Full Summary of Conversation: Transporter Carbon Emissions Project (Roshan Project)

Project Objective:

To calculate GHG emissions (CO_2, CH_4, N_2O) for each transportation trip based on data shared by a logistics company, and to design a tool/dashboard that calculates emissions automatically, provides KPIs, and supports decarbonization analysis.

Phase 1: Project Planning

User Objective: Automate carbon emissions calculations for each trip from an Excel sheet. Desired output is a dashboard (initially Excel, possibly upgraded to an online version).

Project Plan Outline:

- **Input Sheet**: Upload raw trip data
- **Emission Factor Sheet**: Lookup table for EF per km/liter for fuel & vehicle type

Emission Calculation Sheet:

Emissions (kg CO_2e) = Distance × Emission Factor per km
OR
Emissions (kg CO_2e) = Fuel Used × Emission Factor per liter

-
- **Dashboard Output**:
    - Total emissions by vehicle, trip, and month
    - Emission intensity (gCO_2e/km and gCO_2e/ton-km)
    - Visuals: bar charts, trends, route heatmaps, pie charts

Online Options Suggested:

- Google Sheets + AppSheet/Data Studio
- Streamlit Dashboard
- Microsoft Power BI (free tier)

Phase 2: Timeline Estimation

Question: How long would it take to build a working tool?

Timeline (Solo Developer with AI Help)

- Planning: 0.5-1 day
- EF & logic setup: 1.5 days
- Excel parsing: 0.5 day
- Visuals: 1.5 days
- UI: 1 day
- Testing: 1 day
- Deployment: 0.5 day
- **Total: ~6-7 working days**

Phase 3: Dashboard Wireframe

AI provided a wireframe sketch showing:

1. Header: Company Name, Report Download, Date Selector
2. KPI Cards:
    - Total CO_2e

    - Emission Intensity
    - Avg Distance
    - Top Fuel Type
3. Emissions Breakdown:
    - By Category (Fuel/Vehicle)
    - Trend Chart (Monthly)
    - Top 5 Vehicles
4. Operational Insights:
    - Hotspot Map
    - Utilization vs Emissions
    - Recommendations Panel
5. Efficiency Table:
    - Vehicle ID, Trips, Load, Fuel, CO_2e, gCO_2e/ton-km

Phase 4: Example Calculation (Sample Trip)

Given Trip:

Vehicle	Fuel Type	Distance
LCV	Diesel	250 km

Emission Factors Used (g/km):

- CO_2 = 1320
- CH_4 = 0.05

- N_2O = 0.02

GWP:

- CH_4 = 25
- N_2O = 298

Calculations:

CO_2 = 250 × 1320 = 330,000 g = 330 kg
CH_4 = 250 × 0.05 × 25 = 312.5 g = 0.3125 kg CO_2e
N_2O = 250 × 0.02 × 298 = 1,490 g = 1.49 kg CO_2e
Total CO_2e = 330 + 0.3125 + 1.49 = **331.80 kg CO_2e**

Phase 5: Sheet-Based Trip Example

Trip Example from Excel:

- Vehicle: AP39TE1926
- Fuel: Diesel
- Distance: 1242 km

Emission Factors Used:

- CO_2 = 1620 g/km
- CH_4 = 0.05 g/km
- N_2O = 0.03 g/km

Calculations:

CO_2 = 1242 × 1620 = 2,012,040 g = 2,012.04 kg
CH_4 = 1242 × 0.05 × 25 = 1.55 kg CO_2e
N_2O = 1242 × 0.03 × 298 = 11.09 kg CO_2e
Total CO_2e = 2012.04 + 1.55 + 11.09 = **2024.68 kg CO_2e**

Phase 6: Efficiency KPIs (Based on Sheet Data)

Calculable Now:

- CO_2e/trip
- gCO_2e/km
- Trip Duration = End - Start
- Delay = End - Expected End
- Trips per Vehicle
- Emissions per Vehicle
- Route-based emissions

Missing or Assumed:

- Load per trip
- Fuel consumed
- Mileage (km/l)
- Vehicle Emission Standard (VES)
- Return Trip Load
- Idle Time

Phase 7: Data Availability Assessment

We Have (From File):

- Vehicle No, Fuel Type, Vehicle Type, Distance
- Start/End/Expected Time
- Trip Date, Route Info, Trip Status

We Can Calculate:

- Duration, Delay, CO_2, CH_4, N_2O, CO_2e
- gCO_2e/km, Monthly summaries

We Need to Ask:

- Load per trip
- Fuel used per trip
- Real mileage
- Return trip load
- Vehicle Emission Standard
- Idle time & Refrigeration use

Phase 8: Decarbonization Insights

Using Current Data:

- Top emitting vehicles/routes
- Emission trend over time
- Delay-emission correlation

With Added Data:

- gCO_2e/ton-km (load-based efficiency)
- Fuel-switch modeling (e.g. diesel to HVO)
- Cold chain impact (refrigerated fuel usage)

Phase 9: Final Consolidated Tables

Top 5 Missing But Crucial Fields

Metric	Why It Matters
Fuel Consumed	Accurate CO_2 from EF/liter
Load (tons)	Enables gCO_2e/ton-km
VES	EF tuning for CH_4/N_2O accuracy
Real Mileage	Predict fuel use, efficiency
Return Trip Load	Determine true ton-km

Optional (Advanced) Data:

- Idle Time
- Refrigeration Use
- Cold Chain Hours

Final Notes

- With current data, ~70% accuracy is possible
- With the 5 missing fields: accuracy improves to 90-95%
- The project is scalable into a Streamlit, Power BI, or Google Sheets dashboard

- Client-facing checklist or request form is recommended to fill data gaps
  t-ready data request templa