Briefing Note: Comparative analysis of carbon emissions and energy mix trends for DISCOMs: BESCOM, EDP, and TANGEDCO (FY18-FY24).

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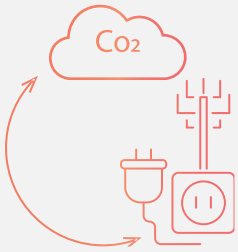

Introduction

This briefing note presents a comparative analysis of the energy mix and carbon emissions of three prominent Indian electricity distribution companies (DISCOMs): the Bangalore Electricity Supply Company Limited (BESCOM), the Electricity Department of Puducherry (EDP), and the Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO). The study uses power plant-specific CO_2 emissions data through Scope 2 accounting based on the Central Electricity Authority's database for the fiscal years 2017-18 to 2023-24 (CEA,2021) and aggregates this data to arrive at distribution company-specific annual emission values.

Key Findings

Fossil dependence and diversification

- In FY2023-24, BESCOM procured 67% of its electricity from fossil fuels, followed by TANGEDCO at 52%, and EDP at 43%.
- From 2017-18 to 2023-24, EDP decreased fossil fuel procurement by 37%, increased nuclear energy procurement by 17%, and renewable energy procurement increased by 16%.
- BESCOM renewable energy procurement increased by 30% from FY2017-18 to FY2023-24, while it maintained the fossil fuel procurement at around 50% from FY2020-21 to FY2022-23.
- TANGEDCO maintained a 51% average fossil fuel share over the entire period. TANGEDCO's non-fossil fuel share decreased from 25% in FY2017-18 to 37% in FY2023-24.

Emission trends from FY2017-18 to FY2023-24

- EDP reported the lowest emission factor (EF) among the three DISCOMs, a decrease of 24% from 0.80 tCO_2/MWh in FY2017-18 to 0.60 tCO_2/MWh in FY2023-24.
- BESCOM showed a decrease in EF by 40% from 0.76 tCO_2/MWh to 0.71 tCO_2/MWh by FY2021-22. However, it may be noted that in FY2021-22, it achieved an EF of 0.46 tCO_2/MWh in FY2023-24.
- TANGEDCO followed the national average, with EF initially decreasing to 0.65 tCO2/MWh in FY2020-21 before increasing to 0.75 tCO_2/MWh in FY2023-24, remaining above the national average of 0.73 tCO_2/MWh.

Absolute emissions trends FY2017-18 to FY2023-24

- TANGEDCO: Annual CO_2 emissions increased by 47% from 54.48 million tCO2 to 83.05 million tCO_2.
- BESCOM: Annual CO_2 emissions increased by 30% from 23.59 million tCO_2 to 30.60 million t CO_2.
- EDP: Annual CO_2 emission increased by 5% from 2.61 million tCO_2 to 2.75 million t CO_2.

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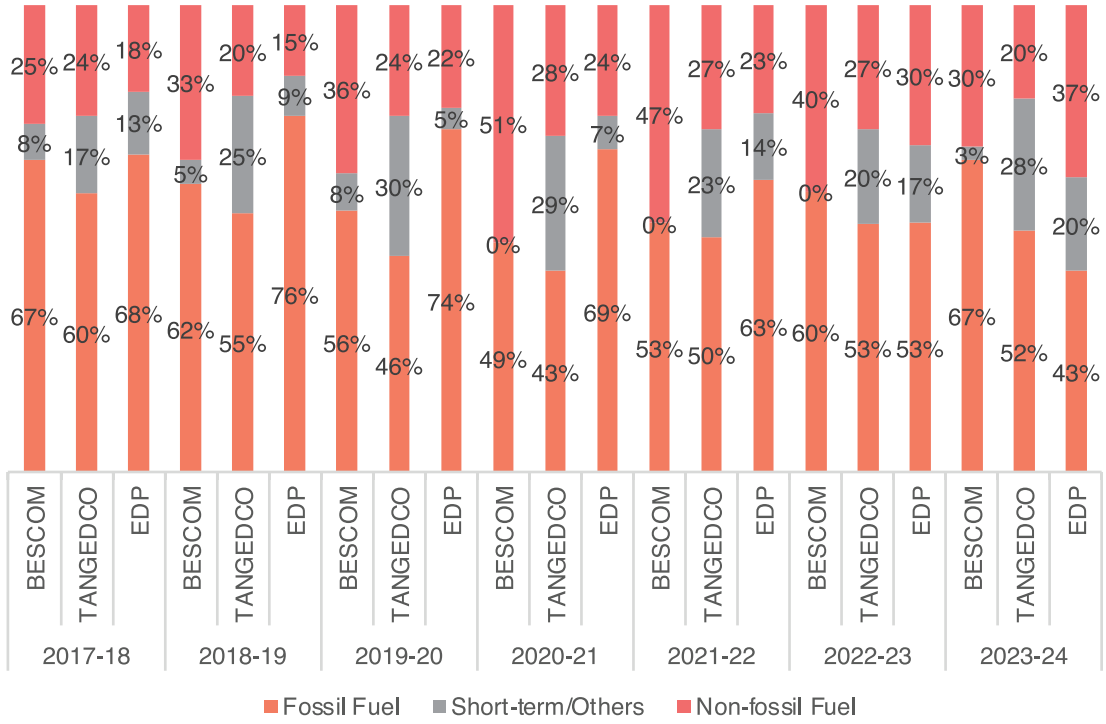
Comparative analysis

Energy mix trends

All three DISCOMs have a dominant fossil fuel procurement, but their low-emission transition paths vary significantly. Across FY2017-18 and FY2023-24, EDP reduced its reliance on fossil fuels by 37%, increased its nuclear energy procurement by 17% and expanded its renewable energy share from 0% to 16% (EDP, 2025). Similarly, BESCOM increased its average renewable energy share to 31% over the same period; its non-fossil fuel share increased from 25% to 37%, primarily from solar and wind, while biomass, hydro, and nuclear contributions remained limited (BESCOM, 2025). In contrast, TANGEDCO maintained a fossil fuel share average of 51% of its total procurement. TANGEDCO's non-fossil fuel share increased from 25% to 37% (TANGEDCO, 2025).

In FY2023-24, fossil fuels, including coal, lignite, and gas, maintained dominance across all distributors, with BESCOM showing the highest dependency at 67% of total procurement, primarily driven by coal-based generation. TANGEDCO followed with a 52% reliance on fossil fuels, while EDP demonstrated the most balanced approach at 43%. The transition towards non-fossil fuel sources, encompassing wind, solar, hydro, biomass, and nuclear technologies, revealed significant progress differentials among the three distributors. EDP led this transformation with 37% non-fossil fuel procurement, reflecting consistent improvement from baseline measurements and deliberate investment in renewable infrastructure. BESCOM achieved a 38% integration of non-fossil fuels. TANGEDCO recorded a 20% procurement of non-fossil fuels. Short-term procurement patterns further illuminated operational strategies, with TANGEDCO utilising flexible sources for 28% of its energy mix, demonstrating active grid balancing and opportunistic renewable purchasing approaches. EDP maintained a 20% short-term procurement, consistent with its balanced diversification strategy, while BESCOM showed minimal short-term sourcing at only 3%, reflecting a preference for long-term contracted energy sources.

Figure 1: Procurement by fuel type and DISCOMS (%) (BESCOM, 2025) (EDP, 2025) (TANGEDCO, 2025)



TANGEDCO exhibited a high reliance on short-term procurement, which increased by 30% in FY2019-20 (TANGEDCO, 2025). BESCOM's short-term procurement which includes the sales and purchases, shares of short-term have considered to be zero. (BESCOM, 2025). TANGEDCO's fossil fuel share declined from 60% in FY2017-18 to 52% in FY2023-24, while TANGEDCO's short-term and others procurement increased to 28% in FY2023-24. TANGEDCO non-fossil fuel procurement shares averaged at 27% across FY2019-20 to FY2022-23.

Emission levels and growth

TANGEDCO's absolute annual CO_2 emissions remained significantly high, increasing from 54.48 million tonnes of CO_2 in FY2017-18 to 83.05 million tonnes of CO_2 in FY2023-24, driven by a 47% increase in electricity demand. This represents a sharp emission increase in FY2023-24 following the integration of additional non-fossil fuel procurement to meet growing energy requirements (TANGEDCO, 2025). BESCOM's absolute annual emissions increased from 23.59 million tonnes of CO_2 in FY2017-18 to 30.60 million tonnes of CO_2 in FY2023-24, a 30% increase primarily attributed to reliance on non-fossil fuel procurement (BESCOM, 2025). EDP increased its absolute emissions from 2.61 million tonnes of CO_2 in FY2017-18 to 2.75 million tonnes of CO_2 in FY2023-24, reflecting an increase of 5% (EDP, 2025).

Figure 2: TANGEDCO CO2 emissions by fuel type

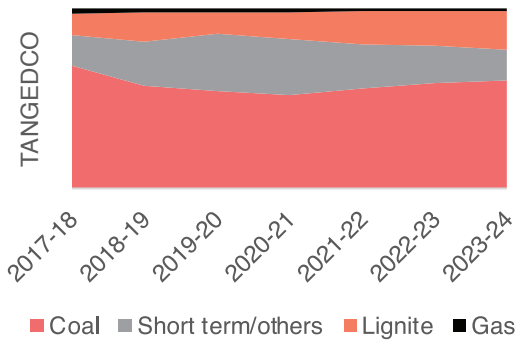


Figure 3: EDP CO2 emissions by fuel type

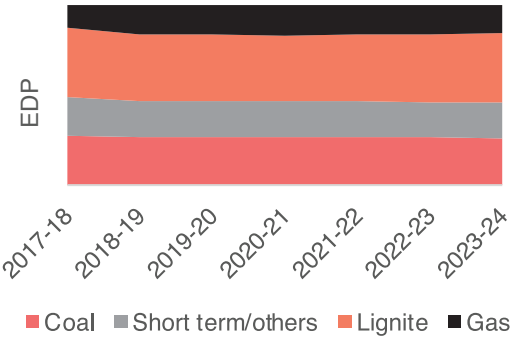
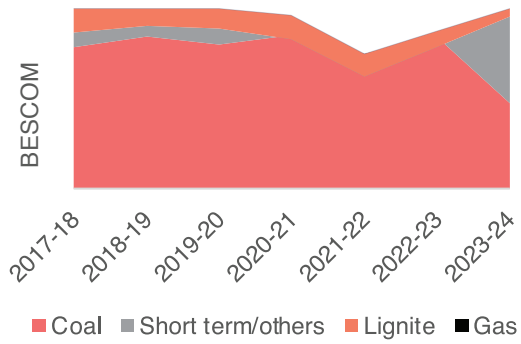


Figure 4: BESCOM CO2 emissions by fuel type



All three DISCOMs experienced a temporary reduction in emissions during the COVID-19 pandemic. In FY2020-21, BESCOM's carbon emissions declined by 36%, driven by reduced electricity demand and higher renewable energy procurement (BESCOM, 2025). EDP recorded an 11% decrease in demand, which was met through short-term/others, and nuclear energy (EDP, 2025). TANGEDCO saw a 12% decline, although fossil fuels remained dominant in its energy mix, with a temporary shift towards short-term and nuclear energy sources (TANGEDCO, 2025).

CO2 Grid Emission Factor (EF):

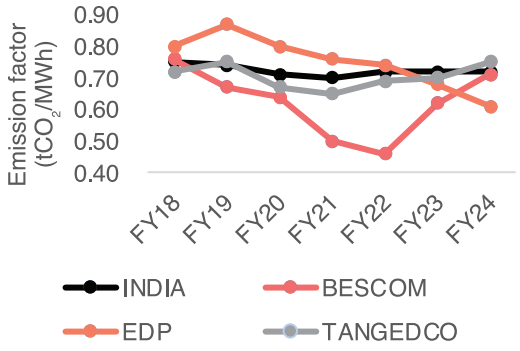
The EF reflects the carbon intensity of the three distributed companies (DISCOMs). The national weighted average emission factor reduced from 0.75 tCO_2/MWh in FY2017-18 to 0.72 tCO_2/MWh in FY2023-24 (CEA, 2021). In India, nuclear and hydro are qualified as must-run sources. The weighted average emission factor also includes generation from renewable energy and grid-connected captive stations (CEA, 2021)

Among the three DISCOMS, a comparative analysis from FY2017-18 to FY2023-24 reveals differing decarbonisation trajectories. In FY2017-18, TANGEDCO outperformed both BESCOM and EDP with an EF of 0.72 tCO_2/MWh, compared to BESCOM at 0.76 tCO_2/MWh, and EDP was higher at 0.80 tCO_2/MWh. However, in FY2018-19, EDP's performance further declined to 0.87 tCO_2/MWh. Meanwhile, BESCOM improved significantly to 0.67 tCO_2/MWh, creating a notable 20% gap between BESCOM and EDP. In FY2020-21, BESCOM reached its lowest EF at 0.50 tCO_2/MWh, outperforming TANGEDCO by 15% at 0.65 tCO_2/MWh and EDP by 26% at 0.76 tCO_2/MWh. BESCOM's exceptional performance persisted in FY2021-22 with 0.46 tCO_2/MWh, maintaining a substantial lead over TANGEDCO's 0.69 tCO_2/MWh and EDP's 0.74 tCO_2/MWh. In FY2023-24, EDP has reduced its EF to 0.61 tCO_2/MWh, representing a reduction of 26% of its EF from its base year performance.

Table 1: Emission Factor (EF) comparison for DISCOMs (BESCOM, 2025) (CEA, 2021) (EDP, 2025) (TANGEDCO, 2025)

FY	INDIA	BESCOM	EDP	TANGEDCO
2017-18	0.75	0.76	0.80	0.72
2018-19	0.74	0.67	0.87	0.75
2019-20	0.71	0.64	0.80	0.67
2020-21	0.70	0.50	0.76	0.65
2020-22	0.72	0.46	0.74	0.69
2022-23	0.72	0.62	0.68	0.70
2023-24	0.72	0.71	0.61	0.75

Figure 5: Weighted average emission factor (tCO_2/MWh)



Between FY2019-20 and FY2023-24, BESCOM and EDP experienced a decline in their EF. However, TANGEDCO experienced a reduction from FY2017-18 to FY2022-23, but in FY2023-24, TANGEDCO's EF has since increased to 0.75 tCO_2/MWh. A high emission factor signals greater exposure to carbon pricing and regulatory costs, making the transition to cleaner energy increasingly critical for long-term sustainability.

Decarbonization Trajectories and Strategic Response:

The comparative assessment of BESCOM, EDP, and TANGEDCO from FY 2017-18 to FY 2023-24 reveals three distinctly different institutional approaches to energy transition. Performance metrics show varying degrees of strategic adaptation to India's evolving decarbonisation imperatives. EDP emerges as the top performer through systematic diversification strategies, achieving a 37% reduction in fossil fuel dependency, while expanding nuclear procurement by 17% and establishing renewable energy infrastructure from zero to 16% of total procurement. This results in EF improvements from 0.80 tCO_2/MWh to 0.61 tCO_2/MWh, positioning the utility below national averages despite initial challenges. BESCOM displays volatile but ultimately progressive traits, reaching an exceptional EF of 0.46 tCO_2/MWh during FY 2021-22 by strategically integrating renewables and benefiting from hydro conditions. However, subsequent resource variability exposed institutional vulnerabilities, as hydro generation declined from 5,506 GWh to 1,956 GWh, leading to increased coal dependence and a rise in emission factor to 0.71 tCO_2/MWh. Despite this, BESCOM maintained a 30% growth in renewable energy procurement and continued to meet RPO targets, including 15.25% solar energy against a target of 7.25%. TANGEDCO shows concerning performance trends, maintaining an average of 51% fossil fuel share throughout the period while experiencing a 47% absolute increase in emissions, from 54.48 to 83.05 million tCO_2. Its emission factors remain above national averages at 0.75 tCO_2/MWh in FY 2023-24, indicating an inadequate institutional response to carbon intensity reduction. Heavy reliance on short-term procurement accounts for 28% of its energy mix, suggesting reactive rather than strategic planning, which exposes the utility to market volatility, limits systematic renewable integration, and underscores the need for comprehensive strategic restructuring to align with national decarbonisation goals.

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