Mapping India's Energy Transition: A data dive into the strategic role of state-owned enterprises in the energy sector

Data, Definitions, Methodology, and References Annex

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This document sets out the analytical methodology underlying the International Institute for Sustainable Development's digital story, *Mapping India's Energy Transition: A Data Dive Into the Strategic Role of State-Owned Enterprises in the Energy Sector*. It describes, for each figure, what parameters were collected for the nine PSUs, what parameters were collected for India as a whole, and what was calculated from those inputs. Sources for all PSU-level and India-level data points are listed in the companion data sheet. All data are from publicly available sources for FY 2024–25 (April 1, 2024, to March 31, 2025) unless otherwise noted.

Scope and Analytical Framework

PSUs Covered

The nine central public sector undertakings covered in this analysis, with their official names, are listed in Table 1.

Table 1. PSUs covered and their primary area of operation

Abbreviation	Official name	Primary sector
CIL	Coal India Limited	Coal mining
NTPC	NTPC Limited (formerly National Thermal Power Corporation)	Power generation
NLCIL	NLC India Limited (formerly Neyveli Lignite Corporation)	Lignite mining and power
ONGC	Oil and Natural Gas Corporation Limited	Upstream oil and gas
OIL India	Oil India Limited	Upstream oil and gas
IOCL	Indian Oil Corporation Limited	Refining and marketing
BPCL	Bharat Petroleum Corporation Limited	Refining and marketing
GAIL	GAIL (India) Limited (formerly Gas Authority of India Limited)	Gas transmission and marketing
NHPC	NHPC Limited (formerly National Hydroelectric Power Corporation)	Hydropower generation

Source: Company websites.

Analysis Level–Consolidated group

All figures are reported at the consolidated group level, incorporating material subsidiaries operating in the energy sector. The subsidiaries consolidated into each parent group are in Table 2.

Table 2. Subsidiaries included in consolidated group

Parent PSU	Material subsidiaries included in consolidated group
CIL	Eastern Coalfields Limited (ECL), Bharat Coking Coal Limited (BCCL), Central Coalfields Limited (CCL), Western Coalfields Limited (WCL), South Eastern Coalfields Limited (SECL), Northern Coalfields Limited (NCL), Mahanadi Coalfields Limited (MCL)

Parent PSU	Material subsidiaries included in consolidated group
NTPC	NTPC Renewable Energy Limited (NTPC REL), NTPC Mining Limited, Kanti Bijlee Utpadan Nigam Limited (KBUNL), Patratu Vidyut Utpadan Nigam Limited (PVUNL), Nabinagar Power Generating Company Limited (NPGCL), North Eastern Electric Power Corporation Limited (NEEPCO), Tehri Hydro Development Corporation India Limited (THDC), Ratnagiri Gas and Power Private Limited (RGPPL)
NLCIL	Neyveli Uttar Pradesh Power Limited (NUPPL); joint ventures with state utilities were consolidated in NLCIL accounts
ONGC	Hindustan Petroleum Corporation Limited (HPCL), Mangalore Refinery and Petrochemicals Limited (MRPL), ONGC Tripura Power Company Limited (OTPC)
OIL	Numaligarh Refinery Limited (NRL)
IOCL	Chennai Petroleum Corporation Limited (CPCL)
BPCL	Bharat PetroResources Limited (BPRL)
GAIL	GAIL Gas Limited (city gas distribution subsidiary)
NHPC	NHDC

Source: Company websites.

Note: Consolidation follows each company's published consolidated financial statements for FY 2024–25. Only subsidiaries whose activities are material to the energy metrics analysed are included.

Reference period: FY 2024–25 (April 1, 2024–March 31, 2025).

Currency: Financial figures are in Indian rupees (INR) crore, where 1 crore = 10 million. USD equivalents use the average INR/USD exchange rate for FY 2024–25 (~INR 84.5 per USD).

Rounding: Shares and percentages are rounded to one decimal place.

Share of Nine PSUs in India's Energy System

The table below sets out, for each metric, what was collected for the nine PSUs, what was collected as the India total, and what was calculated. All values are directly reported; no estimation was required for this figure.

Table 3. Share of nine PSUs in India's energy system

Metric (unit)	Collected for PSUs	Collected for India	Calculated
Coal production (million tonnes)	Consolidated group production from annual reports	India total production	PSU share (%)
Crude oil production (million tonnes)	Consolidated group production from annual reports	India total production	PSU share (%)

Metric (unit)	Collected for PSUs	Collected for India	Calculated
Natural gas production (billion cubic metres)	Consolidated group production from annual reports	India total production	PSU share (%)
Gas pipeline throughput (million standard cubic metres per day)	Consolidated group throughput from annual reports	India total pipeline throughput	PSU share (%)
Installed capacity—fossil fuels (gigawatts)	Consolidated group capacity from annual reports	India total installed capacity	PSU share (%)
Installed capacity—non-fossil fuels (gigawatts)	Consolidated group capacity from annual reports	India total installed capacity	PSU share (%)
Electricity generation—fossil fuels (terawatt-hours)	Consolidated group generation from annual reports	India total generation	PSU share (%)
Electricity generation—non-fossil fuels (terawatt-hours)	Consolidated group generation from annual reports	India total generation	PSU share (%)
Refining capacity (million tonnes per annum)	Consolidated group capacity from annual reports	India total refining capacity	PSU share (%)
Petroleum product sales (million tonnes)	Consolidated group sales from annual reports	India total product sales	PSU share (%)

Source: Data Annex.

Economic and Social Contribution of Nine PSUs

The table below sets out what was collected for the nine PSUs, what was collected as the India denominator, and what was calculated. All PSU values are directly reported from consolidated company accounts.

Table 4. Economic and social contribution of nine PSUs

Metric (unit)	Collected for PSUs	Collected for India (denominator)	Calculated
Total revenues (INR crore)	Aggregate operating revenues from consolidated annual reports	Nominal GDP (INR crore)	PSU revenues as % of GDP

Metric (unit)	Collected for PSUs	Collected for India (denominator)	Calculated
Payments to central exchequer—dividends, taxes, levies (INR crore)	Aggregate payments from annual reports	Union Government net revenue receipts (INR crore)	PSU payments as % of central receipts
Payments to state exchequers—royalties, levies, state taxes (INR crore)	Aggregate payments from annual reports	States' own revenue receipts (INR crore)	PSU payments as % of state receipts
Capital expenditure (INR crore)	Aggregate capex from annual reports	Combined central government and public sector capex (INR crore)	PSU capex as % of central government and public sector capex
CSR spending (INR crore)	Aggregate CSR spend from annual reports	Total public sector CSR spend (INR crore)	PSU CSR as % of public sector CSR
R&D spending (INR crore)	Aggregate R&D spend from annual reports	Total public sector R&D spend (INR crore)	PSU R&D as % of public sector R&D
Permanent employees (number of persons)	Headcount from annual reports and Business Responsibility and Sustainability Report (BRSR)	Central public sector enterprises (CPSE) total permanent employment (persons)	PSU share of CPSE permanent employment
Contractual workers (number of persons)	Headcount from annual reports and BRSR	CPSE total contractual employment (persons)	PSU share of CPSE contractual employment
Foreign exchange earnings—Free on board (INR crore)	Aggregate earnings from annual reports	India total merchandise exports (INR crore)	PSU earnings as % of merchandise exports
Foreign exchange expenditure (INR crore)	Aggregate expenditure from annual reports	India total merchandise imports (INR crore)	PSU expenditure as % of merchandise imports

Source: Data Annex.

Note: Sources for all PSU and India values are listed in the companion data sheet.

India State-Owned Enterprises Emissions–Consolidated by Parent Group (FY 2024–25)

What was collected for PSUs: Scope 1 (direct) GHG emissions in million tonnes CO_2 equivalent (Mt CO_2e) from each PSU group's FY 2024–25 BRSR disclosure. Subsidiary Scope 1 figures are aggregated to the consolidated parent. For indirect emissions, fuel sales volumes were collected from company annual reports and Central Electricity Authority (CEA) Monthly Coal Consumption Reports.

What was collected for India: India's national GHG total from EDGAR (JRC/European Commission, 2024 release), which provides annual independent estimates using Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines and International Energy Agency (IEA) World Energy Balances activity data. India's most recent official inventory (BUR-4, December 2024) covers only 2020; EDGAR fills this gap for FY 2024–25.

What was calculated—indirect (Scope 3) emissions: Downstream combustion emissions from sold fuels were estimated using the volumes collected above and the emission factors in Table 5. Company-reported Scope 3 figures were not used directly due to inconsistency and double-counting risk from inter-PSU commodity flows. PSU-specific treatments are described below. The PSU share of national emissions = (total Scope 1 + estimated Scope 3 Cat. 11) ÷ EDGAR India total × 100.

Scope 2 is excluded to avoid double counting with power-sector Scope 1 already in the group.

Table 5. Emission factors applied

Fuel or commodity	Emission factor	Calorific value basis
Domestic Indian coal	1.588 tonnes CO_2 per tonne of coal	Gross calorific value (GCV): Oxidation factor 0.98 applied.
Imported coal	2.31 tonnes CO_2 per tonne of coal	GCV: Oxidation factor 1.0, based on net calorific value (NCV) of 25.8 GJ/tonne for imported steam coal.
Natural gas and compressed natural gas (CNG)	56.1 kilograms CO_2 per gigajoule	NCV: CNG carries the same factor as pipeline natural gas, as compression does not alter carbon content.

Source: NITI Aayog, 2023.

Note: The domestic coal factor of 1.588 t CO_2/t is from the Government of India's IESS Energy Security Scenarios 2047. It reflects the high-ash, sub-bituminous character of Indian thermal coal (~43% carbon by weight, as-received) and is more conservative (lower) than the IPCC generic sub-bituminous default of ~1.68 t CO_2/t.

Table 6. PSU-specific calculation approach for indirect emissions

PSU	Calculation approach for indirect (Scope 3) emissions
CIL	CIL does not report Scope 3 emissions. External coal dispatch volumes are used to estimate downstream combustion CO_2. Coal supplied to NTPC and NLCIL is excluded (captured in their Scope 1). For the remaining power plants, each plant's CO_2 is attributed in proportion to CIL's share of coal supply using CO_2 baseline database for the Indian power sector and CEA monthly coal report. For non-power and captive sector sales, the domestic coal emission factor is applied directly to dispatch volumes.
NLCIL	CO_2 from external lignite-fired plants supplied by NLCIL is estimated from plant-level emission data.

PSU	Calculation approach for indirect (Scope 3) emissions
NTPC	Indirect emissions not separately estimated. NTPC's Scope 3 (principally transport diesel) is already captured within IOCL, ONGC, and BPCL indirect emissions as downstream diesel combustion.
ONGC (consolidated)	Upstream crude and gas flows to PSU refineries are excluded to avoid double counting with IOCL and BPCL direct emissions. HPCL indirect emissions from petroleum product sales are included in the consolidated ONGC group figure.
OIL India (consolidated)	Upstream flows to PSU refineries excluded. NRL product sales excluded as BPCL (primary offtaker) captures those emissions in its own indirect emissions.
IOCL (consolidated)	IOCL indirect emissions from petroleum product sales are reported directly.
BPCL	BPCL indirect emissions from petroleum product sales are reported directly.
GAIL (consolidated)	Indirect emissions restricted to CNG sales by GAIL Gas Limited. GAIL's broader Scope 3 is not used due to double-counting risk from gas supplied to NTPC and PSU refineries already counted elsewhere.
NHPC	No fossil fuel product sales. Scope 3 Category 11 emissions are nil.

Source: Author.

Residual Double Counting

Diesel consumed by CIL, NTPC, and NLCIL for mining and auxiliary operations may appear both in oil PSU indirect emissions and in those PSUs' own Scope 1 figures. The overlap is approximately 2 Mt CO_2e—well below 1% of combined group indirect emissions. No adjustment is made, given its immateriality; it is disclosed here for transparency.

Nine PSUs–Energy flows (FY 2024–25)

What was collected: Physical volumes for each inter-PSU and PSU-to-system energy flow from company annual reports and CEA/MoPNG publications: crude oil flows from producers to refineries (million tonnes); natural gas flows (million standard cubic metres); coal and lignite flows from producers to power plants (million tonnes); fossil and non-fossil electricity flows from generators to the national grid (terawatt-hours); grid electricity consumed by PSUs (terawatt-hours); diesel supplied to coal producers (kilolitres); fuel oil supplied to thermal power plants (kilolitres).

What was calculated: All physical volumes converted to petajoules (PJ) using the calorific value factors in Table 7.

Table 7. Energy conversion factor for different fuels or energy carrier

Fuel or energy carrier	Conversion factor	Full unit name
Domestic coal	17.5 GJ per tonne	Gigajoules per tonne, NCV; CEA dispatch-weighted average for Indian thermal coal
Lignite	11.9 GJ per tonne	Gigajoules per tonne, NCV; revised from IEA default to reflect Indian lignite quality
Crude oil	41.9 GJ per tonne	Gigajoules per tonne, NCV; IEA Energy Statistics default
Natural gas	38.1 GJ per 1,000 cubic metres	Gigajoules per thousand standard cubic metres, NCV
Electricity	3.6 GJ per megawatt-hour	Gigajoules per megawatt-hour; standard electrical energy conversion
Diesel	35.7 GJ per kilolitre	Gigajoules per kilolitre, NCV
Fuel oil	39.2 GJ per kilolitre	Gigajoules per kilolitre, NCV; density-adjusted per kilolitre basis

Source: Central Electricity Authority, 2025.

Nine PSUs–Net-zero and renewable energy targets

What was collected for PSUs: Each PSU's publicly stated net-zero commitment year (Scope 1 and Scope 2 operational net-zero, unless otherwise specified) and renewable energy capacity targets (gigawatts) at various milestone years, from company annual reports, BRSR disclosures, and sustainability reports for FY 2024–25. Progress on installed renewable capacity (gigawatts commissioned) from company annual reports.

What was collected for India: India's national net-zero target year (2070) and 2030 renewable capacity target (500 GW non-fossil installed capacity) from the Government of India's Nationally Determined Contribution (updated 2022) and NITI Aayog publications. Progress on national renewable installed capacity from CEA monthly generation reports.

What was calculated: Aggregate PSU renewable capacity target (sum of individual PSU targets at the nearest common milestone year) and aggregate progress (sum of installed renewable capacity across the nine PSU groups). No emission factor calculations are involved in this figure.

Nine PSUs–Collective ambition across the energy transition

What was collected for PSUs: Publicly stated ambition and current progress across five transition dimensions—emissions (net-zero targets), renewable energy capacity (gigawatts), biowaste-to-energy technologies, electric vehicles (charging infrastructure installed), and

green hydrogen (capacity in kilowatts or kilotonnes per year)—from company annual reports and BRSR disclosures for FY 2024–25.

What was collected for India: India's national 2030 goals and the central government incentive framework for each of the five dimensions, from official government sources.

What was calculated: Aggregate 9-PSU totals for each dimension where individual figures could be summed (e.g., total renewable capacity target in GW, total charging stations installed). Where aggregation was not meaningful (e.g., net-zero target years), PSU commitments are presented individually.

Key Definitions

Financial year (FY): In India, the government and corporate financial year runs from April 1 to March 31, and is named by the year in which it ends. FY 2024–25 = April 1, 2024, to March 31, 2025.

Scope 1 emissions: Direct GHG emissions from sources owned or controlled by the entity, expressed in CO_2 equivalents. Sourced from BRSR disclosures.

Scope 3 Category 11 emissions—Use of sold products: Indirect GHG emissions from the downstream combustion of fossil fuels and energy products sold by the PSU to end consumers. Estimated using volumes and emission factors as described in Table 6.

BRSR: Mandatory annual sustainability disclosure required of all top 1,000 listed Indian companies by market capitalization under Securities and Exchange Board of India regulations since FY 2022–23. All nine PSUs in this analysis file BRSR disclosures.

EDGAR: Emissions Database for Global Atmospheric Research, produced by the Joint Research Centre of the European Commission. Provides annual country-level GHG estimates using IPCC 2006 methodology and IEA activity data, published with approximately 1-year lag.

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