

# Carbon Crunch

## ESG Analysis Report

### Summary

This report provides a concise analysis of the company's emissions data to highlight key challenges affecting its 2050 Net Zero goal. After cleaning and reviewing the dataset, major emission sources and inefficiencies were identified. Using industry best practices and research, the report proposes clear, actionable strategies to reduce emissions and strengthen sustainability performance.

### Data Cleaning and Analysis Approach

#### Emission Data Cleaning

- Checked for missing facility IDs, duplicate entries, and inconsistent formatting.
- Standardized facility names (e.g., "Tata Steel" vs "TataSteel").
- Ensured GHG types (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) were consistently coded.
- Verified numeric values for emissions and converted them to proper number format.
- Created a Pivot Table summarizing emissions by facility, reporting period, and scope.

#### Operational Data Cleaning

- Validated that energy consumption, production volume, and waste values contained no text strings or blanks.
- Normalized facility names to match the Emission Data for future merging.
- Added a calculated metric: **Energy Intensity** = **Energy Consumption** / **Production Volume** for efficiency tracking.

#### Supplier Data Cleaning

- The "Income Distribution" column contained JSON-like dictionaries.
- Using Excel Power Query, this column was transformed into a **long format**, producing:
  - Supplier ID
  - Facility ID (from dictionary keys)
  - Income Distribution %

#### Regulatory Benchmark Integration

- The company's GHG reduction target (25% reduction) was used to create a **Benchmark Column** in the Emissions Pivot Table:
  - **Benchmark** = **Total Emissions** × **0.75**
- This enabled visual comparison between current emissions and regulatory expectations.

## Key Findings from the Dataset

1. **Emissions vary significantly across facilities**, with Tata Steel (F106), Reliance Industries (F107), and JSW Energy showing the highest CO<sub>2</sub> and CH<sub>4</sub> outputs.
2. **Operational efficiency is inconsistent**, as some sites—like JSW Energy and L&T—consume high energy for relatively lower production output, indicating process gaps.
3. **Suppliers S001 and S002 pose major Scope 3 risks**, contributing large carbon footprints across multiple facilities.

## Key Challenges Impacting Net-Zero 2050

### Challenge 1 High Emissions Concentrated in Specific Facilities

Core facilities like Reliance Industries and Tata Steel show consistently high Scope 1 CO<sub>2</sub> emissions. This indicates:

- Carbon-intensive industrial processes
  - Dependence on fossil fuel-based energy
  - Operational inefficiencies
- If not addressed, these facilities will derail the company's 25% reduction goal.

### Challenge 2 Inefficient Energy Use and Production Variability

- Some facilities have poor energy-per-unit-output ratios.
  - High waste generation and unstable energy patterns suggest inefficiencies.
- If energy intensity is not reduced, future regulatory restrictions and carbon taxes may financially impact the company.

### Challenge 3 Supplier Sustainability Risks (Scope 3 Emissions)

Suppliers with large carbon footprints pose a risk to the company's total emissions profile. Income distribution data shows the company is financially dependent on suppliers whose sustainability practices are unclear. Scope 3 emissions often account for **70–90%** of total emissions in manufacturing supply chains. This could hinder Net Zero goals significantly

## Research Insights & ESG Best Practices

Industry standards (GHG Protocol, IPCC, WEF) highlight four major practices:

1. **GHG Reduction:** Energy-efficient equipment, waste heat recovery, electrification, and renewable power adoption.
2. **Renewable Energy Integration:** PPAs, on-site solar, and electric heat pump transitions used by leaders like Siemens and Mahindra.
3. **LCA Integration:** Identifies high-impact materials, energy hotspots, and waste streams to guide low-carbon product design.

4. **Supplier ESG Practices:** Scorecards, audits, carbon disclosure, and prioritizing low-emission suppliers.

## Strategic Recommendations

1. **Decarbonize High-Emitting Facilities:** Upgrade Tata Steel and Reliance sites with clean fuels, efficient heat systems, automation, and annual reduction targets.
2. **Improve Energy Efficiency:** Deploy EMS systems, optimize production schedules, run energy audits, and reduce industrial waste.
3. **Strengthen Supplier ESG:** Require emission reporting, incentivize sustainable suppliers, and focus on high-risk suppliers identified in the dataset.
4. **Integrate LCA into Operations:** Conduct LCAs for major products, use results for procurement and design choices, and train teams in eco-design.

## Conclusion

The analysis highlights facility-level emissions, operational inefficiencies, and supplier risks as major challenges. Implementing targeted decarbonization, improving energy use, strengthening supplier engagement, and integrating LCA can significantly accelerate progress toward the company's Net Zero 2050 goals.

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