Chain Sustainability & Route Optimization

Tracking emissions, fuel use, and transportation cost for greener logistics decisions

Tools Used:
Power BI · Python · Excel · OpenRouteService API

AUTHOR:
SWARANGEE AGNIHOTRI

Project Background

Context & Motivation

The transportation sector contributes significantly to global CO_2 emissions. Logistics firms need to balance fuel efficiency, cost, and environmental impact to meet sustainability goals.

Problem Statement

How can businesses analyze routes, vehicle types, and fuel usage to optimize emissions and reduce transportation costs?

Goal:

Develop a data-driven dashboard to:

- Track monthly CO_2 emissions
- Compare fuel & vehicle efficiencies
- Identify optimization opportunities

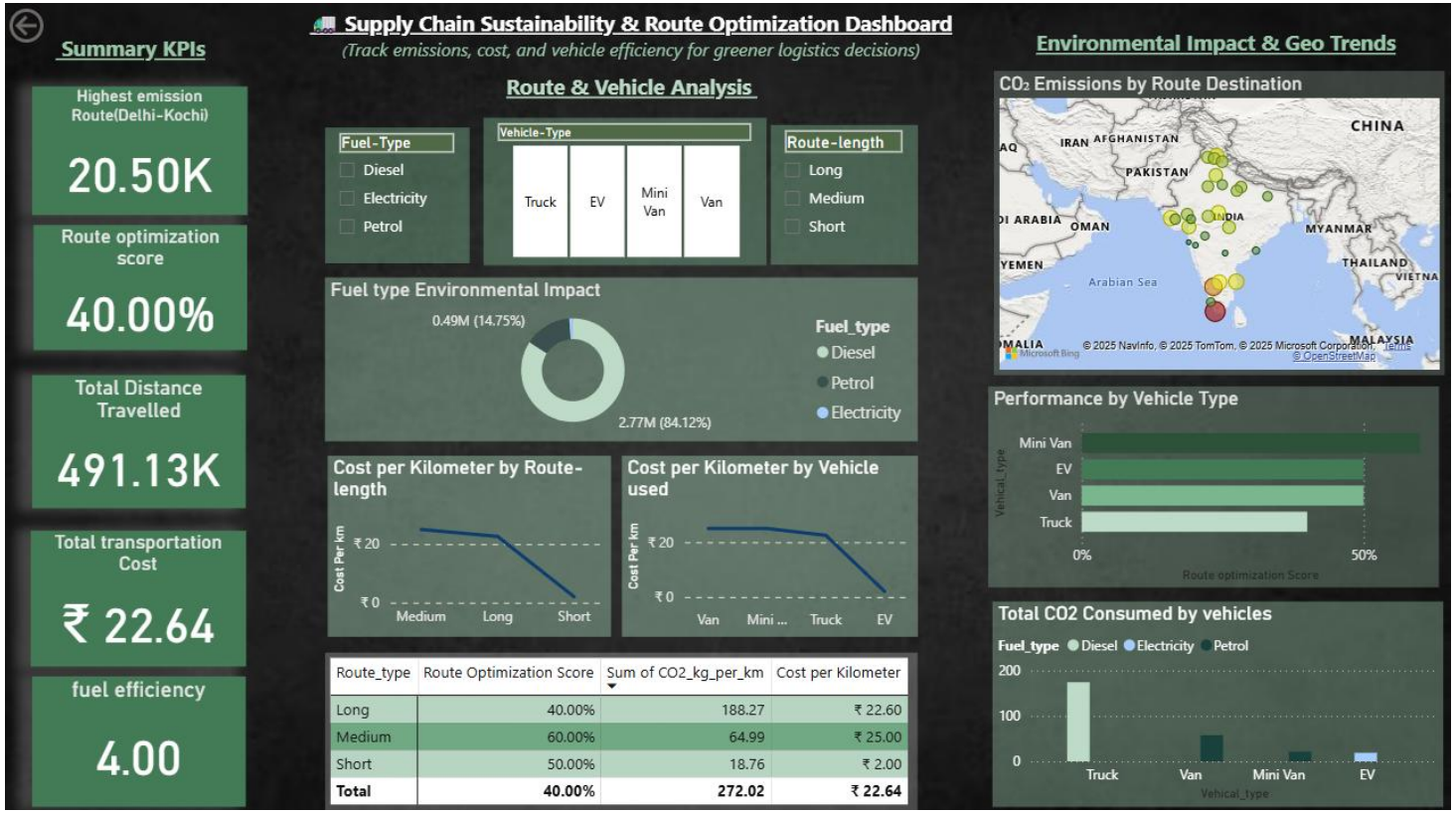
Data Source & Methodology

Data Source & Collection

- **City Coordinates**: Manually mapped from real Indian cities
- **Distance**: Fetched using OpenRouteService API (real road network distances)

Data Preparation

- **Python** used to fetch distances and calculate:
- Fuel Used (based on km/litre)
- CO_2 per Trip (based on fuel type emission factor)
- Monthly Emissions & Cost
- **Excel** used for:
- Fuel Cost Lookup
- Route Length Classification
- Vehicle & Fuel Assignment
- **Power BI** for creating new measures(route optimisation score, fuel efficiency etc) , visualization & interactive dashboard



Dashboard Overview

Sections Explained:

- **Left**: Summary KPIs (Emissions, Cost, Fuel Efficiency, Distance)
- **Middle**: Filters + Route & Vehicle Breakdown (Cost, CO_2/km)
- **Right**: Map + Performance Charts (by Type & Region)

Recommendations

Sustainability & Cost Suggestions

1) Replace diesel trucks with **EVs or Mini Vans** for short routes

2) Assign **medium routes to fuel-efficient vehicles** for max ROI

3) Monitor route-specific performance with dashboards monthly

4) Expand dashboard to include:
- Live fuel prices
- Route time & congestion data
- Alerts for high-emission routes

Key Insights

Business Highlights:

Delhi–Kochi is the highest-emission route: 20.5K kg CO_2/month

Diesel Trucks are widely used but least efficient

EVs have the lowest cost/km (~₹2/km) and lowest CO_2

Medium Routes offer the best route optimization score (60%)

Long routes cost ₹22.60/km vs ₹2.00/km for short routes

Next Steps

Future Enhancements

- Add real-time **traffic/weather API** for dynamic routing
- Introduce **machine learning model** for route-vehicle pairing
- Build a **mobile version** for logistics managers on the go