeholders.

A fourth transition direction may be the gradual strengthening of market readiness for lower-carbon material sourcing and cleaner steel-related value chains, especially where Haryana's auto, engineering, and export-oriented manufacturing ecosystems may increasingly require greener input materials over time.

Taken together, the medium-term direction suggests a dual strategy for Haryana's steel ecosystem: build green from the start in Hisar, while improving energy performance and carbon readiness in Faridabad and other existing downstream clusters.

5.3.2.2 Long-Term Direction (2031–2047)

Over the longer term, Haryana's steel transition may move toward a more advanced trajectory in which the State develops both greener recycled-steel pathways and cleaner industrial metallurgy systems. This longer-term direction may include a growing role for lower-carbon scrap-based production, stronger renewable-linked industrial energy use, and the gradual emergence of cleaner production capacity in new industrial zones. These elements should be understood as directional rather than as immediate commitments.

The report also points toward the possibility that a larger share of steel and allied industrial materials used in Haryana's manufacturing systems could eventually be sourced from greener recycled or lower-carbon pathways developed within or linked to the State. In the case of IMC Hisar, the longer-term possibility of more advanced low-carbon production systems, including future hydrogen-linked pathways, may be retained as part of a strategic horizon rather than as a near-term commitment.

Overall, the long-term direction is toward a steel ecosystem that is more efficient, more resilient to carbon-linked market pressures, and better aligned with emerging expectations around cleaner industrial production and greener manufacturing value chains.

5.3.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

Progress toward the above transition direction will depend not only on plant-level change, but also on the enabling ecosystem, including industrial design standards, transition finance, shared infrastructure, technical facilitation, and systems for monitoring and verification.

5.3.3.1 Enabling Policies, Finance and Institutional Support

Haryana's steel transition is likely to require a stronger enabling framework for industrial standards, low-carbon infrastructure, and transition finance. One important area is the formulation of clearer green industrial design standards for new clusters, so that sustainability-related requirements are integrated into infrastructure planning, utility systems, water management, cleaner energy access, and building standards from the design stage itself.

The report also indicates the relevance of financing instruments capable of supporting shared green infrastructure in industrial clusters and IMCs. These may include pooled finance, concessional support, or other structured instruments for common utility systems, resource-efficiency infrastructure, renewable-linked industrial assets, and transition-support facilities. Such options should be read as indicative areas for policy examination rather than as approved instruments at this stage.

In parallel, greater policy clarity may be needed on what should qualify as greener or lower-carbon steel within the Haryana context, especially if concessional finance, interest support, procurement preferences, or other transition-oriented incentives are to be aligned with cleaner technologies and production systems.

A further enabling requirement is likely to be stronger convergence between industrial planning, infrastructure development, energy systems, and environmental compliance so that new industrial growth does not reproduce conventional high-carbon patterns by default.

5.3.3.2 Indicative KPIs and MRV for Consultation

To support phased implementation and future monitoring, the report may retain a set of indicative KPIs for Haryana's steel transition. These focus on greenfield compliance, energy-intensity reduction, transition-oriented infrastructure finance, and greener material sourcing. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets. Their purpose is to indicate possible areas for future tracking, while recognising that specific baselines, thresholds, timelines, and quantified targets would need to be refined through subsequent consultation with relevant departments and stakeholders.

Currently available reference indicators and future programme-oriented indicators may need to be distinguished more explicitly in the final report. In particular, some metrics such as transition-oriented infrastructure finance deployment or greener material procurement shares are better treated as programme or design indicators unless they are formally adopted and institutionally tracked.

Key indicators that may be retained in indicative form include:

- Greenfield compliance with "Born Green" design principles in IMC Hisar;
- Energy-intensity improvement in Faridabad forging and foundry segments;
- Mobilisation and deployment of transition-oriented infrastructure finance; and
- Progress in greener recycled or lower-carbon material sourcing within relevant manufacturing clusters

Table 5.6: Indicative KPIs for Steel Sector Transition

KPI	Unit of Measurement	Current Baseline/ Reference Position	Illustrative Transition Direction (to be refined through consultation)	MRV Data Source / Verification Agency
IMC Hisar -"Born Green" Compliance	% of new sheds/facilities covered	New cluster development stage	Track progressive adoption of higher sustainability and lower-carbon design standards in new industrial facilities; detailed criteria, coverage thresholds, and verification logic to be refined through consultation.	Cluster development / building compliance records
Faridabad Forging - Energy Intensity Reduction	% improvement versus validated baseline	To be established through audited cluster baseline	Monitor progressive improvement in energy intensity relative to a validated audited baseline, with thresholds and reporting methodology to be defined through consultation.	Certified energy audits / relevant compliance records
Transition-Oriented Infrastructure Finance Mobilised	₹ crore or equivalent approved deployment	No formal baseline under current report structure	Track indicative mobilisation and deployment of pooled or transition-oriented finance for shared green infrastructure, subject to policy design and institutional approval.	Relevant public finance / project reporting systems
Greener Recycled / Lower-Carbon Steel Share in Relevant Manufacturing Hubs	% share of total relevant steel procurement or use	Not formally tracked	Monitor progressive improvement in greener recycled or lower-carbon material sourcing where a credible tracking and reporting architecture is established.	Industry reporting / association data where available

Note: Some KPI items in this table are better understood as future programme or design indicators rather than currently institutionalised baseline measures. They should therefore be interpreted as illustrative monitoring directions for consultation purposes, rather than as approved targets or implementation commitments. Specific thresholds, target values, timelines, and verification arrangements would need to be finalised subsequently through departmental and stakeholder consultation.

SECTOR 4: AUTOMOTIVE

5.4 Sector 4: Automotive

5.4.1 Where We Are

This section sets out the current automotive transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.4.1.1 Sector Context

Haryana's automotive ecosystem is one of the State's most important industrial growth engines and a central anchor of its export economy. The Gurugram–Manesar automotive and engineering cluster is the State's single largest export node, generating ₹52,450 crore in FY 2023-24 and projected at ₹58,639 crore in FY 2024-25 (advance estimates). This gives the sector outsized importance for manufacturing output, employment, supplier ecosystems, and trade competitiveness.

The sector is now entering a structural transition shaped by two parallel shifts. First, globally integrated OEMs in the region—such as Maruti Suzuki, Honda, and Hero MotoCorp—are moving toward carbon-neutral supply chains over the 2040–2050 horizon. Second, climate-trade and ESG compliance expectations are increasingly cascading down from OEMs to their Tier-1, Tier-2, and Tier-3 vendor base. This makes automotive transition in Haryana not only a question of vehicle technology, but also of supplier decarbonisation, digital traceability, and market access.

For Haryana, this creates a dual automotive transition challenge:

- maintaining export competitiveness in a carbon-constrained supply-chain environment; and
- managing the industrial and workforce shift from legacy Internal Combustion Engine (ICE)-linked manufacturing toward EV, electronics, battery, and software-linked value chains

5.4.1.2 Current Baseline

Haryana's automotive transition baseline is defined by a combination of strong export dependence, high OEM concentration, and a growing compliance burden on the MSME vendor ecosystem.

The Gurugram–Manesar cluster is the State's largest automotive and engineering export corridor, with exports of ₹52,450 crore in FY 2023-24 and ₹58,639 crore in

FY 2024-25 (advance estimates). This makes the automotive sector one of the most important channels through which global sustainability mandates are transmitted into Haryana's industrial base.

A key feature of the current baseline is the shift from traditional pollution-control compliance toward supply-chain carbon compliance. In practical terms, the central challenge for many automotive suppliers is increasingly Scope 3—the carbon footprint embedded in procured parts and intermediate goods—rather than only direct factory emissions. Tier-2 and Tier-3 vendors manufacturing components such as castings, fasteners, and plastics are increasingly exposed to ESG audit requirements and component-level emissions reporting expectations from anchor buyers.

The baseline also indicates a serious digital readiness gap. Many vendors still lack unit-level digital MRV systems capable of measuring and reporting product-level or facility-level emissions. This creates a structural vulnerability in a business environment where buyers increasingly require auditable carbon disclosure and traceability.

At the same time, the sector remains exposed to the carbon profile of the wider grid. Even efficient units can face a significant Scope 2 penalty where electricity is drawn from a grid with a high thermal share. This reduces the competitiveness of vendors in ESG-sensitive supply chains unless they gain improved access to decentralized green power, rooftop solar, or open access renewable procurement.

Table 5.7: Haryana Automotive Sector Baseline

Indicator	Value	Source Cited in Report	Remarks
Gurugram–Manesar Auto/Eng. Exports (FY 2023-24)	₹52,450 crore	Economic Survey of Haryana 2024-25	Largest single export node in the State; critical for GSDP.
Gurugram–Manesar Auto/Eng. Exports (FY 2024-25 AE)	₹58,639 crore	Economic Survey of Haryana 2024-25	High export concentration risk under Scope 3, ESG, and buyer-driven decarbonisation pressures.
Dominant Cluster Risk Driver	High Scope 3 exposure	Export cluster baseline	OEM net-zero mandates and Tier-2 vendor delisting risk.
OEM Decarbonisation Trajectory	2040–2050 carbon-neutrality	Corporate sustainability / BRSR disclosures	Strong downstream compliance pressure on supplier base.
Tier-1/2 Suppliers with Carbon Reports	~0% (manual baseline)	Sector KPI baseline	Indicates low current MRV (Monitoring, Reporting, Verification)readiness.
Tier-2/3 MSMEs on Rooftop Solar	<5%	Sector KPI baseline	Indicates weak decentralized clean power uptake in the ecosystem.
Scope 2 Emissions Intensity (Grid)	~0.72 $kgCO_2e/kWh$	CEA 2024 grid average	Represents the carbon penalty embedded in standard grid electricity.

5.4.1.3 Key Transition Risks and Enabling Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the automotive baseline presented in this report, read together with the broader state transition baseline in Chapter 3, relevant state and national policy and regulatory references, stakeholder discussions, and selected comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions or approved policy positions. This is consistent with the report's stated methodology, evidence hierarchy, and consultation-oriented interpretation.

In addition to the sector-specific baseline presented above, the automotive transition challenge for Haryana's supplier ecosystem may also be viewed through the lens of MSME adjustment pressures. Evidence from just transition studies indicates that smaller automotive firms may face a combination of technological uncertainty, financial constraints, emerging buyer-side disclosure expectations, and skill-related adjustment needs. This is particularly relevant in supply chains that are expected to progressively align with lower-emission production, cleaner power use, stronger traceability, and changing product and component requirements. For smaller and mid-tier suppliers, the transition challenge is therefore not only one of decarbonisation, but also one of phased industrial adaptation.

The analysis suggests that Haryana's automotive transition challenge is primarily one of supplier readiness, data systems, clean power access, and workforce adaptation, rather than of final-assembly competitiveness alone.

A first important transition risk appears to arise from high Scope 3 exposure in the Gurugram–Manesar export corridor. Because the cluster is deeply integrated with OEM-led supply chains, transition pressure is increasingly transmitted downstream to smaller vendors through expectations on embedded emissions, carbon reporting, and cleaner sourcing. In the absence of adequate support systems, this may create vendor delisting risks, compliance pressure, or reduced market access for suppliers unable to demonstrate traceable decarbonisation progress.

A second enabling gap relates to carbon-accounting and digital MRV readiness at supplier level. The draft baseline suggests that a very limited share of Tier-1/2 suppliers presently maintain formal carbon-footprint reporting, while many Tier-2/3 suppliers lack auditable digital systems altogether. This may reduce the ability of Haryana's vendor base to respond to increasingly data-intensive procurement and ESG expectations.

A third constraint concerns limited clean power penetration among vendor MSMEs. With rooftop solar uptake among Tier-2/3 units still below 5 per cent and with continued dependence on a grid carrying a significant thermal share, suppliers may remain exposed to a persistent Scope 2 disadvantage. This may become more material over time as OEM ecosystems place greater emphasis on renewable electricity, supplier disclosures, and carbon-intensity reduction per unit of output.

A fourth transition risk relates to the gradual shift from ICE-linked manufacturing toward EV-, electronics-, battery-, and software-linked value chains. While this transition will unfold over time and at different speeds across sub-sectors, it may eventually create adjustment pressures for firms and workers linked primarily to legacy component categories. In this sense, the sector's transition challenge is not only environmental; it is also industrial and workforce-related.

Taken together, these findings suggest that automotive transition in Haryana is best understood as a supplier decarbonisation and industrial adaptation challenge, requiring coordinated attention to digital traceability, clean power access, vendor-upgradation systems, and longer-term skilling pathways. Accordingly, the key transition challenges in the automotive supplier ecosystem may be summarised as:

- rising pressure for supplier-side carbon and compliance readiness;
- uneven access to clean power and enterprise-level data systems;
- financial constraints for smaller firms undertaking technology and process upgrades;
- limited preparedness for longer-term technology shifts in the mobility ecosystem; and
- the need for anticipatory skilling and phased support for supplier adaptation.

5.4.2 Where We Want to Go

This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

5.4.2.1 Indicative Transition Priorities for 2026–2030

In view of the above, the report points toward a set of indicative transition priorities for the 2026–2030 period focused on supplier readiness, green power uptake, and traceability infrastructure. These should be read as possible areas for phased action and further validation rather than as pre-determined commitments.

One priority area that may merit consideration is the development of a vendor carbon-readiness programme for automotive suppliers in the Gurugram–Manesar ecosystem. Such a programme could support enterprise-level carbon accounting, facility audits, supplier categorisation, and phased reporting readiness for export-linked and OEM-linked vendor bases. This would help shift the sector from informal or manual disclosure practices toward more structured compliance preparedness.

A second area that could be prioritised is green power uptake among Tier-2/3 suppliers, especially through rooftop solar, decentralised renewable access, or cluster-level clean power facilitation. Given the current baseline of low supplier solar penetration and continued grid-related carbon exposure, this appears to be one of the more practical medium-term transition levers within the automotive ecosystem.

A third indicative priority is the development of a digital MRV / registry-linked automotive supplier traceability system, potentially linked to the proposed Haryana Digital Carbon Registry or UEI-based architecture referenced elsewhere in the report. Such a system may help improve data consistency, auditable carbon reporting, and buyer-facing documentation across export-linked supplier networks.

A fourth priority that may warrant phased examination is a targeted skilling and re-skilling pathway for workers and supplier firms likely to be affected by the long-term transition from ICE-dominant manufacturing toward EV and electronics-linked systems. This should be viewed as an anticipatory measure rather than as an assumption of immediate displacement.

Taken together, these priorities suggest that Haryana's automotive transition in the medium term may need to focus less on broad sector repositioning and more on supplier ecosystem strengthening, particularly in relation to carbon data, cleaner electricity, and OEM-facing compliance readiness.

5.4.2.2 Long-Term Direction (2031–2047)

Over the longer term, the report points toward a more advanced automotive transition pathway in which Haryana's automotive ecosystem progressively aligns with carbon-neutral supply-chain expectations, cleaner energy use, and greater integration of EV-, electronics-, battery-, and software-related manufacturing capabilities. These elements should be viewed as directional rather than as immediate commitments.

The long-term direction also implies that supplier competitiveness may become increasingly dependent on demonstrated carbon transparency, lower Scope 2 exposure, and improved material and energy traceability. In that sense, the transition horizon for the sector is likely to involve not only cleaner production, but also deeper digitalisation, more standardised reporting systems, and stronger alignment with global procurement norms.

At the same time, the sector's long-term transition would need to remain attentive to Just Transition considerations, particularly in relation to workforce adaptation, supplier diversification, and the capacity of smaller component manufacturers to adjust gradually to changing technology and compliance requirements. This suggests a continuing role for skilling, transition support, and phased vendor-upgradation over the 2031–2047 horizon.

5.4.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

5.4.3.1 Enabling Policies and Finance Considerations

Haryana's automotive transition is likely to require a stronger enabling framework for supplier-upgradation, clean power access, digital traceability, and skilling support. A first area of relevance is the creation of policy and programme instruments that help smaller vendors adopt carbon-accounting systems, participate in audit-based supplier decarbonisation programmes, and access cleaner power solutions in a cost-effective manner. These should be read as indicative enabling measures for further consultation rather than as final policy positions.

The report also points to the importance of institutional coordination across the Department of Industries & Commerce, OEM-linked industrial ecosystems, HSIIDC, DISCOMs, digital MRV / registry institutions, and skilling and compliance agencies, depending on intervention area. This suggests that the sector's transition may require more coordinated support architecture than is presently available if supplier decarbonisation is to be scaled in a structured way.

From a finance perspective, the report does not present a fully developed dedicated automotive transition instrument in the baseline chapter. However, the evidence suggests that supplier transition may benefit from convergence with broader MSME green-finance approaches, audit support systems, rooftop solar facilitation, and digital compliance infrastructure. This is best presented as an indicative policy direction for further exploration.

5.4.3.2 Indicative KPIs and MRV Framework

To support phased implementation and future monitoring, a set of indicative KPIs is proposed for Haryana's automotive transition. These focus on vendor carbon-reporting readiness, supplier green power uptake, and Scope 2 emissions exposure. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets. Their purpose is to indicate possible areas for future tracking, while recognising that specific baselines, thresholds, timelines, and quantified targets would need to be refined through subsequent consultation with relevant departments and stakeholders.

Some indicators in this section are best understood as programme-oriented monitoring variables rather than currently institutionalised baseline measures. In particular, wider supplier carbon reporting, cluster-level rooftop solar uptake, and sector-level Scope 2 intensity improvement would become more meaningful as structured monitoring indicators only where formal implementation and reporting architecture is established.

Key indicators identified in the sector include:

- Tier-1/2 Suppliers with Carbon Footprint Reports
- Tier-2/3 MSMEs on Rooftop Solar
- Scope 2 Emissions Intensity (Grid Penalty per Unit Output)

Table 5.8: Indicative KPIs for Automotive Sector Transition

KPI	Unit of Measurement	Current Baseline (Latest Available)	Illustrative Transition Direction (to be refined through consultation)	MRV Data Source / Verification Agency
Tier-1/2 Suppliers with Carbon Footprint Reports	% of registered export vendors	~0% (current manual accounting)	Progressive moveme nt toward wider carbon-reporting readiness in the export-linked supplier base; formal threshold to be defined through consultation.	Haryana Digital Carbon Registry / nodal MRV platform
Tier-2/3 MSMEs on Rooftop Solar	% of cluster units	< 5%	Track broader adoption of rooftop solar in cluster-based supplier units; numeric threshold to be refined through consultation.	Unified Energy Interface (UEI) / DISCOM
Scope 2 Emissions Intensity (Grid penalty per unit output)	$kgCO_2e/kWh$	~0.72 $kgCO_2e/kWh$ (CEA 2024 Grid Average)	Track broader adoption of rooftop solar in cluster-based supplier units; numeric threshold to be refined through consultation.	UEI Data + OEM ESG Audit Reports

Note: The KPI entries presented above should be interpreted as illustrative monitoring directions for consultation purposes, rather than as approved targets or implementation commitments. Specific thresholds, timelines, and target values would need to be finalised subsequently through departmental and stakeholder consultation.

SECTOR 5: TEXTILES

5.5 Sector 5: Textiles

5.5.1 Where We Are

This section sets out the current textiles transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.5.1.1 Sector Context

Haryana's textiles sector is a significant part of the State's manufacturing and export economy, with Panipat functioning as its dominant cluster and widely recognised as the State's textile capital. The cluster is driven by a large base of dyeing, processing, and textile MSMEs and generated **₹12,968 crore** in exports in FY 2023–24, making the sector an important contributor to industrial output, employment, and trade performance.

At the same time, Panipat represents one of the most transition-sensitive industrial clusters in Haryana because it combines high thermal energy dependence, critical groundwater stress, and significant effluent-management challenges. The cluster's reliance on coal and petcoke boilers for steam generation in dyeing and processing creates major air-quality and carbon-intensity concerns, while its location in an over-exploited groundwater zone creates a parallel water-risk challenge. In that sense, the textiles sector has a dual strategic significance in Haryana's green transition: it is both a high-value manufacturing and export cluster, and one of the clearest examples of the overlap between industrial competitiveness, pollution compliance, water stress, and climate-trade exposure.

5.5.1.2 Current Baseline

Haryana's textiles transition baseline is defined by a combination of export concentration, coal-based thermal dependence, and water-effluent vulnerability, centred in the Panipat cluster. The report notes that Panipat houses 500+ MSME textile/dyeing units that depend heavily on coal and petcoke boilers for steam generation. The cluster accounted for **₹12,968 crore** in exports during FY 2023–24, reinforcing its importance for the State's export economy and foreign-exchange earnings.

The environmental baseline is particularly serious. Panipat lies in an area where

100 per cent of groundwater blocks are categorised as over-exploited, with extraction rates reaching 187 per cent of annual recharge in the cluster context referenced in the report. This creates a severe water-security constraint in a sector that is also highly dependent on water-intensive dyeing and processing operations.

The baseline also indicates weak progress on wastewater closure systems. The section notes that true Zero Liquid Discharge (ZLD) remains rare, with heavy dependence on overloaded CETPs and limited compliance at unit level. The baseline table records ZLD compliance at below 10 per cent and carbon-footprint reporting at 0 per cent among exporters, suggesting that the sector's current challenge is not only one of decarbonisation, but also of water-quality compliance and export-readiness.

Taken together, the current baseline suggests that Panipat's textiles transition challenge is shaped by three interlinked pressures: continued dependence on coal/petcoke-based thermal systems, severe groundwater and effluent stress, and weak preparedness for emerging carbon-disclosure and traceability expectations in export markets.

Table 5.9: Haryana Textiles Sector Baseline

Indicator	Value	Source Cited in Report	Remarks
Panipat Textile Exports (FY 2023-24)	₹12,968 crore	Economic Survey of Haryana 2024-25	Critical for foreign exchange; Major textile and dyeing export cluster in Haryana.
Panipat Textile/Dyeing MSME Units	500+ units	Panipat Sustainability Readiness Report 2026	High concentration of boiler-dependent units; ~70% are small-scale with low tech-adoption.
Groundwater Status	100% Over-exploited	CGWB Dynamic GW Assessment 2025	Entire Panipat block remains in the most critical stress category.
Groundwater Extraction Rate	187% of recharge	CGWB National Compilation 2025	Unsustainable dependence; extraction nearly doubles the natural replenishment rate.
Coal / Petcoke Boiler Units	500+ units	Cluster KPI Baseline 2026	Extremely vulnerable to **CAQM** (Commission for Air Quality Management) winter bans.
ZLD Compliance Rate (Dyeing)	<10%	Sector KPI / HSPCB Monitoring 2025	True Zero Liquid Discharge is rare; high reliance on CETPs with varying efficiency.
Carbon Footprint Reports	0%	Export Cluster Baseline 2025	Indicates very low carbon-disclosure readiness in the export-facing textile base.

5.5.1.3 Key Transition Risks and Enabling Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the textiles baseline presented in this report, read together with the broader state transition baseline in Chapter 3, relevant state and national policy and regulatory references, stakeholder discussions, and selected comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions or approved policy positions.

The baseline suggests that Haryana's textiles transition challenge is concentrated most visibly in the Panipat cluster, where export concentration, carbon-intensive thermal systems, groundwater stress, effluent-management pressure, and weak carbon-readiness are converging in the same production ecosystem. The challenge therefore appears to extend beyond fuel substitution alone and to involve cluster utility reform, water-security compliance, export readiness, and technology upgradation.

A first transition risk arises from continued dependence on coal- and petcoke-based thermal systems for steam generation. With a large concentration of smaller units continuing to depend on boiler-based thermal infrastructure, the cluster remains exposed to carbon intensity, local air-quality vulnerability, and the risk of future tightening of regulatory and market expectations. This also creates a structural obstacle to cleaner production transition at unit level where stand-alone conversion may be commercially difficult.

A second major constraint concerns groundwater stress and weak effluent-management conditions. The baseline points to severe groundwater over-exploitation in Panipat alongside low levels of actual Zero Liquid Discharge compliance and continued dependence on CETP-based treatment systems with variable performance. This implies that the textiles transition challenge in Haryana is not only a decarbonisation issue, but also a matter of water security, industrial compliance, and environmental resilience.

A third enabling gap relates to fragmented supply chains and weak traceability architecture. Carbon-footprint reporting appears to remain negligible among exporters, which suggests limited preparedness for emerging carbon-disclosure, product-traceability, and sustainability-linked procurement expectations in external markets. Over time, this may become a more material competitiveness issue for the cluster, especially where buyers begin to expect stronger reporting and environmental-performance visibility across supplier networks.

A fourth challenge concerns the cost and coordination difficulty of infrastructure and technology upgradation for smaller units. Shared thermal systems, cleaner fuel pathways, ZLD-linked process modifications, water reuse systems, and digital reporting architecture are unlikely to scale smoothly without cluster-level design, financing support, and structured implementation models. This is particularly relevant in a cluster with a large share of smaller units and uneven technology adoption.

A fifth enabling gap relates to skills and implementation capacity for cleaner and more circular production practices. The sector's long-term transition is likely to require not only cleaner thermal systems and better water management, but also stronger local capacity around process efficiency, recycling-linked production systems, digital disclosure, and environmental-compliance management.

Taken together, these findings suggest that textiles transition in Haryana is best understood as a combined issue of cluster utility reform, water-security compliance, air-quality resilience, and export readiness, rather than as a narrow fuel-switching problem alone.

For clarity, the key green transition challenges emerging from the textiles baseline may be summarised as follows:

- continued dependence on carbon-intensive thermal systems;
- high water and effluent-management vulnerability;
- fragmented supply chains and weak traceability;
- infrastructure and technology upgradation costs for smaller units; and
- skill and capacity gaps in adopting cleaner and more circular production practices.

5.5.2 Where We Want to Go

This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

5.5.2.1 Indicative Transition Priorities for 2026–2030

In view of the above, the report points toward a set of indicative transition priorities for the 2026–2030 period focused on cluster decarbonisation, water-effluent compliance, and export-facing readiness. These should be read as possible areas for phased action and further validation rather than as pre-determined commitments.

One priority area that may merit consideration is the development of a Common Boiler Facility (CBF) model for Panipat, so that dispersed coal/petcoke-dependent units can gradually transition toward cleaner shared thermal infrastructure. The KPI framework in the draft refers to an indicative direction of 150 TPH through 3 × 50 TPH centralised modules. In the final report, this is best retained as a directional implementation concept subject to technical validation, commercial structuring, and cluster consultation.

A second area that could be prioritised is accelerated ZLD and wastewater-compliance improvement in the Panipat dyeing ecosystem. This is critical because the textiles transition challenge in Panipat is inseparable from water and effluent management. Accordingly, strengthening CETP performance, moving a larger share of dyeing units toward actual closure and reuse, and creating a more structured compliance pathway may warrant high priority in the medium term.
A third indicative priority is the gradual alignment of export transition support with carbon-reporting readiness.

Together, these priorities suggest a dual strategy for Panipat: decarbonise cluster utilities, and tighten water-effluent compliance and export readiness.

5.5.2.2 Long-Term Direction (2031–2047)

In the longer term, the textiles section points toward a more advanced industrial transition in which Panipat evolves from a conventional textile-processing cluster into a more circular, lower-water, and lower-carbon textile hub.

The long-term direction includes the possibility of a closed-loop textile ecosystem, including waterless dyeing technologies such as supercritical CO_2 dyeing, and the development of Panipat as a global textile recycling capital with automated sorting and chemical recycling capabilities. The section frames this as an opportunity to connect Haryana to the growing global circular-fashion and recycled-fibre market.

These elements should be treated as a strategic horizon and directional outlook rather than approved commitments.

5.5.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

5.5.3.1 Enabling Policies and Finance Considerations

Haryana's textiles transition will require a stronger enabling framework for cluster utility finance, water-compliance investment, and export-facing carbon readiness.

The section identifies several indicative instruments, including a HEEP Green Kicker in the form of an additional refund for ZLD-certified units, partial support for cluster thermal infrastructure through a Haryana Green Bond / HSIIDC financing window, and an FLDG-type de-risking mechanism for biomass boiler projects. These are intended to improve the finance ability of shared infrastructure and cleaner-technology adoption in a sector otherwise dominated by high-carbon incumbency.

Institutionally, implementation would involve the Department of Industries & Commerce, HSPCB, HSIIDC, CETP / SPV institutions, finance actors, and relevant exporter bodies, especially where common boiler systems, CETPs, and carbon-reporting mechanisms are to be scaled.

These policy and finance considerations are indicative in nature and are intended to support discussion on enabling conditions for textiles transition.

5.5.3.2 Indicative KPIs and MRV for Consultation

To support phased implementation and future monitoring, a set of indicative KPIs is proposed for Haryana's textiles transition. These focus on fuel switching, cluster utility rollout, ZLD compliance, and carbon-disclosure readiness. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets. Their purpose is to indicate possible areas for future tracking, while recognising that specific baselines, thresholds, timelines, and quantified targets would need to be refined through subsequent consultation with relevant departments and stakeholders.

Some indicators in this section are best understood as programme-oriented monitoring variables rather than currently institutionalised baseline measures. In particular, common boiler conversion, stronger ZLD-linked compliance, and wider exporter carbon reporting would become more meaningful as structured monitoring indicators only where formal implementation and reporting architecture is established.

Key indicators identified in the sector include:

- Coal / Petcoke Boiler Units in Panipat
- Common Boiler Facility Capacity
- ZLD Compliance Rate
- Carbon Footprint Reports Filed by Exporters

Table 5.10: Indicative KPIs for Textiles Sector Transition

KPI	Unit of Measurement	Current Baseline (Latest Available)	Illustrative Transitio n Direction (to be refined through consultation)	MRV Data Source / Verification Agency
Coal/Petcoke Boiler Units in Panipat	Number of operational units	500+ units	Track progressive phase -down of coal- and petcoke-based boiler dependence and scaling of cleaner cluster thermal alternatives; thresholds to be defined through consultation.	Haryana State Pollution Control Board (HSPCB) Compliance Register
Common Boiler Facility (CBF) Capacity	TPH (Tonnes Per Hour) of steam	0 TPH	Monitor phased rollout and operationalisation of common boiler or shared cleaner thermal infrastructure where viable; scale and timeline to be refined through consultation.	Special Purpose Vehicle (SPV) / HSIIDC
ZLD Compliance Rate (Panipat Dyeing)	% of active dyeing units	< 10%	Track progressive improvement in actual ZLD-linked compliance and reuse performance among relevant units, subject to validation of compliance architecture and reporting systems.	HSPCB CETP / Unit-level Inspection Reports
Carbon Footprint Reports Filed	% of registered exporters	0%	Progressive movement toward wider carbon-reporting readiness in export-linked units; formal reporting threshold to be defined subsequently through consultation.	Haryana Digital Carbon Registry / nodal MRV platform

Note: The KPI entries presented above should be interpreted as illustrative monitoring directions for consultation purposes, rather than as approved targets or implementation commitments. Specific thresholds, timelines, and target values would need to be finalised subsequently through departmental and stakeholder consultation.

SECTOR 6: AGRICULTURE & ALLIED

5.6 Sector 6: Agriculture & Allied

5.6.1 Where We Are

This section sets out the current agriculture and allied transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.6.1.1 Sector Context

Agriculture remains the foundational backbone of Haryana's rural economy and a major pillar of livelihoods, food systems, and resource use. In FY 2024-25, agriculture contributed 15.9 percent to the State's Gross State Value Added (GSVA), while the sector continued to absorb roughly 32 percent of the workforce. This makes the agricultural green transition not only an environmental priority, but also a major socioeconomic and livelihood transition for Haryana.

Haryana remains a major producer of paddy and wheat, but this production system is highly resource-intensive. The sector relies heavily on tubewell-based irrigation linked to subsidized grid electricity and is concentrated in districts where groundwater stress is severe. At the same time, seasonal crop-residue burning has historically imposed significant environmental and economic costs, not only on agriculture but also on nearby industry through air-quality deterioration and GRAP-linked disruptions.

This gives agriculture and allied activities a dual strategic significance in Haryana's green transition. On one hand, the sector remains indispensable to rural livelihoods and food security. On the other hand, it is deeply connected to the State's water stress, power subsidy burden, biomass management challenge, and regional air-quality pressures.

5.6.1.2 Current Baseline

Haryana's agriculture and allied transition baseline is defined by a combination of resource-intensive cultivation, improving crop-residue management, and significant decarbonisation potential in irrigation and biomass utilization.

The sector contributed 15.9 percent to Haryana's GSVA in FY 2024-25, with an absolute GSVA of ₹95,767 crore. At the same time, the report identifies a large decarbonisation opportunity in irrigation energy use, with the State Energy Efficiency Action Plan (SEEAP) estimating an immediate investment potential of ₹174 crore for solar-powered agricultural pumps.

A major positive shift in the baseline is the improvement in crop-residue management. During the 2025 harvesting season, paddy stubble-burning incidents were limited to 662 cases, representing a very sharp reduction relative to earlier years. This indicates that Haryana enters the transition pathway with a substantially improved baseline on direct seasonal agricultural emissions, even though the challenge of sustaining and monetizing zero-burn agriculture remains.

The resource-stress baseline, however, remains severe. The section identifies the water-energy nexus as a core structural issue: MSP-backed paddy cultivation continues to drive groundwater over-extraction, averaging 136.75 percent of annual recharge, which in turn locks farmers into high-energy tubewell irrigation and contributes to the State's agricultural power burden. The existing policy framework includes support for crop diversification under Mera Pani Meri Virasat, with a support rate of ₹7,000 per acre, but the report suggests that a deeper transition in cropping and irrigation systems is still required.

Table 5.11: Haryana Agriculture and Allied Sector Baseline

Indicator	Value	Source Cited in Report	Remarks
Agriculture Share of GSVA	15.9%	Economic Survey of Haryana 2024-25	Confirms agriculture r emains a bedrock of the State economy despite industrialization.
Agriculture GSVA (Absolute)	₹95,767 crore	Economic Survey of Haryana 2024-25	Total value added by crops, livestock, forestry, and fishing (at current prices).
Workforce Dependence	~32%	PLFS 2023-24 / MoSPI	Reflects the sector's critical role in rural livelihoods and social stability.
Stubble-Burning Cases (2025)	662 cases	CAQM / PIB (Dec 1, 2025)	A record **91% decline** from 2021; highlights the success of in-situ/ex-situ management.
Solar Pump Investment Potential	₹174 crore	SEEAP 2023 (Haryana White Paper)	Represents the "low-hanging fruit" for decarbonizing irrigation energy.
Mera Pani Meri Virasat Rate	₹7,000 per acre	Dept. of Agriculture, Haryana	Primary fiscal tool to nudge farmers away from water-intensive paddy.
Groundwater Extraction Rate	**136.75%**	CGWB National Assessment 2024-25	Haryana is now the 3rd most water-stressed state, behind Punjab and Rajasthan.

Note: The agriculture and allied baseline combines macroeconomic contribution, livelihood dependence, irrigation-energy transition potential, and crop-residue management performance. Stubble-burning reduction represents an improved emissions baseline, while groundwater dependence and irrigation energy intensity remain major structural constraints.

5.6.1.3 Key Risks and Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the agriculture and allied baseline presented in this report, read together with the broader State transition baseline, relevant policy and scheme context, and selected comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions or approved policy positions.

The baseline suggests that Haryana's agriculture transition challenge is closely tied to the State's wider resource and production structure. While the sector remains economically and socially significant, its current pattern in several districts continues to be shaped by groundwater-dependent cropping systems, residue-management pressures, and uneven uptake of climate-smart and resource-efficient farm practices. As a result, the transition challenge appears to extend beyond farm-level technology adoption alone and to involve water security, aggregation architecture, rural value chains, incentive design, and stronger convergence between agriculture, energy, and biomass systems.

A first transition risk arises from the continued dependence of major cropping systems on water-intensive production patterns in a context of groundwater stress. In several parts of the State, this creates a structural resource challenge that is likely to affect long-term resilience, input sustainability, and the economic viability of current production systems if transition toward more efficient practices and diversification pathways remains limited.

A second major challenge concerns crop-residue management and biomass utilisation. Although policy attention and interventions have increased, the baseline indicates that residue-burning pressures and biomass handling constraints continue to persist. This points to the need for stronger aggregation, local value-chain development, and more viable pathways to convert rural biomass into productive energy, material, or carbon-linked opportunities.

A third enabling gap relates to uneven adoption of climate-smart and low-emission farm practices. Technologies and practices such as solar pumps, efficient irrigation, diversification-linked incentives, and climate-smart production systems exist in policy or scheme form, but their effective scale-up appears uneven across locations and farm categories. This suggests that stronger last-mile support, farmer-facing implementation models, and district-sensitive rollout mechanisms may be needed.

A fourth challenge concerns the limited monetisation and programme architecture for climate-positive rural activities. Activities such as soil-carbon improvement, biomass aggregation, low-emission cultivation practices, and ecosystem-service enhancement may hold transition value, but currently appear to have weak institutional pathways for aggregation, verification, and farmer-facing benefit delivery at scale.

A fifth constraint is the need for stronger convergence between agriculture, water, energy, and rural enterprise systems. The baseline suggests that transition in the agriculture sector cannot be addressed only as an agronomic issue. It is also connected to irrigation systems, biomass logistics, renewable-energy interfaces, local processing opportunities, and rural implementation capacity.

Taken together, these findings suggest that agriculture transition in Haryana is not only a question of changing production practices. It is also a question of water security, aggregation systems, incentive alignment, rural value chains, and stronger institutional support for climate-smart implementation.

For clarity, the key green transition challenges emerging from the agriculture and allied baseline may be summarised as follows:

- continued dependence on water-intensive and groundwater-stressed production systems in several districts;
- persistence of residue-management and biomass-utilisation constraints despite ongoing interventions;
- uneven adoption of climate-smart and resource-efficient farm practices;
- weak monetisation and aggregation pathways for climate-positive rural activities; and
- insufficient convergence between agriculture, water, energy, and rural enterprise systems.

5.6.2 Where We Want to Go

This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

5.6.2.1 Indicative Transition Priorities for 2026–2030

For the medium term, the section identifies a set of practical transition priorities centered on biomass monetisation, crop-residue supply chains, and irrigation decarbonisation.

One important priority is the development of a district-level Bio-CNG / compressed biogas network in rice-producing districts. The section refers to a model in which one 50 TPD Bio-CNG plant is established in each major rice-growing district, especially Karnal, Kurukshetra, and Kaithal, with an indicative project cost of around ₹50 crore per plant. This is intended to convert crop residue from a pollution liability into a value-generating energy feedstock.

A second priority is the strengthening of the biomass aggregation chain by positioning Farmer Producer Organisations (FPOs) as biomass aggregators, with more reliable straw procurement arrangements and a transition from fragmented residue disposal toward organized feedstock supply systems.

A third priority is the reorientation of Crop Residue Management (CRM) support toward ex-situ biomass logistics, including baling, storage, and transport. This would better align public support with the creation of a viable residue-to-energy market.

A fourth priority is expansion of PM-KUSUM / feeder-level solarisation for agriculture, so that irrigation demand is progressively decarbonized and agricultural solar infrastructure also creates opportunities for surplus power monetisation.

Together, these priorities suggest a dual strategy: sustain zero-burn agriculture, and build a biomass-and-solar-based rural energy transition around irrigation and crop residue.

5.6.2.2 Long-Term Direction (2031–2047)

In the longer term, the agriculture and allied section points toward a broader transition from resource-intensive, fossil-dependent farming to a more climate-resilient, diversified, and energy-linked rural production system.

The long-term direction implies a future in which crop residue becomes a stable rural energy commodity, irrigation becomes progressively cleaner through solarisation, and agriculture is more closely aligned with water stewardship and diversification incentives. In this framework, farmers are not only food producers, but also potential suppliers within a broader biomass and clean-energy value chain.

These elements should be treated as a strategic horizon and directional outlook rather than approved commitments.

5.6.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

5.6.3.1 Enabling Policies and Finance Considerations

Haryana's agriculture and allied transition will require a stronger enabling framework for biomass market creation, irrigation decarbonisation, and crop diversification support.

The section suggests that stronger alignment is needed between crop-residue management support, biomass-energy infrastructure, and agricultural procurement ecosystems. In practical terms, this means linking Agriculture Department incentives, FPO-based logistics, Bio-CNG / biomass project finance, and feeder-level solarisation under a more coherent implementation framework.

It also indicates the continued relevance of schemes such as Mera Pani Meri Virasat and PM-KUSUM, but implies that these need to be integrated into a wider transition architecture if the State is to reduce both groundwater stress and the agricultural power burden.

Institutionally, implementation would involve the Department of Agriculture & Farmers' Welfare, HAREDA, FPOs, biomass/Bio-CNG project SPVs, district implementation machinery, transport/logistics actors, and relevant finance institutions.

These policy and finance considerations are indicative in nature and are intended to support discussion on enabling conditions for agriculture and allied transition.

5.6.3.2 Indicative KPIs and MRV for Consultation

To support phased implementation and future monitoring, a set of indicative KPIs is proposed for Haryana's agriculture and allied transition. These focus on crop-residue reduction, biomass utilisation, irrigation decarbonisation, and diversification support. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets. Their purpose is to indicate possible areas for future tracking, while recognising that specific baselines, thresholds, timelines, and quantified targets would need to be refined through subsequent consultation with relevant departments and stakeholders.

Some indicators in this section are best understood as programme-oriented monitoring variables rather than currently institutionalised baseline measures. In particular, biomass aggregation by FPOs, Bio-CNG/CBG plant rollout, solarised irrigation progression, and diversification-linked acreage shifts would become more meaningful as structured monitoring indicators only where formal implementation and reporting architecture is established.

Key indicators that emerge from the section include:

- Stubble-Burning Incidents
- Bio-CNG / CBG Plants Commissioned
- Biomass Aggregated via FPOs
- Solar Pump Deployment / Solarised Irrigation
- Area Shift under Mera Pani Meri Virasat

Table 5.12: Indicative KPIs for Agriculture and Allied Sector Transition

KPI	Unit of Measurement	Current Baseline (2025/26)	Illustrative Transition Direction (to be refined through consultation)	MRV Data Source / Verification Agency	Strategic Vision Linkage
Stubble Burning Incidents	Number of active fire events	662 cases(Down ~90% from 2021 levels)	Track sustained reduction toward near-zero incidence through continued prevention, enforcement, and viable ex-situ residue management systems; thresholds to be refined through consultation.	ISRO / HARSAC Satellite Monitoring	Air Quality & GRAP Avoidance
Bio-CNG Plants Commissioned	Number of operational plants	0	Monitor phased rollout of Bio-CNG / CBG capacity across major rice-growing districts where feedstock availability, aggregation systems, and project viability support implementation.	Department of Industries	"Waste-to-Wealth" / Rural Circular Economy
Biomass Aggregated via FPOs (Ex-situ supply chain)	MT / year	Minimal tracking (Predominantly in-situ)	Track progressive scale-up of ex-situ biomass aggregation through FPO-linked supply chains to support Bio-CNG, biomass energy, and other productive end uses; scale and reporting thresholds to be refined through consultation.	Farmer Producer Organization (FPO) MIS / Agriculture Dept.	Ex-Situ Stubble Monetization

Table 5.12: Indicative KPIs for Agriculture and Allied Sector Transition

KPI	Unit of Measurement	Current Baseline (2025/26)	Illustrative Transition Direction (to be refined through consultation)	MRV Data Source / Verification Agency	Strategic Vision Linkage
Paddy Area Diversified (Mera Pani Meri Virasat)	Lakh acres	~1.0 Lakh acres(Based on MFMB portal registrations)	Monitor progressive increase in area shifted under diversification support, subject to validation of baseline acreage and refinement of annual direction through consultation.	Department of Agriculture / MFMB Portal	Groundwater Conservation
Solar Pumps Installed (PM-KUSUM)	Number of pumps	~1.84 Lakh pumps (MNRE Feb 2026 Status)	Track progressive expansion of solarised irrigation and associated diesel-replacement trajectory, with quantified thresholds and programme milestones to be refined through consultation.	HAREDA / MNRE PM-KUSUM Dashboard	Agricultural Decarbonization

Note: The KPI entries presented above should be interpreted as illustrative monitoring directions for consultation purposes, rather than as approved targets or implementation commitments. Specific thresholds, timelines, and target values would need to be finalised subsequently through departmental and stakeholder consultation.

SECTOR 7: SUSTAINABLE WATER MANAGEMENT

5.7 Sector 7: Sustainable Water Management

5.7.1 Where We Are

This section sets out the current sustainable water management transition context, baseline conditions, and the principal risks, constraints, and enabling gaps emerging from the available evidence.

5.7.1.1 Sector Context

Water security remains one of Haryana's most critical physical constraints to long-term economic growth, industrial expansion, and urban resilience. The latest baseline in the report indicates that Haryana's average groundwater extraction rate stands at 136 percent of annual recharge, while 88 out of 143 assessed blocks are categorized as over-exploited. This means that groundwater stress is no longer a sector-specific issue; it is a cross-cutting constraint on agriculture, industry, urbanization, and future investment.

The water challenge is especially significant because it coincides with Haryana's industrial geography. Several major industrial and export-linked districts—including Gurugram, Faridabad, and Panipat—fall within highly stressed groundwater zones where new freshwater extraction is increasingly constrained. In this context, water availability is becoming a core determinant of industrial competitiveness and investment viability.

At the same time, Haryana faces a major circular water paradox. The report records that 1,487 MLD of treated wastewater is already generated, but only 281 MLD, or roughly 18 percent, is currently reused. This reveals a large untapped opportunity to shift from freshwater dependence toward a treated-wastewater-based industrial and urban water economy.

5.7.1.2 Current Baseline

Haryana's sustainable water management baseline is defined by a combination of acute groundwater stress, high concentration of over-exploited blocks, and a large treated-wastewater reuse gap.

The report indicates that Haryana's average groundwater extraction ratio stands at 136 percent of annual recharge, indicating that the State is extracting water at a rate well above natural replenishment. This is reinforced by the fact that 88 out of 143 assessed groundwater blocks are officially classified as over-exploited. Together, these indicators show that water stress is structural rather than localized.

The treated wastewater baseline also reveals a major infrastructure gap. Municipal and industrial systems together generate approximately 1,487 MLD of treated wastewater, but only 281 MLD (18 percent) is currently reused. This implies that roughly 1,206 MLD of treated water remains unutilized, despite high water demand in nearby industrial and urban areas.

The baseline further indicates that, while treated wastewater reuse is the most immediate circular-water opportunity, several supporting indicators remain weak or incomplete in the current evidence base. These include the urban sewage treatment gap, performance compliance of active CETPs, and the absence of dedicated reuse pipeline infrastructure in major industrial corridors. In the KPI framework, reuse pipeline length is effectively at 0 km as a dedicated industrial reuse network.

Table 5.13: Haryana Water and Wastewater Baseline

Indicator	Value	Source Cited in Report	Remarks
Groundwater Extraction Ratio	136.75% of recharge	CGWB 2025 / HWRA	Updated from 134% based on the latest 2025 national assessment.
Over-Exploited Blocks	88 out of 143	HWRA / Vidhan Sabha (Feb 2026)	Increased from 88 (2024) to 91 (2025) as per recent legislative briefing.
Treated Wastewater Generated	1,487 MLD	SEP 2025	Refers to the current discharge baseline earmarked for transition.
Treated Wastewater Reused	281 MLD (18%)	SEP 2025 / HWRA	Highlights a significant "circularity gap" in the current water balance.
Untapped Reuse Potential	~1,206 MLD	Derived Baseline	Represents the immediate volume available for industrial/power sector swap.
Reuse Pipeline (Industrial)	0 km	HSIIDC Baseline 2025	No dedicated industrial-grade recycled water network commissioned yet.

Note: The sustainable water management baseline combines groundwater stress, treated-water reuse performance, and industrial reuse infrastructure readiness. Groundwater extraction and treated-wastewater reuse are hard baseline indicators; sewage-gap and CETP-compliance improvements remain dependent on stronger operational data and institutional monitoring.

5.7.1.3 Key Risks and Gaps

Basis of identification: The risks, constraints, and enabling gaps outlined in this section are derived from the sustainable water management baseline presented in this report, read together with the broader State transition baseline, relevant policy and regulatory context, stakeholder discussions, and selected comparative references where relevant. These are presented as indicative analytical findings intended to support consultation and prioritisation, and should not be interpreted as definitive sector conclusions or approved policy positions.

The baseline suggests that Haryana's sustainable water transition challenge is shaped by the interaction of groundwater stress, low levels of treated-wastewater reuse, uneven urban wastewater infrastructure, and weak integration between water regulation, industrial demand planning, and reuse systems. As a result, the transition challenge appears to extend beyond water conservation alone and to involve infrastructure finance, urban service delivery, industrial substitution of freshwater, regulatory alignment, and long-term aquifer resilience.

A first major risk arises from continued over-extraction of groundwater in already stressed areas. With several blocks classified as over-exploited and the overall groundwater extraction ratio remaining significantly above sustainable levels, the baseline indicates a structural risk to long-term water security. This has implications not only for agriculture and rural livelihoods, but also for industrial location choices, urban growth patterns, and future investment viability.

A second challenge concerns the continued under-utilisation of treated wastewater as a managed infrastructure resource. Although wastewater generation and treatment capacity are significant in urban areas, actual reuse remains limited relative to potential. This suggests that Haryana's water transition challenge is not simply one of treatment capacity, but also of pipeline connectivity, demand aggregation, offtake arrangements, and the institutional ability to match treated-water supply with industrial and non-potable demand.

A third enabling gap relates to uneven wastewater and sewage-management systems in urban areas. The baseline indicates that sewage-treatment gaps remain material in several ULBs and that stronger validation may still be needed for parts of the existing evidence base. This implies that urban wastewater transition may require not only expansion of treatment systems, but also improved operational performance, stronger monitoring, and more credible reuse-linked service planning.

A fourth challenge concerns industrial effluent quality and CETP performance. In corridors where treated wastewater is expected to support wider reuse systems, the effectiveness and reliability of CETP-linked compliance becomes especially important. Where industrial effluent quality remains uneven or poorly monitored, this may undermine the viability of circular water-use pathways and create regulatory as well as environmental risk.

A fifth constraint relates to fragmented institutional coordination. The transition to a more circular and reuse-oriented water economy is likely to require stronger convergence between groundwater regulation, STP planning, ULB systems, industrial demand centres, pipeline infrastructure, and compliance oversight. At present, these functions appear to remain distributed across multiple institutions, which may limit integrated planning and implementation.
Taken together, these findings suggest that sustainable water management in Haryana is not only a hydrological issue. It is also a question of infrastructure planning, reuse economics, urban wastewater performance, industrial substitution systems, and regulatory coordination.

For clarity, the key green transition challenges emerging from the sustainable water baseline may be summarised as follows:
- continued groundwater over-extraction and block-level water stress;
- under-utilisation of treated wastewater despite growing urban generation and industrial demand potential;
- sewage-treatment and wastewater-service gaps in selected ULBs;
- uneven CETP performance and compliance reliability; and
- fragmented institutional coordination across water regulation, wastewater systems, and industrial reuse planning.

5.7.2 Where We Want to Go
This section outlines the indicative transition direction for the sector across the medium term (2026–2030) and the longer-term horizon to 2047, based on the baseline and transition logic set out above.

5.7.2.1 Indicative Transition Priorities for 2026–2030
For the medium term, the section identifies a set of practical transition priorities centered on treated-wastewater reuse, industrial water substitution, and targeted urban infrastructure upgrades.

One important priority is the development of reuse pipeline infrastructure linking municipal STPs in Gurugram and Faridabad to major industrial demand centres such as IMT Manesar and IMT Faridabad. The section refers to an indicative network of 200 km pipeline infrastructure with associated CETP upgrades, with an estimated capital requirement of ₹3,500 crore.

A second priority is the notification of "Zero Freshwater Zone" requirements in critically stressed industrial blocks, under which industries would meet non-potable needs—such as cooling, washing, and process-support uses—from treated wastewater rather than freshwater extraction.

A third priority is sewage-gap closure in selected ULBs, supported by STP performance improvement and offtake agreements for treated-water reuse. This is intended to make urban wastewater systems more compatible with industrial and non-potable demand.

A fourth priority is CETP upgrading so that industrial effluent compliance improves before wastewater is considered for wider reuse systems.

Together, these priorities suggest a dual strategy: reduce freshwater dependence in stressed industrial corridors, and turn treated wastewater into a usable infrastructure resource rather than a disposal burden.

5.7.2.2 Long-Term Direction (2031–2047)

In the longer term, the water section points toward a broader transformation from a depletion-based water economy to a more circular, recharge-oriented, and resilience-focused system.

The long-term direction includes the possibility of "sponge city" urban and industrial design, with permeable surfaces and urban water bodies used to strengthen rainwater recharge; solar-powered brackish groundwater desalination in the south-western parts of Haryana such as Hisar and Sirsa; and a move toward net water positive aquifer restoration, with extraction brought below recharge levels. It also points toward the emergence of decentralized water markets, in which treated water is traded as a managed utility resource between STPs and industrial consumers.

These elements should be treated as a strategic horizon and directional outlook rather than approved commitments.

5.7.3 How Can We Reach There

This section identifies the enabling policies, financing considerations, institutional support measures, and illustrative monitoring architecture that may help support phased sectoral transition.

5.7.3.1 Enabling Policies and Finance Considerations

Haryana's sustainable water transition will require a stronger enabling framework for reuse infrastructure finance, treated-water offtake systems, aquifer protection, and institutional convergence.

The section indicates that stronger coordination is needed between HWRA, PHED, ULBs, HSIIDC, HSPCB, and industrial demand centres so that groundwater regulation, wastewater treatment, pipeline infrastructure, and industrial reuse are planned as one connected system rather than as separate departmental functions.

It also suggests that treated-water reuse projects will require a more viable financing and demand model, especially in relation to pipeline infrastructure, STP upgrades, reuse offtake agreements, and compliance-linked industrial substitution of freshwater.

These policy and finance considerations are indicative in nature and are intended to support discussion on enabling conditions for sustainable water management.

5.7.3.2 Indicative KPIs and MRV for Consultation

To support phased implementation and future monitoring, a set of indicative KPIs is proposed for Haryana's sustainable water management transition. These focus on groundwater stabilisation, treated-wastewater reuse, block-level stress reduction, sewage-gap closure, CETP compliance, and reuse infrastructure rollout. At this stage, however, these indicators should be treated as consultation-oriented monitoring variables rather than as final approved targets. Their purpose is to indicate possible areas for future tracking, while recognising that specific baselines, thresholds, timelines, and quantified targets would need to be refined through subsequent consultation with relevant departments and stakeholders.

Some indicators in this section are best understood as programme-oriented monitoring variables rather than currently institutionalised baseline measures. In particular, block-level depletion reversal, large-scale treated-water reuse, sewage-gap closure in selected ULBs, and reuse pipeline rollout would become more meaningful as structured monitoring indicators only where formal implementation and reporting architecture is established.

Key indicators emerging from the section include:

- Groundwater Extraction Ratio
- Treated Wastewater Reused
- Over-Exploited Blocks
- Sewage Treatment Gap
- CETP Performance Compliance
- Reuse Pipeline Length Commissioned

Table 5.14: Indicative KPIs for Sustainable Water Management

KPI	Unit	Current Baseline / Reference Position	Illustrative Transition Direction (to be refined through consultation)	MRV Source/ Verification Agency
Groundwater extraction ratio	% of recharge	136%	Directionally move toward reduced extraction pressure and improved alignment with recharge conditions in stressed areas; thresholds to be refined through basin- and block-level consultation.	HWRA/CGWB
Treated wastewater reused	MLD / %	281 MLD / 18%	Track progressive increase in treated-wastewater reuse and substitution of freshwater in appropriate urban-industrial applications; quantified milestones to be defined subsequently through consultation.	HWRA / ULB / PHED
Over-exploited blocks	Number of blocks (of 143)	88 blocks	Monitor gradual reduction in the number and severity of over-exploited blocks over time through validated block-level reporting; numeric direction to be refined through consultation.	CGWB block reports

Table 5.14: Indicative KPIs for Sustainable Water Management

KPI	Unit	Current Baseline / Reference Position	Illustrative Transition Direction (to be refined through consultation)	MRV Source/ Verification Agency
Sewage treatment gap (ULBs)	MLD	Baseline requires stronger validation in current evidence base	Track progressive reduction in the sewage-treatment gap in priority ULBs, subject to validation of the current baseline and refinement of implementation thresholds through consultation.	ULB / PHED MIS
CETP performance compliance	%	Baseline requires stronger validation in current evidence base	Monitor improvement in CETP performance and compliance consistency through inspection and operational reporting; quantified threshold to be defined subsequently through consultation	HSPCB inspection
Reuse pipeline length commissioned	km	0	Track phased rollout of treated-water conveyance and reuse-supporting infrastructure where viable demand and offtake conditions exist; scale and timeline to be refined through consultation.	HWRA/HSIIDC

Note: The KPI entries presented above should be interpreted as illustrative monitoring directions for consultation purposes, rather than as approved targets or implementation commitments. Specific thresholds, timelines, and target values would need to be finalised subsequently through departmental and stakeholder consultation.

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CHAPTER 6: TRANSITION FINANCE LANDSCAPE AND INSTRUMENTS

Note: All financial instruments, fund sizes, and leverage ratios presented in this chapter are indicative proposals for consultation. They are not approved financial commitments.

6.1 Financial Baseline

Haryana's MSME ACP disbursed ₹1,21,516 crore in 2024–25 against a target of ₹84,278 crore, representing 144 percent achievement. Despite strong overall credit channels, the share of explicitly green MSME credit remains below 1 percent by stakeholder estimate, as no formal green taxonomy or classification framework currently exists within the State's banking and credit infrastructure. The five-year green transition CAPEX requirement (2026–2030), anchored to SEEAP modelling, is estimated at approximately ₹16,250 crore (₹3,250 crore per annum), representing approximately 2.6 percent of annual ACP flow.

6.2 Proposed Finance Instruments

Table 6.1: Proposed Green Finance Instruments for Haryana

Instrument Type	Proposed Instrument	Description	Indicative Scale	Remarks
Credit Targeting	Green Portfolio Standard (GPS)	Direction to earmark a share of MSME ACP credit toward eligible green technologies, based on a State positive list / taxonomy	10% of ACP = ~₹12,000 Cr/yr	Policy proposal; requires SLBC direction
Banking Sector Support	Haryana Green Interest Subvention	Additional interest support linked to verified green installations, monitored through the digital MRV system	~₹65 Crore/year	Budget-supported through nodal banking institutions
Micro-Unit Risk Mitigation	CGTMSE Green Window	Support for guarantee fees on green loans for smaller units facing collateral barriers	Could improve access for underfinanced micro-units	Facilitation through nodal transition platform
New Technology Risk Mitigation	H-GTF / FLDG	First-loss default guarantee structure for newer technologies (Bio-CNG, common boilers, shared green infrastructure)	₹200 Crore corpus; 5x leverage	Indicative; subject to State approval
Capital Markets	Haryana Sovereign Green Bond	Bond issuance for common green infrastructure in industrial clusters and IMCs	₹1,000 Crore Tranche 1	Institutional structuring through HSIIDC

6.3 Finance Design Principles

Three design principles emerge from the proposed finance architecture. First, transition finance should not rely only on direct subsidy; it should also improve the bankability of projects and technologies that currently struggle to secure finance. Second, public financial support should be linked to verifiable outcomes through the digital MRV system. Third, the financing architecture should distinguish between small-unit access barriers and technology-risk barriers, since these require different policy responses.

CHAPTER 7: CROSS-CUTTING ENABLERS

Note: Governance, finance, skilling, and digital architecture presented in this chapter are indicative implementation and institutional design options for consultation, not approved institutional arrangements.

7.1 Governance & Programme Management

A major constraint to Haryana's green transition is the persistence of institutional silos across departments and agencies that shape industrial development, environmental regulation, power supply, finance, and urban infrastructure. In practice, these institutions often operate with distinct mandates, compliance systems, and operational timelines, which can create regulatory friction for firms, especially MSMEs, attempting to modernize production systems, adopt cleaner technologies, or comply with evolving environmental requirements.

To address this challenge, the report proposes a whole-of-government implementation architecture that may be anchored through a centralized governance and programme management mechanism, referred to here as the Green Growth Hub (GGH). The GGH is envisaged as a nodal bridging platform that could support cross-departmental coordination, programme management, implementation facilitation, and transition monitoring.

In this formulation, the GGH may serve as a common institutional platform through which finance, technical support, compliance facilitation, digital monitoring, and cluster-level transition programmes can be better aligned. Its proposed role is to reduce administrative fragmentation, improve coordination across departments, and support more coherent implementation of green transition initiatives.

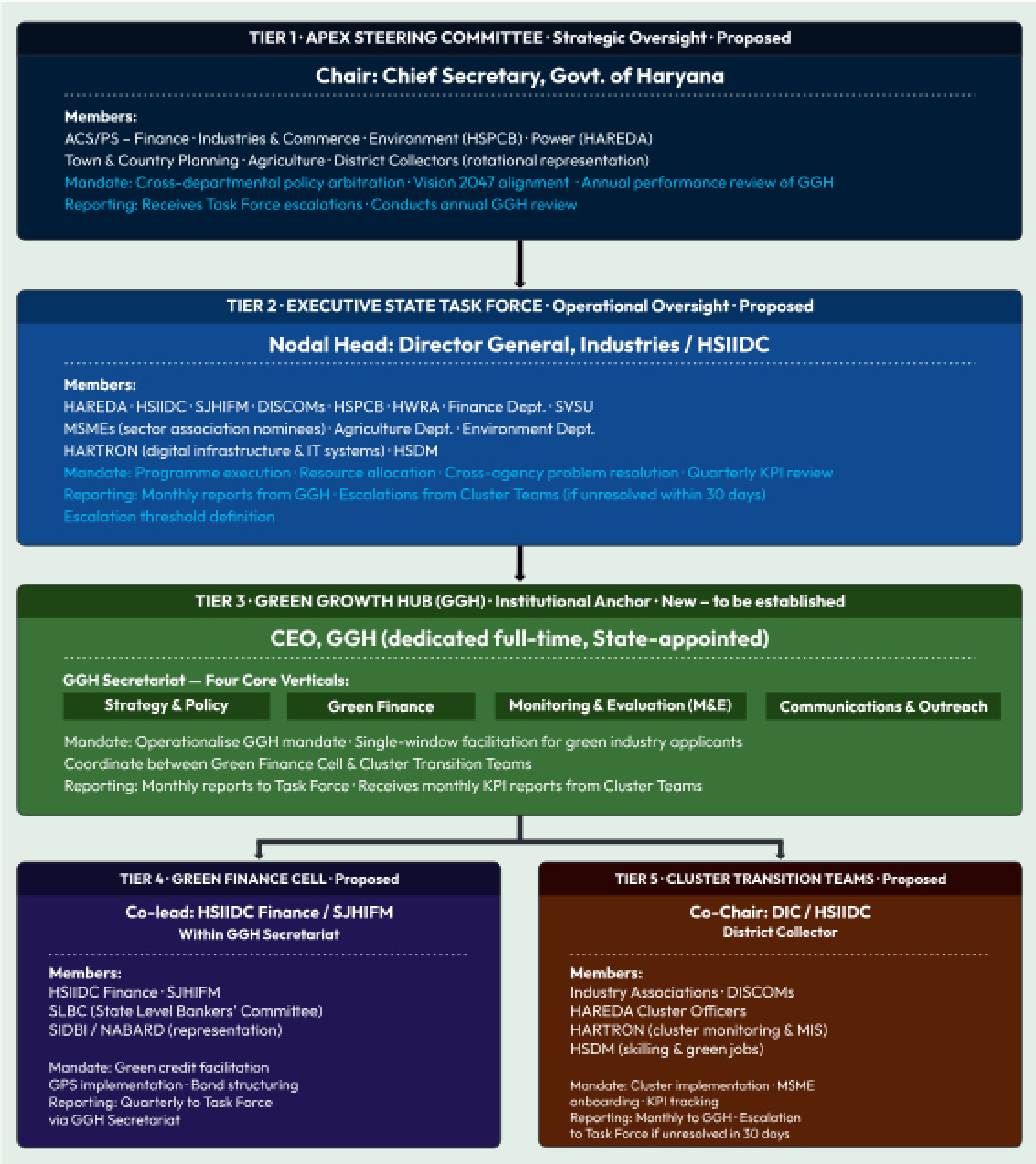
7.1.1 Indicative Governance Architecture

The governance structure may be organized through a multi-tier arrangement combining strategic oversight, operational review, implementation support, and specialized finance and technical functions.

Table 7.1: Indicative Green Growth Hub Governance Architecture

Governance Tier	Chair / Nodal Head	Core Members / Composition	Indicative Mandate & Responsibilities
1. Apex Steering Committee (Strategic Oversight)	Chief Secretary, Govt. of Haryana	ACS/PS of Finance, Industries & Commerce, Environment (HSPCB), Power (HAREDA), Town & Country Planning, Agriculture, District Collectors (rotational representation)	Cross-departmental policy arbitration; Vision 2047 alignment; annual performance review of GGH
2. Executive State Task Force(Operational Oversight)	Director General, Industries / HSIIDC / Any other Nodal Head appointed by State	Heads of HAREDA, HSIIDC, SJHIFM, DISCOMs, HSPCB, HWRA, Finance Dept., SVSU, MSMEs (sector association nominees), Agriculture Dept., Environment Dept., HARTRON (digital infrastructure & IT systems) , HSDM	Programme execution, resource allocation, cross-agency problem resolution; quarterly KPI review; escalation threshold definition
3. Green Growth Hub — GGH(Institutional Anchor)	CEO, GGH (dedicated full-time position, State-appointed)	Core GGH Secretariat comprising four verticals: Strategy & Policy, Green Finance, Monitoring & Evaluation (M&E), Communications & Outreach	Operationalise GGH mandate; coordinate between Green Finance Cell and Cluster Transition Teams; serve as single - window facilitation point for green industry applicants; monthly reporting to Task Force.
4. Green Finance Cell (Within GGH Secretariat)	HSIIDC Finance / SJHIFM (Co-lead)	HSIIDC Finance, SJHIFM, SLBC (State Level Bankers' Committee) , SIDBI / NABARD (representation)	Green credit facilitation; GPS (Green Performance Score)implementation; green bond structuring; pipeline reporting to Task Force quarterly
5. Cluster Transition Teams (District / Cluster Level)	DIC / HSIIDC + District Collector (Co-Chair)	Industry associations, DISCOMs, HAREDA cluster officers, HARTRON (real-time cluster data monitoring & MIS) , HSDM (skilling liaison & green jobs facilitation)	Cluster-level implementation; MSME onboarding; KPI tracking; monthly reporting to GGH Secretariat; escalation to Task Force if unresolved within 30 days

Figure 7: GGH Organisational Structure (Indicative)



7.2 Transition Finance Architecture

Please refer to Chapter 5 for the full description of proposed green finance instruments.

Three overarching design principles for the finance architecture are: (i) shift from subsidy to bankability improvement; (ii) link public support to verifiable outcomes through digital MRV; and (iii) tailor instrument design to the specific barrier type — unit access, technology risk, or shared infrastructure.

7.3 Skills and Just Transition

7.3.1 Transition Context

Haryana's green transition is also a labour-market transition. The shift toward cleaner production, EV-linked manufacturing, biomass value chains, circular water systems, and digital MRV will create demand for new technical and managerial roles while placing pressure on workers in legacy carbon-intensive occupations. A just transition approach is important for social protection and for ensuring the State has an adequately prepared workforce.

The case for a just transition in Haryana is strengthened by evidence that many smaller enterprises remain at an early stage of readiness for sustainability-linked adjustment. MSME-focused transition studies show that awareness of ESG-linked expectations is often limited, that enterprises respond more strongly to market pressure than to regulation alone, and that sustainability investments frequently compete with immediate working-capital requirements. This suggests that skilling and just transition policy in Haryana should not be limited to workforce retraining alone. It should also include enterprise-facing awareness, managerial capability, practical compliance support, and phased handholding so that workers and smaller firms are better able to adapt to evolving production, reporting, and market requirements.

7.3.2 Indicative Green Jobs and Skilling Architecture

A State Green Jobs Census is proposed to estimate the scale, location, and timing of job creation and displacement. Shri Vishwakarma Skill University (SVSU), Palwal, is proposed as the key institutional anchor for a Green Skilling Academy, developing curricula for EV servicing, industrial solar and micro-grid maintenance, biomass systems, water and waste systems, and digital carbon accounting.

Table 7.2: Illustrative Job Transition Matrix

Sector	At-Risk Roles	Bridge Skill Required	Potential New Green Role	Transition Direction
Energy	Boiler operators, coal truckers, genset mechanics	Biomass handling, anaerobic digestion, process control	Bio-CNG Plant Operator	Positive transition potential
Automotive	ICE mechanics, casting/forging labour	High-voltage systems, battery chemistry, electric motors	EV Maintenance Technician	Positive transition potential
Waste	Informal ragpickers in unsafe conditions	MRF operations, health & safety	MRF Operator (formal employment)	Formalisation
Construction	Conventional masons, civil engineers	AAC blocks, insulation, net-zero design	Green Building Specialist	Upskilling
Agriculture	Farmers dependent on residue burning	Biomass aggregation, FPO management	Biomass Aggregator / Energy Supplier	Income diversification

7.3.3 Indicative Workforce Policy Directions

The proposed workforce policy package may include: mass reskilling through bridge courses and transition-linked skilling programmes; gender inclusion targets of at least 20 percent in State-supported green jobs and skilling programmes; and social protection or transition stipends of up to 12 months for workers who may not be easily redeployed.

7.4 Technology & Digital MRV

7.4.1 Digital Infrastructure Context

The report proposes a digital public infrastructure for transition monitoring, verification, and service delivery comprising two inter-linked components:

a) Unified Energy Interface (UEI)-MRV Backbone: UEI is envisaged as a three-layer system:

- an input layer drawing data from utility smart meters (where available), fuel purchase / invoicing systems, audit instruments, and sensor-linked infrastructure;
- a processing layer converting raw data into standardized performance indicators (energy intensity, carbon intensity, water reuse, compliance proxies, etc.); and
- an output layer generating unit-level Green Passports (or equivalent

verification instruments), and aggregated reporting outputs for sector and State-level transition tracking.

b) Green Growth Hub Portal-Service & Enablement Layer:

To translate MRV into uptake, the report proposes a Green Growth Hub Portal as a single-window platform for MSMEs, industrial units, and clusters to access transition packages, green finance options, verified technology providers, expert support, and a knowledge repository. The Portal may be designed to consume UEI outputs (Green Passport / verified performance indicators) for eligibility verification, incentive linkage, and reporting, while also functioning as the practical interface through which firms can participate in transition programmes.

Together, UEI + Portal shift digital transition infrastructure from "monitoring only" to a full implementation stack, from onboarding → assessment/audits → finance/product access → implementation → verified outcomes.

7.4.2 Indicative Strategic Functions of UEI + Portal

The combined system would serve four broad functions:

- Audit trail and buyer-side ESG traceability:
  Unit-level verification outputs (Green Passport) support procurement traceability, ESG reporting needs, and buyer-driven carbon disclosure requirements.
- Eligibility verification for incentives and green finance:
  Verified indicators and audit records enable rule-based eligibility checks for instruments such as green interest support, guarantees, performance-linked subsidies, and transition-linked packages.
- Transaction enablement and aggregation:
  The Portal enables practical delivery—empanelled auditors/ESCOs/RESCOs, cluster aggregation models, standard packages/BoQs, and guided workflows so MSMEs can move from intent to implementation.
- State-level reporting and transition inventory:
  Aggregated outputs support department dashboards, sector tracking, and State-level reporting for carbon inventory and transition performance.

Table 7.3: Proposed UEI + Green Growth Hub Dashboard Architecture

Layer	KPI / Output Type	Reporting Frequency	Indicative Owner
Layer 1 — Vision (State)	**Macro indicators:** GSDP, manufacturing share, MSME registrations, RE share, per-capita income; State transition scorecards	Annual	Planning / Finance (with nodal coordination platform)
Layer 2 — Sector (Department)	**Sector KPIs:** Power, MSMEs, water, transport, industry; scheme/programme performance indicators; compliance and adoption metrics	Quarterly	Line Departments + proposed nodal coordination platform / PMU
Layer 3 — Unit / Project (Implementation)	**Unit-level outputs:** Audits completed, savings verified, plants commissioned, fuel-switch outcomes, water reuse MLD, Green Passport status	Monthly / Quarterly	Programme MIS / implementing entities / nodal PMU; Portal operator as the service layer

Note: Layer 3 is where the Green Growth Hub Portal acts as the user-facing interface, while UEI remains the verification backbone

7.4.3 Green Growth Hub Portal: Core Modules (Service Layer)

Table 7.4: Proposed Green Growth Hub Portal Modules, Functions, Outputs, and Illustrative Institutional Anchor

GGH Module / Functional Pillar	Core Function	Indicative Outputs / User Services	Illustrative Institutional Anchor
1. Enterprise Onboarding & Green Profiling	Provide a single entry point for MSMEs / industrial units to register and identify their transition starting point.	Unit registration; sector/cluster tagging; baseline profile (energy, water, waste); transition need identification.	Nodal coordination platform / PMU with MSME / Industries Dept.
2. Transition Diagnostic & Green Pathway Advisory	Help enterprises understand transition gaps and suitable pathways based on sector, scale, and cluster context.	Diagnostic tools; sector-specific pathways; technology options; firm/cluster-level action roadmaps; readiness status.	Technical PMU / Knowledge partner with sector departments.
3. Transition Packages & Scheme Discovery	Present curated transition packages aligned to common needs and enable discovery of relevant support schemes.	Standardized packages (e.g., Rooftop Solar, Water Reuse); scheme directory; package-to-scheme mapping.	Nodal PMU with line departments; HSIIDC / MSME Department.
4. Green Finance & Incentive Facilitation	Link firms to financial products and public support instruments needed for transition investments.	Green finance catalogue; incentive eligibility screening; links to guarantee/subsidy windows; finance readiness support.	Finance Dept. with partner FIs (SIDBI / NABARD) and Nodal PMU.
5. Green Technology Vendor / Aggregator Marketplace	Connect enterprises with verified technology providers, ESCOs, RESCOs, and solution integrators.	Empanelled vendor directory; technology categories; standard specifications / BoQs; cluster aggregation options.	Industries / MSME Dept. with technical agencies and industry associations.
6. Expert Network, Audits & Handholding Support	Provide access to approved experts, auditors, and implementation support agencies for enterprise transition.	Panel of auditors/consultants; booking workflow; audit reports; advisory support; handholding for implementation.	Nodal PMU / Program Management Unit with empanelled technical experts.

GGH Module / Functional Pillar	Core Function	Indicative Outputs / User Services	Illustrative Institutional Anchor
7. Knowledge Library, SOPs & Capacity Building	Build awareness and capability by providing structured guidance, practical tools, and sectoral knowledge resources.	SOPs; guidance notes; case studies; buyer-side ESG requirements; training modules; webinar repository.	Knowledge partner / Nodal PMU with sector depts and training institutions.
8. MRV, Green Passport & Reporting Dashboard	Use UEI-linked or audit data to generate verification outputs and support reporting at all levels.	**Green Passport** / verified status; performance dashboards; verified savings/emissions/resource -efficiency indicators.	UEI / MRV backbone operator with Nodal PMU and implementing entities.
9. Programme Management & Pipeline Tracking	Support the State in tracking demand, aggregating clusters, and monitoring the transition pipeline.	Pipeline dashboard; cluster aggregation lists; adoption funnel; district/sector progress analytics; bottleneck tracking.	Nodal coordination platform / PMU with Planning / Finance.

Note: The Green Growth Hub Portal is envisaged as the service-delivery and facilitation layer of the State's transition architecture. While the UEI / digital MRV system provides the verification backbone, the GGH Portal enables enterprises to access transition pathways, support instruments, technology providers, finance options, and implementation support through a structured single-window interface.

7.4.4 Phased Roll-out (Green Growth Hub Portal and UEI-linked MRV)

Phase 1 (0–12 months): Portal Operationalisation and Audit-based Verification

In the initial phase, the priority would be to operationalise the Green Growth Hub Portal as a practical single-window platform for MSMEs and industrial units. Core modules may include enterprise onboarding and green profiling, basic transition diagnostics, transition package and scheme discovery, vendor and expert linkage, knowledge resources, and basic programme tracking.

During this phase, MRV may rely primarily on self-reported information, document uploads, and third-party audits. The immediate objective would be to establish a functional transition support system without waiting for full digital integration. Outputs may include basic enterprise green profiles and audit-verified status for selected interventions.

Phase 2 (12–24 months): Integration and Transaction Enablement

In the second phase, the Portal may be strengthened through the addition of finance and incentive workflows, cluster aggregation features, standardized transition packages, and improved pipeline monitoring. Subject to feasibility, selected integrations may also be developed with utility billing systems, departmental MIS platforms, partner financial institutions, and standardized performance calculators.

At this stage, the MRV framework may evolve into a hybrid model, combining audit-based verification with limited automated data flows to support eligibility screening, programme monitoring, and reporting.

Phase 3 (24+ months): UEI-enabled Automation and Advanced Reporting
In the longer term, the UEI backbone may support more standardized and automated verification for priority indicators. This may include generation of Green Passports, stronger dashboard-based monitoring, and aggregated State-level reporting on transition performance and verified outcomes.

However, even in this more advanced stage, third-party verification may continue to remain necessary for interventions and sectors where full automation is not feasible.

Note: This phased approach enables early functionality of the Green Growth Hub Portal while allowing deeper automation and UEI integration to be developed progressively in line with data readiness, institutional capacity, and implementation experience.

CHAPTER 8: CONSOLIDATED RECOMMENDATIONS

Note: The recommendations presented in this chapter are indicative action priorities for consideration across three time horizons. They support policy sequencing, interdepartmental coordination, and programme design, and should not be interpreted as approved government decisions or finalized commitments.

8.1 Horizon 0: Immediate Actions (0–12 Months, 2026)

Immediate recommendations are primarily enabling, preparatory, and institution-building in nature. Their purpose is to establish the institutional, regulatory, analytical, and financial foundations required for subsequent scale-up. This horizon should also be used to develop the initial communication architecture, technical guidance frameworks, and implementation instruments necessary for coordinated green transition action across departments and sectors.

Table 8.1: Immediate Priority Recommendations (0–12 Months)

#	Indicative Action	Indicative Lead Owner	Illustrative Monitoring Indicator
R1	Consider establishment / notification of a State Green Transition Hub or Green Growth Hub (GGH) -type mechanism, along with an inter-departmental steering arrangement for transition coordination	Chief Secretary / Planning/HSIIDC/SJHIFM	Nodal coordination structure/ PMU / operational; quarterly review template prepared
R2	Design a Communication Strategy and phase-wise implementation plan and budget to promote a whole-of-government and whole-of-society approach to Green Economy and Green Growth	Nodal transition platform/ / SJHIFM /Information, Public Relations & Languages	Communication strategy prepared; phased outreach plan and budget finalized
R3	Initiate preparation of a Green Transition Roadmap / SOPs for Haryana's MSMEs, including p ractical adoption pathways and Just Transition principles	Industries / MSME / SJHIFM / nodal transition platform	Draft MSME transition roadmap / SOP prepared; consultation process initiated
R4	Prepare transition guidelines for key sectors, including Automotive, Textiles, Steel, and Power	Industries / sector departments / nodal transition platform/SJHIFM	Sector guideline drafts prepared for priority sectors
R5	Prepare guidelines / SOPs on renewable energy integration and decarbonisation, including shared models such as RESCO / cluster solarisation where relevant	Power Department / HAREDA / nodal transition platform/SJHIFM	Draft RE integration / decarbonisation guidelines prepared
R6	Draft guidelines drawing on global practices for climate-smart agriculture and sustainable water management, including reuse, efficiency, and resilience-oriented approaches	Agriculture / Horticulture / HWRA / PHED / nodal transition platform/SJHIFM	Draft guidelines prepared; departments / experts consulted

Table 8.1: Immediate Priority Recommendations (0–12 Months)

#	Indicative Action	Indicative Lead Owner	Illustrative Monitoring Indicator
R7	Consider issuing an SLBC-linked direction to earmark a share of MSME credit flow toward eligible green transition technologies, supported by publication of a state positive list / green taxonomy	Finance Department / SLBC	Share of ACP -linked green lending; green technology list notified
R8	Consider notification of a "No New Coal Boilers" framework for the Panipat planning area	Environment / HSPCB	Number of new coal boiler approvals post -notification
R9	Consider reforms in Green Open Access for MSMEs, including lower participation thresholds and a transition framework to address DISCOM revenue concerns	Power Department / nodal transition platform	Launch pilot MSME cluster decarbonisation programmes in selected clusters
R10	Launch pilot MSME cluster decarbonisation programme s in selected clusters, including audits, retrofit pipelines, RESCO preparation, and digital compliance support	Industries / MSME / HSIIDC	Number of units audited; verified savings; compliance uptake
R11	Prepare a DPR and institutional structure for a Pan ipat Common Boiler Facility (CBF) based on biomass steam systems	HSIIDC / GGH	DPR completed; implementation structure identified
R12	Initiate architecture design and pilot planning for the Unified Energy Interface (UEI) or equivalent digital MRV platform with selected DISCOM participation	Nodal transition platform / DISCOMs	UEI architecture approved; pilot scope agreed
R13	Consider introduction of a Green Interest Subvention mechanism linked to verified installations through digital MRV systems.	Finance Department / Industries	Scheme framework prepared; number of beneficiary MSMEs once launched

8.2 Horizon 1: 2026–2030 Scale-Up Actions

The 2026–2030 horizon focuses on scaling proven pilots, building shared infrastructure, expanding sector-specific transition interventions, and institutionalizing MRV, skilling, advisory support, and finance mechanisms. During this phase, the Green Growth Hub should evolve from a coordinating / facilitation mechanism into a stronger platform for transaction support, enterprise services, technical guidance, and programme monitoring.

Table 8.2: Indicative Scale-Up Recommendations (2026–2030)

#	Indicative Action	Indicative Lead Owner	Illustrative Monitoring Indicator
R14	Develop Bio-CNG / CBG rollout in major rice-producing districts and strengthen FPO-led biomass aggregation systems	Industries / Agriculture / nodal transition platform	Number of plants commissioned; biomass aggregated; stubble-burning incidence
R15	Develop treated-wastewater reuse pipelines connecting STPs in Gurugram / Faridabad with industrial demand centres, and consider Zero Freshwater Zone approaches in critically stressed areas	HWRA / HSIIDC / PHED	MLD reused; number of industries on treated-water offtake
R16	Roll out the UEI / digital MRV dashboard statewide and progressively link state-supported projects to common reporting and Green Passport systems	Nodal transition platform / relevant departments / DISCOMs	Number of registered enterprises; Green Passports / digital records issued
R17	Operationalise and expand the Green Growth Hub Portal as a single-window platform for enterprise onboarding, transition packages, finance linkage, vendor discovery, expert support, and knowledge services.	Nodal transition platform / PMU / relevant line departments	Number of enterprises onboarded; number of services / packages accessed; conversion to implementation
R18	Scale MSME solarisation and shared ESCO / RESCO models across multiple industrial clusters).	HSIIDC / HAREDA / nodal transition platform	MW installed; number of MSMEs solarised; verified energy savings
R19	Implement a motor-replacement drive for inefficient IE1 / IE2 motors using bulk procurement and financing support	EESL / DISCOMs	Bond / financing instrument structured; deployment volume
R20	Explore issuance of a green bond or equivalent instrument for financing CETPs, common boilers, solar parks, and other shared green infrastructure	Finance Department / HSIIDC	Bond issued; ₹ Crore deployed; credit rating maintained
R21	Consider adoption of "Born Green" standards in IMC Hisar and other new industrial clusters, including green-building and dual-piping norms	HSIIDC / Industries	Share of new sheds compliant with prescribed standards
R22	Establish a Green Skilling Academy / bridge-course system anchored through SVSU and related institutions	Skill Development / SVSU / nodal transition platform	Number of workers reskilled; courses operational; gender inclusion metrics
R23	Develop a Green Vendor Certification programme for the Gurugram–Manesar automotive ecosystem and other supplier clusters	Industries / OEM ecosystem / nodal transition platform	Number of certified vendors; number of audits / ESG readiness assessments

#	Indicative Action	Indicative Lead Owner	Illustrative Monitoring Indicator
R24	Expand ULB-level municipal solid waste performance contracts in additional cities with third-party verification	ULB Department / nodal transition platform	Processing rate; landfill diversion rate; verified service performance
R25	Operationalise and periodically update sector transition guidelines / SOPs for Automotive, Textiles, Steel, Power, MSMEs, renewable energy integration, climate-smart agriculture, and sustainable water management through pilot learning and departmental feedback.	Relevant line departments / nodal transition platform	Number of sector guidance documents adopted / updated; departments using them in programmes.

Note: Scale-up actions should be taken up selectively based on pilot performance, institutional capacity, financing availability, and sector readiness.

8.3 Horizon 2: System Transformation Actions (2031–2047)

The long-term horizon focuses on structural transformation, deeper institutional embedding of MRV and green finance, major industrial repositioning, strengthened public investment systems, and resource-efficiency shifts across the State economy. Actions in this horizon represent strategic directions for gradual consideration based on technological, financial, and institutional progress over time.

Table 8.3: Indicative System Transformation Actions (2031–2047)

#	Indicative Action	Indicative Lead Owner	Illustrative Vision Linked Outcome
R26	Institutionalize MRV protocols, green public procurement, and climate-risk screening across public investment systems	Planning / Finance / PWD	Share of public investments screened for climate and transition risk
R27	Position Haryana as a manufacturing and systems hub for green hydrogen / electrolyser - linked industries and grid - balancing technologies where feasible	Industries / HSIIDC / nodal transition platform	Electrolyser / storage -linked industrial capacity established
R28	Develop Panipat as an advanced textile recycling and circular - fashion hub	Industries / HSIIDC / nodal transition platform	Volume of textile waste processed; recycled textile export value
R29	Move progressively toward a low - carbon / net-zero industrial grid through higher RE share, demand response, and industrial flexibility systems	Power / HAREDA / nodal transition platform	Renewable share in supply; grid emission factor reduction
R30	Develop second-generation bio-refinery value chains using paddy straw and allied biomass for fuels and bio-based materials	Develop second-generation bio-refinery value chains using paddy straw and allied biomass for fuels and bio-based materials	Straw processed; bio-based product output; related industrial revenues
R31	Integrate sponge-city and recharge-oriented design into industrial estates and urban growth areas, especially in highly stressed water zones	HWRA / HSIIDC / Town & Country Planning	Groundwater extraction ratio decline; recharge and reuse indicators
R32	Explore advanced e-waste and critical-material recovery ecosystems linked to future electronics and circular-economy value chains	Industries / HSIIDC	E-waste processed; high-value material recovery indicators
R33	Mainstream the Green Growth Hub / UEI architecture into a mature State transition support system combining enterprise services, finance, data, verification, and strategic monitoring across sectors.	Planning / Finance / nodal transition platform / relevant departments	Integrated transition platform operational; share of supported projects under common MRV / service architecture.

Note: The 2031–2047 recommendations represent long-term transformation directions and should be interpreted as strategic possibilities for phased consideration, not as immediate commitments.

CHAPTER 9: Next Steps for Validation, Consultation and Action

As this report is intended to function as a baseline and consultation document rather than a final approved roadmap, the immediate next steps should focus on validation, prioritisation, and institutional alignment. At this stage, the priority is to move from analytical baseline findings toward a consultative process through which sector priorities, implementation sequencing, KPI definitions, and MRV arrangements can be refined with relevant departments and stakeholders. This would help translate the report's indicative pathways into a more grounded and implementable State transition agenda.

The following next steps may merit priority consideration:

1. Baseline validation and sector consultation:

Validate the report's baseline findings, transition risks, and enabling gaps through structured consultation with relevant departments, industry bodies, financial institutions, cluster stakeholders, and other sector actors. This would help confirm factual baselines, identify data gaps, and test the practical relevance of the sectoral transition issues identified in the report.

2. KPI and MRV refinement through consultation:

Refine the current indicative KPI and MRV framework through sector-specific consultation so that indicators, definitions, target direction, baselines, and verification arrangements are more clearly grounded and mutually agreed. At this stage, the KPI tables in this report should be treated as illustrative and consultation-oriented rather than as approved target frameworks.

3. Prioritisation of near-term action areas:

Identify those sectors, districts, clusters, and enabling measures that may be suitable for early piloting or phased implementation during the 2026–2030 period. This would help distinguish between areas requiring immediate support architecture and those better suited to longer-term policy development.

4. Common infrastructure and support architecture:

Examine areas where shared infrastructure, common technical services, digital MRV systems, and coordinated market or policy signals may reduce the transition burden on smaller enterprises and fragmented sector ecosystems. This is likely to be especially relevant in clusters where unit-level transition remains commercially or technically difficult without pooled solutions.

5. Finance and implementation design:
Further examine financing support, working-capital constraints, facilitation mechanisms, institutional convergence, and programme-delivery arrangements required for phased transition implementation. This should include consideration of how smaller enterprises, stressed geographies, and common infrastructure needs may be better supported through future programme design.

6. Development of a phased implementation roadmap:
Following validation and consultation, prepare a more detailed phased roadmap setting out priority actions, sequencing logic, institutional roles, financing pathways, and monitoring architecture for subsequent consideration by the State. This would help move the report from analytical baseline and pathway framing toward a more operational transition planning instrument.

ANNEXURES

ANNEXURE A: EVIDENCE REGISTER

All numeric indicators used in this report are listed below with full source traceability, cross-referenced to the sections and tables where they appear. Where an indicator is derived from official data, the derivation method is noted. Sources reflect those cited in the main body of the report

Table A.1: Evidence Register – Indicators, Values, Sources, and Cross-References

Indicator	Value	Source Cited in Report	Report Reference / Cross-Reference
A. State Economy and Economic Structure			
GSDP 2024-25	**₹12.13 Lakh Crore**	Economic Survey of Haryana 2024-25	Sec 3.1, Exec Summary
GSDP Growth Rate	11.8% (current prices)	Economic Survey of Haryana 2024-25	Sec 3.1
Per Capita Income	**₹ 3,53,182**	Economic Survey of Haryana 2024-25	Sec 3.1, Exec Summary
Per capita income vs. national avg	~1.7x national average	Economic Survey of Haryana 2024-25	Sec 3.1
GSVA – Services share	51.20%	Economic Survey of Haryana 2024-25	Sec 3.1
GSVA – Industry share	32.90%	Economic Survey of Haryana 2024-25	Sec 3.1
GSVA – Agriculture share	15.90%	Economic Survey of Haryana 2024-25	Sec 3.1, Sec 5.6
Agriculture GSVA (Absolute)	**₹95,767 crore**	Economic Survey of Haryana 2024-25	Sec 5.6, Table 5.11
B. Industrial and Export Geography			
Total Industrial Exports FY 2023-24	**₹1,63,430 Crore**	Economic Survey of Haryana 2024-25	Sec 3.2, Table 4.1
Total Industrial Exports FY 2024-25 (AE)	**₹1,83,041 Crore**	Economic Survey of Haryana 2024-25	Sec 3.2, Table 4.1
4-district export concentration	>70% of state exports	Economic Survey of Haryana 2024-25; Statistical Abstract of Haryana 2023-24	Sec 3.2, Table 4.1
Gurugram-Manesar auto/eng exports (FY 2023-24)	**₹52,450 Crore**	Economic Survey of Haryana 2024-25	Sec 3.2, Table 4.1, Sec 5.4
Gurugram-Manesar auto/eng exports (FY 2024-25 AE)	**₹58,639 Crore**	Economic Survey of Haryana 2024-25	Sec 5.4, Table 5.7
Faridabad engineering exports (FY 2023-24)	**₹20,422 Crore**	Economic Survey of Haryana 2024-25	Sec 3.2, Table 4.1
Faridabad engineering exports (FY 2024-25 AE)	**₹22,873 Crore**	Economic Survey of Haryana 2024-25	Sec 5.3, Table 5.5
Panipat textile exports (FY 2023-24)	**₹12,968 Crore**	Economic Survey of Haryana 2024-25	Sec 3.2, Table 4.1, Sec 5.5
Karnal agro-processing exports (FY 2023-24)	**₹9,121 Crore**	Economic Survey of Haryana 2024-25	Sec 3.2, Table 4.1
Panipat CBAM border tax risk	15-20%	Qualitative assessment based on sector characteristics	Sec 4.5 - verify officially

Indicator	Value	Source Cited in Report	Report Reference / Cross-Reference
C. Power and Energy Baseline			
Total Installed Power Capacity	15,936.65 MW (as of 31 Dec 2024)	Economic Survey of Haryana 2024–25 (Table 4.6)	Sec 3.3, Sec 6.2, Table 5.3
Renewable Installed Capacity	2,912.13 MW	MNRE / ICED State Profile 2025	Sec 3.3, Sec 6.2, Table 5.3
Solar Capacity	2,512.96 MW	ICED / MNRE Physical Progress 2024–25	Sec 3.3, Table 5.3
Bio-power Capacity	325.67 MW	ICED / HAREDA Physical Achievements	Sec 3.3, Table 5.3
Small Hydro Capacity	73.50 MW	MNRE / ICED State Profile	Sec 3.3, Table 5.3
Renewable share of grid supply	~4.62%	ICED Haryana Supply Profile 2024–25	Sec 3.3, Sec 6.2, Table 5.3
Total Units Sold FY 2024–25 (up to Dec 2024)	48,489.5 MkWh	Economic Survey of Haryana 2024–25	Sec 3.3, Table 5.3, Table 5.4
Per-capita electricity consumption	2,289 kWh	Economic Survey of Haryana 2024–25 / CEA Baseline	Sec 3.3, Table 5.3
State bus fleet electrification target	100% by 2029	SEEAP 2023, Haryana	Sec 6.2, Table 5.4
D. Water and Environment Baseline			
Groundwater extraction ratio	136.75% of recharge	CGWB 2025 / HWRA	Sec 3.4, Sec 5.7, Table 5.13
Over-exploited groundwater blocks	88 out of 143	HWRA / CGWB 2025; Vidhan Sabha (Feb 2026)	Sec 3.4, Sec 5.7, Table 5.13
Treated wastewater generated	1,487 MLD	State Environment Plan (SEP) 2025	Sec 3.4, Sec 5.7, Table 5.13
Treated wastewater reused	281 MLD (18%)	State Environment Plan (SEP) 2025	Sec 3.4, Sec 5.7, Table 5.13
Untapped treated wastewater reuse potential	~1,206 MLD	Derived from SEP 2025 baseline	Sec 3.4, Sec 5.7, Table 5.13
Reuse pipeline (industrial)	0 km	HSIIDC Baseline 2025	Sec 5.7, Table 5.13, Table 5.14
Registered MSME units statewide	14,14,352 units	Government Open Data Platform	Sec 3.5, Sec 6.1, Table 5.1
MSME clusters (SEEAP)	56 clusters / 21 districts	SEEAP 2023, Haryana	Sec 6.1, Table 5.1

Indicator	Value	Source Cited in Report	Report Reference / Cross-Reference
E. MSME and Credit Landscape			
Rice milling units in SEEAP clusters	451 units	SEEAP 2023, Haryana	Sec 6.1, Table 5.1
MSME solarisation rate	<5%	SEP / SEEAP	Sec 6.1, Table 5.1
Motor efficiency standard (prevalent)	IE1	Energy Audit Baseline	Sec 6.1, Table 5.1
Green CAPEX Subsidy (State)	50% of cost (up to ₹**20 lakh/MSME)**	Haryana Revised Energy Conservation Scheme (HR-ECS)	Sec 6.1, Table 5.1
Energy Audit Support (State)	75% of cost (up to ₹**2 lakh/MSME)**	Department of Renewable Energy, Haryana	Sec 6.1, Table 5.1
MSME ACP target 2024–25	₹**84,278 Crore**	Economic Survey of Haryana 2024–25	Sec 3.5, Sec 6.1, R2
MSME ACP disbursed 2024–25	₹**1,21,516 Crore**	Economic Survey of Haryana 2024–25	Sec 3.5, Sec 6.1, R2
ACP achievement rate	144% of target	Economic Survey of Haryana 2024–25	Sec 3.5
SEEAP efficiency investment potential	₹ **6,610 Crore (through 2031)**	SEEAP 2023, Haryana	Sec 3.5, Exec Summary, Sec 7.1
SEEAP annual CO_2 **reduction (ambitious)**	11.2 $MtCO_2$	SEEAP 2023, Haryana	Exec Summary
5-year transition CAPEX (modelled)	~₹**16,250 Crore**	SEEAP-anchored modelling	Sec 6.1, Exec Summary
Annual CAPEX requirement	₹ **3,250 Crore/year**	SEEAP-anchored modelling	Sec 7.1
F. SEEAP and Transition Finance Projections			
CAPEX as % of ACP	~2.6%	Derived calculation from SEEAP / ACP data	Sec 6.1, Exec Summary
IMC Hisar Area	2,988 Acres	NICDC / PIB (Feb 2026)	Sec 5.3, Table 5.5
Energy cost share – Faridabad forging	22–30% of OPEX	SEEAP 2025 / Industry Survey	Sec 5.3, Table 5.5
State Steel SEC Benchmark	5.8–6.4 Gcal/tonne	BEE PAT Cycle / SEEAP 2025	Sec 5.3, Table 5.5
Global Best SEC Benchmark (steel)	4.5–5.0 Gcal/tonne	World Steel Association (2025)	Sec 5.3, Table 5.5

Indicator	Value	Source Cited in Report	Report Reference / Cross-Reference
G. Steel Sector Baseline			
IPPU Emissions – Steel contribution	Highest sectoral share	GHG Platform / HSPCB 2025	Sec 5.3, Table 5.5
Dominant Cluster Risk Driver – Automotive	High Scope 3 exposure	Export cluster baseline	Sec 5.4, Table 5.7
OEM Decarbonisation Trajectory	2040–2050 carbon-neutrality	Corporate sustainability / BRSR disclosures	Sec 5.4, Table 5.7
Tier-1/2 suppliers with carbon reports	~0% (manual baseline)	Sector KPI baseline	Sec 5.4, Table 5.7, Table 5.8
Tier-2/3 MSMEs on Rooftop Solar	<5%	Sector KPI baseline	Sec 5.4, Table 5.7, Table 5.8
H. Automotive Sector Baseline			
Scope 2 Emissions Intensity (Grid)	~0.72 $kgCO_2e/kWh$	CEA 2024 grid average	Sec 5.4, Table 5.7, Table 5.8
Panipat textile/dyeing MSME units	500+ units	Panipat Sustainability Readiness Report 2026	Sec 5.5, Table 5.9
Groundwater status – Panipat	100% Over-exploited	CGWB Dynamic GW Assessment 2025	Sec 5.5, Table 5.9
Groundwater extraction rate – Panipat	187% of recharge	CGWB National Compilation 2025	Sec 5.5, Table 5.9
Coal / Petcoke boiler units – Panipat	500+ units	Cluster KPI Baseline 2026	Sec 5.5, Table 5.9
I. Textiles Sector Baseline			
ZLD compliance rate (dyeing)	<10%	Sector KPI / HSPCB Monitoring 2025	Sec 5.5, Table 5.9, Table 5.10
Carbon Footprint Reports – textiles exporters	0%	Export Cluster Baseline 2025	Sec 5.5, Table 5.9, Table 5.10
CBF specification (Panipat)	3 × 50 TPH Fluidized Bed Biomass	Technical proposal (sector analysis)	Sec 5.5, Table 5.10
Agriculture workforce dependence	~32%	PLFS 2023–24 / MoSPI	Sec 5.6, Table 5.11
Stubble-burning cases (2025)	662 cases	CAQM / PIB (Dec 1, 2025)	Sec 5.6, Table 5.11
Solar pump investment potential (SEEAP)	₹ **174 crore**	SEEAP 2023 (Haryana White Paper)	Sec 5.6, Table 5.11
Mera Pani Meri Virasat support rate	₹ **7,000 per acre**	Department of Agriculture, Haryana (scheme notification)	Sec 5.6, Table 5.11, Table 5.12

Indicator	Value	Source Cited in Report	Report Reference / Cross-Reference
J. Agriculture and Allied Sector Baseline			
Solar Pumps Installed (PM-KUSUM)	~1.84 Lakh pumps	MNRE PM-KUSUM Dashboard (Feb 2026 status)	Sec 5.6, Table 5.12
Bio-CNG plant specification	50 TPD per plant; **~₹ 50 crore each**	SEEAP / sector analysis	Sec 5.6, Table 5.12
Green Interest Subvention cost	**₹ 65 Crore/year**	Modelling estimate	Sec 6.2, R8
SLBC green credit target (GPS)	10% of ACP = **~₹ 12,000 Crore/yr**	Policy proposal	Sec 6.2, R2
H-GTF corpus	**₹ 200 Crore**	Finance instrument proposal	Sec 6.2
H-GTF leverage ratio	5x (**~₹ 1,000 Crore bank lending)**	Standard FLDG leverage	Sec 6.2
K. Transition Finance Instruments (Indicative)			
HSIIDC Green Bond Tranche 1	**₹1,000 Crore**	Finance instrument proposal	Sec 6.2, R14
Green jobs target 2030	55,000+ new jobs	Qualitative estimate [indicative]	Sec 6.3 – verify officially
Reskilling target 2030	1 Lakh workers	Indicative target	Sec 7.3, R16
Women in green jobs target 2030	20%	Indicative target	Sec 7.3
Transition Stipend duration	Up to 12 months	Workforce policy proposal	Sec 7.3

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SUSTAINABLE DEVELOPMENT GOALS
COORDINATION AND ACCELERATION CENTRE