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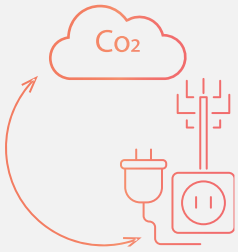
# Briefing Note: ELECTRICITY DEPARTMENT-PUDUCHERRY (EDP) CARBON EMISSIONS AND ENERGY MIX: TRENDS AND INSIGHTS (FY18-FY24)

Date: May 2025




## Introduction

This report establishes a distribution licensee-specific $CO_2$ emissions tracking methodology, leveraging the Central Electrical Authority's Power Plant-wise CO2 database for the fiscal year 2017-18 to 2023-24 (CEA, 2021). By aggregating and allocating emissions based on power procurement and distribution patterns, this analysis provides a granular view of scope 2 emissions associated with individual licenses. The resulting dataset aims to serve as a standardised and readily accessible resource for policymakers, grid operators, and entities mandated to report their environmental footprint, facilitating informed decision-making and accurate emission disclosure. Electricity Department-Puducherry (EDP) is the sole authority responsible for the transmission and distribution of electric power in the region. It procures power from central and state generating stations and has greater control in adopting dynamic approaches to achieve renewable energy targets.

## Key Findings

- In FY 2023-24, Electricity Department Puducherry (EDP) weighted average emission factor of 0.61 $tCO_2$/MWh was significantly lower than the national average of 0.72 $tCO_2$/MWh, highlighting EDP's continued emission reduction efforts.
- Total electricity procurement by EDP increased by 1,245 GWh, representing a 26% rise from FY18-FY24, driven by a growing electricity demand and a strategic diversification into renewable and nuclear energy sources.
- Fossil fuels continued to dominate the energy mix, however, their share declined by 43% between FY18-FY24, while nuclear energy procurement surged by 17% and renewable energy procurement grew from 0% to account for 16% of the total mix.
- Despite a reduction in the reliance on fossil fuels, EDP's $CO_2$ emission factor reduced by 23% from FY18 to FY24, primarily due to the increased "short-term/other" procurement.
- EDP currently has a Renewable Purchase Obligation (RPO) backlog of 1,236 MW, which is equivalent to 39% of the target.

## Energy Sources

**Fossil-based energy continues to be the predominant energy source of EDP.**

The energy generation portfolio of EDP over the year reveals a measured transition towards renewable sources while continuing to draw significantly on conventional fossil fuels such as coal, lignite, and gas. The data indicates a significant 9% increase in the solar and wind procurement beginning in FY 2022-23, reflecting the utility's responsiveness to evolving sustainability goals. Despite this, coal, lignite, and gas have remained dominant in the energy mix, representing 82% in FY 2017-18 and decreasing to 63% in FY 2023-24 of the total procurement, contributing to the bulk of power generation and associated emissions. Notably, emissions from fossil fuels have diminished due to a 16% increase in procurement of renewable energy in FY 2023-24, aligned with a broader diversification strategy and increased procurement from short-term/alternative sources.

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## Transition in Energy Mix

**In FY 2017-18, fossil fuels constituted nearly 68% of EDP's total energy procurement, a dependency that reduced to approximately 43% by FY 2023-24.** Over the period, the contribution of renewable energy sources, primarily wind and solar, increased from 0% to nearly 9% by FY 2022-23. This shift in the energy mix reflects EDP's gradual but steady efforts to diversify its power procurement portfolio, aligning with national sustainability goals and the state's growing energy demand.

## Thermal Energy Trends

**Thermal procurement trends for EDP reflect the impact of operational dynamics, market dependencies, and evolving policy orientations on its energy sourcing. In FY 2017-18, coal and lignite procurement stood at 1,322 GWh and 691 GWh respectively, contributing 62% to a predominantly thermal based portfolio.** By FY 2019-20, coal procurement remained relatively stable at 1,342 GWh while lignite procurement reached 776 GWh, indicating consistent reliance on thermal sources. However, a shift became evident in FY 2020-21, with coal procurement dropping to 1,273 GWh and lignite to 585 GWh, likely the result of pandemic-induced demand fluctuations and diversification efforts. Notably, in FY 2023-24, coal procurement declined further to 1,021 GWh as lignite procurement rebounded to 697 GWh. This evolving trend is marked by a rise in short-term and renewable procurement, signaling EDP's gradual transition towards a more balanced and sustainable energy mix amidst changing economic and policy landscapes.

## Renewable Energy Adoption

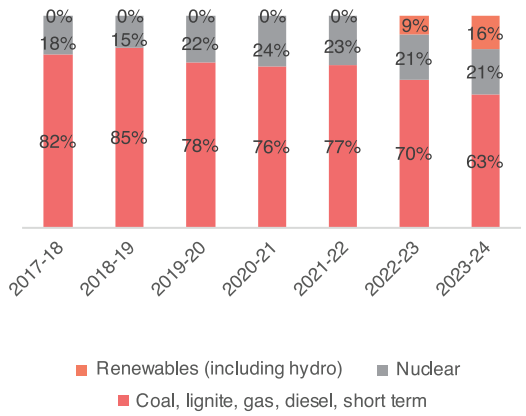
**EDP's evolving alignment with renewable energy goals is evident in its gradual uptake of wind and solar energy procurement over the last two fiscal years.** Between FY 2017-18 and FY 2021-22, renewable energy procurement remained absent, with the EDP relying heavily on fossil-based sources. However, this trend shifted from FY 2022-23 onwards, marked by an increase in renewable procurement, rising from zero in FY 2018-22 to 108 GWh from wind and 208 GWh from solar in FY 2022-23. This demonstrates a meaningful response to clean energy mandates. This growth continued in FY 2023-24, with wind procurement reaching 461 GWh, a 10% increase, and solar increasing to 253 GWh, a 6% increase from FY 2022-23. Signaling the EDP's strengthening commitment to a low-carbon portfolio. The EDP still faces a cumulative RPO backlog of 1,236 GWh, with the current compliance level standing at 1,903 GWh out of a total obligation of 3,139 GWh.

In parallel, the EDP has leveraged transition energy as nuclear energy, procuring a substantial 953 GWh in FY 2023-24, as well as short-term procurement. This has a 106% increase from 439 GWh in FY 2017-18 to 906 GWh in 2023-24. These strategies help to meet demand variabilities, infrastructure upgrades, and energy storage. Proactive investment and policy support in these demands will be essential for advancing EDP's transition to a more resilient and climate-aligned energy system.

*Table 1: Procurement by fuel type (GWh/year)*

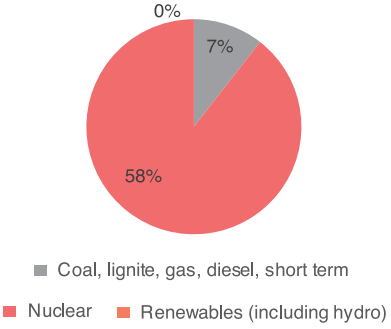
| By fuel type | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|---|---|
| Coal | 1,322 | 1,392 | 1,342 | 1,273 | 1,262 | 1,110 | 1,021 |
| Short term/others | 439 | 275 | 146 | 218 | 486 | 598 | 906 |
| Lignite | 691 | 787 | 776 | 585 | 632 | 591 | 697 |
| Gas | 215 | 216 | 240 | 218 | 236 | 221 | 225 |
| Diesel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nuclear | 604 | 474 | 704 | 713 | 784 | 768 | 953 |
| Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind | 0 | 0 | 0 | 0 | 0 | 108 | 461 |
| Solar | 0 | 0 | 0 | 0 | 0 | 208 | 253 |
| Biomass | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 3,272 | 3,143 | 3,207 | 3,006 | 3,400 | 3,603 | 4,517 |

*Figure1: Procurment by fuel category (%)*




From FY 2018-19 to FY 2023-24, the EDP experienced a notable shift in its electricity procurement portfolio, with a total increase of 1,245 GWh across all sources.

*Figure 2: Increase in power demand by fuel source (%) during FY18–24*



## CO2 Emissions By Fuel Type

**BESCOM's emissions have rebounded sharply EDP's greenhouse gas (GHG) emissions, measured in tonnes of $CO_2$ ($tCO_2$), have undergone significant shifts between FY 2017-18 and FY 2023-24.**

In FY 2017-18, total emissions were approximately 2.61 million $tCO_2$, with coal alone contributing 1.26 million $tCO_2$, accounting for about 48% of the total emissions. By FY 2019-20, overall emissions declined slightly to 2.57 million $tCO_2$, largely due to a reduction in coal and short-term procurement.

A slight dip in emissions was noticed during FY 2020-21, as a consequence of the COVID-19 pandemic, with total emissions falling to 2.29 million $tCO_2$, as energy demand contracted and reliance on fossil fuels decreased. Coal, lignite and gas emission during this period fell by 7% respectively.

As demand rebounded post the pandemic, emission rose again by 7% reaching 2.45 million $tCO_2$ in FY 2022-23, followed by a further increase of 12% to 2.75 million $tCO_2$ in FY 2023-24. Short-term procurement emerged as a key emission driver, contributing 0.65 million $tCO_2$, nearly 25% of the total emissions.

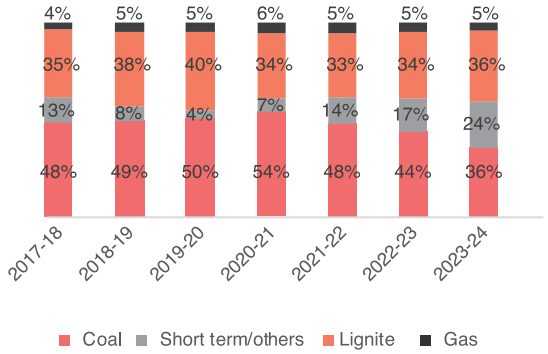
*Table 2: CO2 emissions by fuel type (Million tCO2/year)*

| By fuel type | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|---|---|
| Coal | 1.26 | 1.34 | 1.29 | 1.24 | 1.21 | 1.07 | 0.98 |
| Short term/others | 0.33 | 0.20 | 0.10 | 0.15 | 0.35 | 0.43 | 0.65 |
| Lignite | 0.92 | 1.05 | 1.03 | 0.77 | 0.84 | 0.82 | 0.99 |
| Gas | 0.09 | 0.13 | 0.14 | 0.13 | 0.14 | 0.13 | 0.13 |
| Diesel | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nuclear | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Biomass | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2.61 | 2.72 | 2.57 | 2.29 | 2.53 | 2.45 | 2.75 |

The fluctuating emissions values observed in EDP's "Short-term/others" category between FY 2017-18 and FY 2023-24 reflect the region's evolving procurement dynamics and energy planning strategies. Emissions from short-term sources declined steadily from 0.33 million $tCO_2$ in FY 2017-18 to a low of 0.10 million $tCO_2$ in FY 2019-20, a reduction of nearly 70%, before rising again to 0.99 million $tCO_2$ by FY 2023-24, a further increase of 24%. The initial drop can be attributed to strategic reductions in short-term thermal power purchases.

During FY 2020-21, a rise in emissions from short-term sources suggests increased reliance on market-based procurement to meet growing electricity demand, likely due to lagging renewable capacity and thermal generation constraints. While emissions from coal steadily declined, dropping from 1.26 million $tCO_2$ in FY 2017-18 to just 0.98 million $tCO_2$ in FY 2023-24, short-term procurement filled the gap, emerging as a key emission contributor. These trends highlight the pressures faced by EDP, maintaining supply reliability while transitioning towards cleaner procurement strategies. Future reductions in emissions from short-term sources will depend on greater renewable integration, enhanced grid flexibility, and long-term planning.

*Figure 3: share of CO2 emission by fuel source (%)*




## CO2 Emissions Intensity

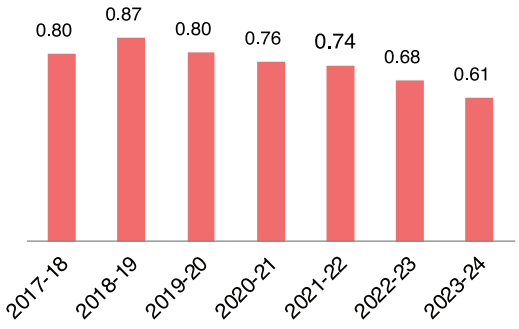
**Fossil-based energy continues to be the predominant energy source**

The weighted average emission factor for EDP's power supply has demonstrated both progress and setbacks over the past several years. In FY 2017-18, the emission factor was approximately 0.80 $tCO_2$/MWh, increased to 0.87 $tCO_2$/MWh in FY 2018-19, and decreased to 0.80 $tCO_2$/MWh in FY 2019 -20.

A noticeable decline occurred in FY 2020-21, with the emission factor falling to 0.76 $tCO_2$/MWh, influenced by lower demand during the pandemic and minor shifts away from coal and lignite. However, this was short-lived; by FY 2021-22, the emission factor had increased to 0.74 $tCO_2$/MWh, followed by a slight decline to 0.68 $tCO_2$/MWh in FY 2022-23. In FY 2023-24, the emission factor further reduced to 0.61 $tCO_2$/MWh.

Over the full period from 2017-18 to FY 2023-24, the EDP achieved a marginal 5% reduction in emission intensity. However, it still stands lower than the national weighted average of 0.72 $tCO_2$/MWh (CEA, 2021).

*Figure 4: EDP weighted average emission factor (tCO2/MWh)*



Among the three primary fuel types in EDP's energy portfolio, lignite consistently demonstrates the highest specific emission intensity, primarily due to its low calorific value, which results in greater fuel usage for equivalent electric generation. Lignite's specific emission peaked at 1.33 $tCO_2$/MWh in FY 2018-19 and gradually increased to 1.42 $tCO_2$/MWh in FY 2023-24, remaining notably higher than coal and short-term sources throughout the period.

Coal-based power exhibited a relatively stable emission intensity, holding at 0.96 $tCO_2$/MWh from FY 2017-18 to FY 2023-24, with only minor fluctuations due to changes in fuel mix, operational efficiency. The "Short-term/others" maintaining lower and more consistent emission levels, ranging from 0.75 $tCO_2$/MWh in FY 2017-18 to 0.72 $tCO_2$/MWh in FY 2023-24, reflecting their more diverse and occasionally cleaner fuel composition. Despite a steady decrease in lignite's specific consumption, it remains the least efficient and most emission-intensive source in EDP's portfolio.

*Table 3: Emission factor by fuel source (tCO2/MWh)*

| By fuel type | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|---|---|
| **Coal** | 0.96 | 0.96 | 0.96 | 0.97 | 0.96 | 0.97 | 0.96 |
| **Short term/ others** | 0.75 | 0.74 | 0.71 | 0.70 | 0.72 | 0.71 | 0.72 |
| **Lignite** | 1.34 | 1.33 | 1.33 | 1.32 | 1.32 | 1.39 | 1.42 |
| **Gas** | 0.43 | 0.60 | 0.57 | 0.61 | 0.58 | 0.60 | 0.57 |
| **Diesel** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Nuclear** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Hydro** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Wind** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Solar** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Biomass** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total** | **0.80** | **0.87** | **0.80** | **0.76** | **0.74** | **0.68** | **0.61** |

*Table 4: Comparison of weighted average emission factor (tCO2/MWh)*

| Emission Factor (tCO2/MWh) | 2017-18 | 2018-19 | 2019-20 | 2020-21 | 2021-22 | 2022-23 | 2023-24 |
|---|---|---|---|---|---|---|---|
| **India** | 0.75 | 0.74 | 0.71 | 0.70 | 0.72 | 0.71 | 0.72 |
| **EDP** | 0.80 | 0.87 | 0.80 | 0.76 | 0.74 | 0.68 | 0.61 |

## Core insights for EDP

From FY 2017-18 to FY 2021-22, EDP faced significant Renewable Purchase Obligation (RPO) shortfalls due to lower renewable energy procurement and high dependency on nuclear power. However, there has been notable progress, with solar energy procurement increasing by 22% in the last two years, from 208 GWh FY in 2022-23 to 253 GWh FY in 2023-24, and non-solar procurement rising from 108 GWh to 461 GWh during the same period. Despite these improvements, EDP still faces a cumulative RPO backlog of 1,236 GWh, with the current compliance level standing at 1,904 GWh out of a total obligation of 3,139 GWh (JERC, Electricity Department of Puducherry (EDP), 2025). Moving forward, EDP must focus on strategic power procurement, expansion of local renewable projects, and integration of energy storage solutions to clean the backlog while ensuring future compliance.

EDP faces several challenges in achieving Renewable Purchase Obligation (RPO) compliance (F. No. 09/13/2021 - RCM, RPO, 2022). The long-term RPO trajectory, determined in consultation with the Ministry of New Renewable Energy (MNRE), mandates a steady increase in renewable energy procurement. In order to meet both annual RPO targets and backlog clearance, EDP must incrementally procure additional renewable energy capacity each year while addressing challenges such as limited local generation, high dependency on external procurement, and variability in renewable energy supply.

*Table 5: EDP's RPO trajectory*

| FY | Projected Demand (GWh)" | Required compliance (GWh) | Projected Renewable compliance (%) | Additional procurement to clear backlog | Total procurement required (GWh) |
|---|---|---|---|---|---|
| **2024 - 25** | 3,000 | 897 | 30% | 300 | 1,197 |
| **2025 - 26** | 3,100 | 1,023 | 33% | 286 | 1,309 |
| **2026 - 27** | 3,200 | 1,151 | 36% | 250 | 1,401 |
| **2027 - 28** | 3,300 | 1,281 | 39% | 200 | 1,481 |
| **2028 - 29** | 3,400 | 1,405 | 41% | 150 | 1,555 |
| **2029 - 30** | 3,500 | 1,516 | 43% | 50 | 1,566 |

EDP must increase the renewable energy procurement by 43% annually to clear its RPO backlog and align with (F. No. 09/13/2021 - RCM, RPO, 2022) revised trajectory. To ensure a stable and reliable supply, hybrid renewable energy, along with battery energy storage solutions should be considered. Additionally, public-private partnerships (PPPs) should be leveraged to accelerate implementation, and enhance investment in renewable energy infrastructure.

From FY 2022-23, several thermal power plants that contracted to deliver electricity to Puducherry demonstrated a shift in operational patterns evident from a marginal reduction in average PLF values. This can be attributed in part to increased flexible operation practices, including two-shift operations to balance peak renewable generation periods. The increased use of secondary fuel (oil) during these operations requires consideration in future emission factor estimation, as ramping cycles typically elevate specific fuel consumption and emissions per MWh during non-continuous operation. (CEA, 2023).

## Recommendations

### Mandate CO2 emission disclosure for EDP

Public reporting of DISCOM-specific $CO_2$ emissions will promote transparency and empower consumers, policymakers, and investors with critical insights into the environmental impact of power generation and distribution. To ensure consistency and comparability, EDP should adopt a standardised emissions reporting framework (CEA, 2021). This will enable accurate tracking of emissions, support evidence-based decision making, and facilitate benchmarking against other distribution licensees, ultimately reinforcing accountability and accelerating the shift towards a low-carbon energy future.

### Set emission reduction targets for distribution licensees

With access to precise data on emission volumes, sources, and intensities, such as those reflected in EDP's recent $CO_2$ emission trends, policymakers can formulate focused regulations and design strategic incentives to support a just and effective energy transition. Establishing clear, time-bound emission reduction targets for EDP will provide a structured roadmap towards achieving net-zero emissions, encouraging the development of clear procurement targets for renewable energy. Ambitious targets not only catalyse internal transformation but also set benchmarks that drive systemic change across the power sector.

### Phase out the most polluting power plants

In FY 2023–24, EDP continued to procure electricity from several coal and lignite-based thermal power plants, many of which are over 20 years old. These aging plants contribute substantially to the Union Territory's carbon emissions due to their reduced operational efficiency and high emission intensity. Notably, lignite-based thermal power plants, with a combined installed capacity of 2,390 MW, exhibit an emission intensity of approximately 1.42 $tCO_2$/MWh, making them one of the most carbon-intensive components of EDP's power mix.

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