THE CHALLENGING ELECTRIFICATION OF COMMERCIAL VEHICLES IN EUROPE

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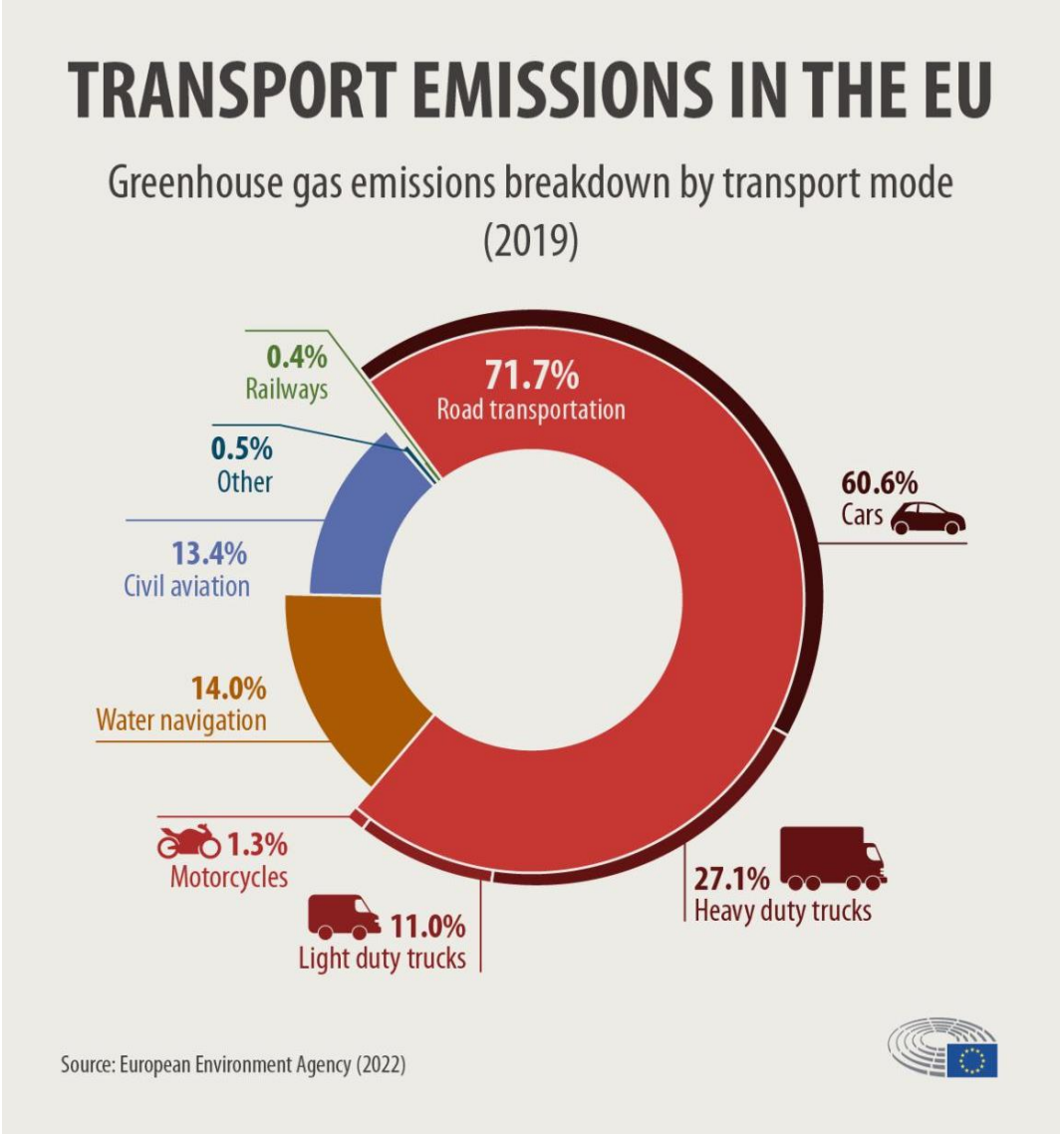
CONTENT

- Why electrifying commercial vehicles?
- EU policies
- Focus on the road freight transport
- Life Cycle Emissions
- Cost-Benefit Analysis
- Key challenges for Austria and Czech Republic

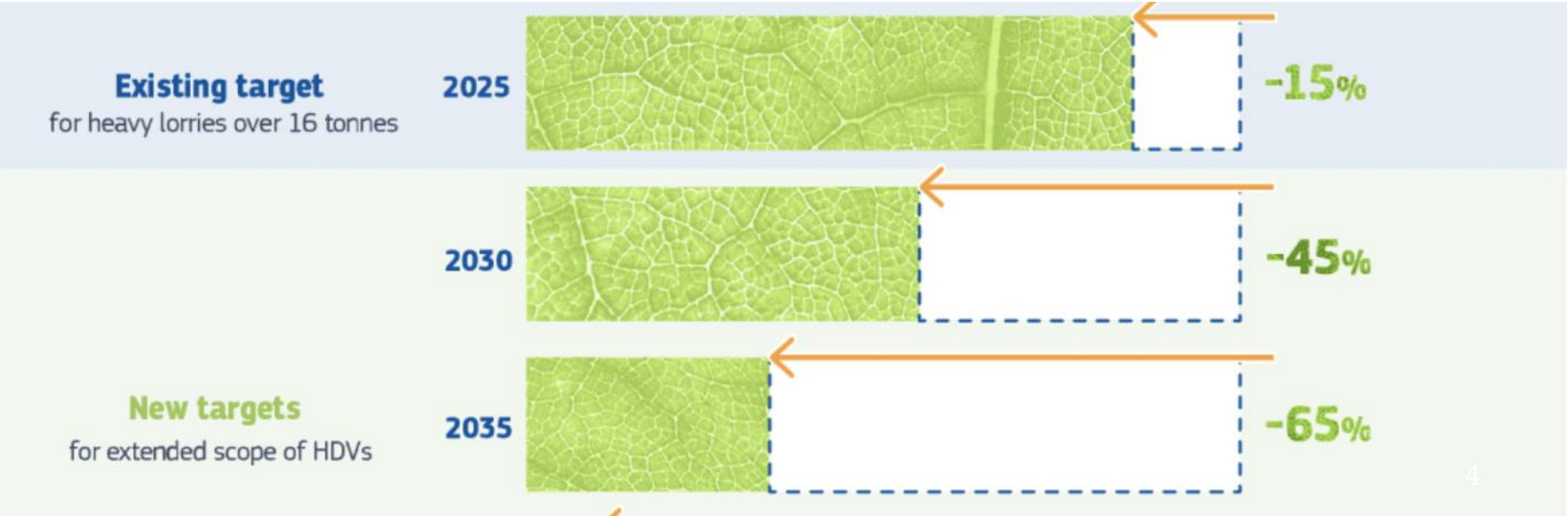
INTRODUCTION

- Context: decarbonation of transport sector
  ¼ EU CO2 emissions – rising since 1990
- Need for electrification of commercial vehicles
- What are the challenges and opportunities?
- Focus of the study on road freight transport



EU POLICY FRAMEWORK

- EU wants -55% GHG emissions by 2030
- AFIR = build chargers for trucks
- Truck makers must cut CO_2



AUSTRIA / CZECH REPUBLIC POLICIES

- Czechia: 95% freight by road, low electrification
- Problem: fossil fuels + few chargers
- Austria: clear plan + 100% green charging
- Austria is further ahead than Czechia

LIFE CYCLE ASSESSMENT (LCA)

Evaluation of the environmental impacts throughout the entire life cycle of a product from raw material extraction to end-of-life disposal or recycling.

- Production Phase:
  52 tonnes CO_2 vs. 25 tonnes CO_2 due to the battery of E-Trucks
- Operational Phase:
  If powered by renewable, break even point during first year of use
- Total Life Cycle Emissions:
  typical truck's lifetime: 500,000–1,300,000 km

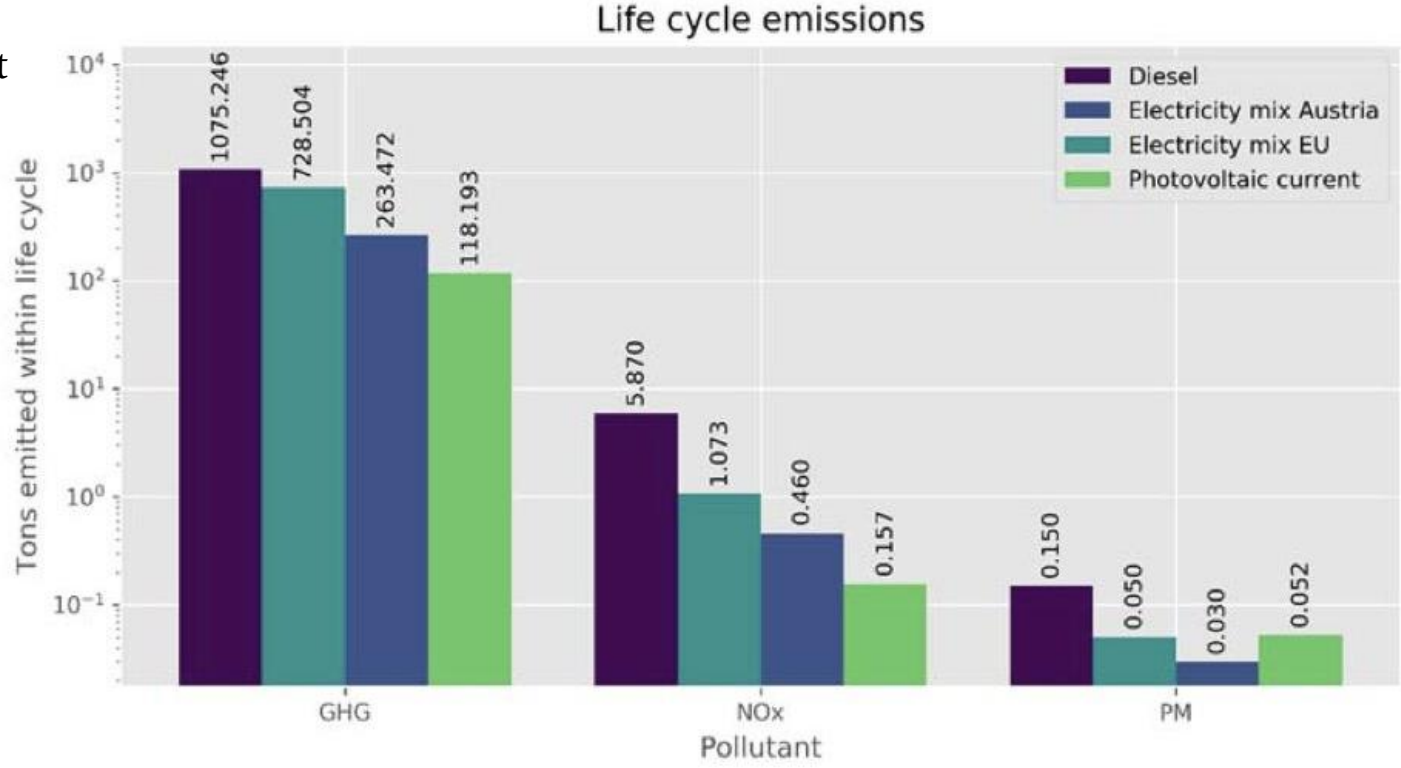


Figure 1: Total life cycle emissions of diesel and electric trucks for three electricity mixes. Source: Schlacher, A.

DEPENDENCE ON ELECTRICITY MIXES

LCA Result on GHG Emission depend on the carbon intensity of electricity:

- Czech Republic:
  525 gCO2eq/kWh
- Austria:
  160 gCO2eq/kWh

Source: Electricity Map 2023

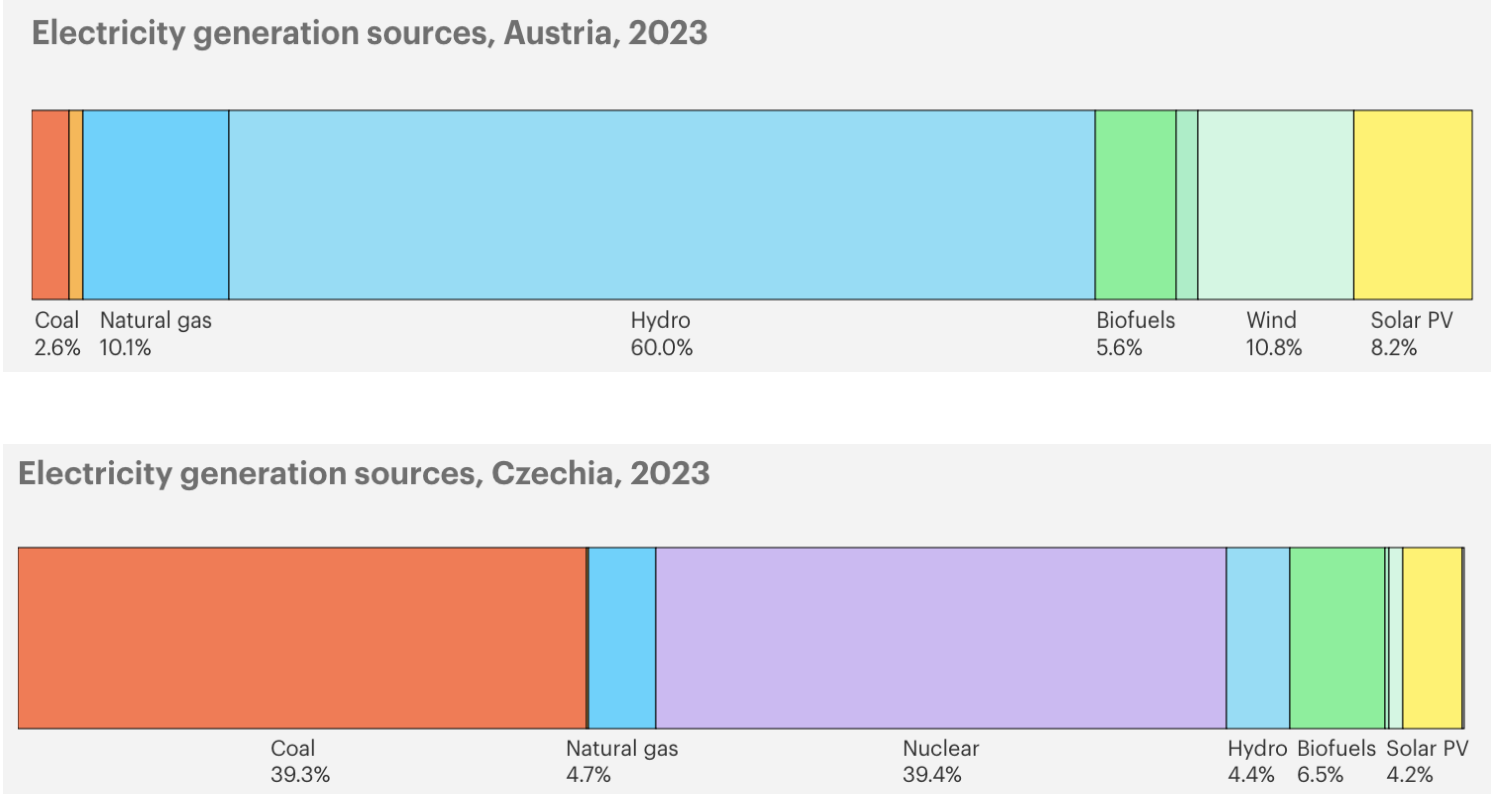


Figure 2: Electricity mix of Austria and Czech Republic in 2023. Source: IEA

TOTAL COST OF OWNERSHIP

Simplified Total Cost of Ownership (TCO) example	Diesel HDV Truck-1 year (80,000km)	Electric HDV Truck - 1 year (80,000km)	Diesel HDV Truck-3 year (240,000km)	Electric HDV Truck - 3 year (240,000km)	Diesel HDV Truck-5 year (400,000km)	Electric HDV Truck - 5 year (400,000km)	Comment
Acquisition Cost (MSRP)	€ 116,230.00	€ 272,800.00	€ 116,230.00	€ 272,800.00	€ 116,230.00	€ 272,800.00	Price of electric HDV truck is high, upto double or even triple cost of diesel HDV truck, but as volumes increase this is expected to decline. Taxes ie VAT and Registration tax differ per MS, see ACEA. We assume acquisition taxes incl in Acquisition Cost example.
Purchase Subsidy (Member States subsidies differ)	€ 0.00	€ 125,256.00	€ 0.00	€ 125,256.00	€ 0.00	€ 125,256.00	Example: Germany offers upto 80% of the difference in cost of an electric truck versus diesel as purchase incentive.
New Acquisition Cost (after subsidy)	€ 116,230.00	€ 147,544.00	€ 116,230.00	€ 147,544.00	€ 116,230.00	€ 147,544.00	Note after subsidy, acquisition cost falls sharply for e-trucks.
Fuel Cost	€ 36,400.00	€ 0.00	€ 109,200.00	€ 0.00	€ 182,000.00	€ 0.00	Assume Euro 1.3 per liter diesel and 35 liters per 100km.
Electricity Cost	€ 0.00	€ 28,800.00	€ 0.00	€ 86,400.00	€ 0.00	€ 144,000.00	Assume Euro 0.3 per kWh, assume battery 300kWh for 250km.
Maintenance	€ 14,800.00	€ 4,440.00	€ 44,400.00	€ 13,320.00	€ 74,000.00	€ 22,200.00	Electric trucks expected to have around 25-40% of diesel truck annual maintenance costs, diesel trucks maintenance costs about Euro 18.5 per 100km.
Vehicle Taxes	€ 4,660.00	€ 0.00	€ 13,980.00	€ 0.00	€ 23,300.00	€ 0.00	Vehicles taxed by weight. Lorry 4,000GVW tax is Euro 466, so 40 tonne lorry is Euro 4660 per year. But zero emission trucks exempt from annual vehicle tax.
Road Tolls	€ 11,960.00	€ 5,980.00	€ 35,880.00	€ 8,970.00	€ 59,800.00	€ 14,950.00	Zero emission trucks will get 50% off road tolls in EU from 2023, and avoid planned CO_2 charges expected to be levied on ICE trucks. See Eurovignette Directive. After 2025, ZET expect up to 75% off tolls. Example Germany 0.081 to 0.218 Euro per km.
Sub TCO	€ 184,050.00	€ 186,764.00	€ 319,690.00	€ 256,234.00	€ 455,330.00	€ 328,694.00	Regulations such as emission taxes, which are added on to fuel prices and vehicle taxes, allow the TCO of electric trucks to reduce. Overall parity is achieved faster in markets where there is strong regulatory pressure. Countries where high regulatory pressure reach TCO parity earlier for electric trucks.
Depreciation	€ 23,246.00	€ 34,062.50	€ 48,351.68	€ 68,233.00	€ 68,473.42	€ 102,333.00	Assumption: residual value of ICE diesel truck drops around 20% a year. Residual value of electric truck, excluding battery, drops the same, but battery depreciates just 5% per annum, bringing overall annual rate of depreciation lower for electric truck.
Residual Value	€ 92,984.00	€ 238,737.50	€ 67,878.32	€ 204,567.00	€ 47,756.58	€ 170,467.00	Electric truck retains higher resale value than ICE truck. As low residual value is a negative, this adds to total TCO costs, while high residual is a benefit this is subtracted.

Source: ECG – The Association of European Vehicle Logistics. (2022, April). *The cost of going electric* (p. 5). https://www.ecgassociation.eu/wp-content/uploads/2022/04/ECG-Business-Intelligence-22.04-Cost-of-going-electric.pdf

COST-BENEFIT ANALYSIS

Assumptions and Sources

Component	Value
CO_2 emission difference	0.9 kg/km
Social cost of carbon	€100/t CO_2
Health impact cost (NO_x, PM2.5)	€0.01/km
Energy prices	€1.3/l diesel, €0.30/kWh electro
Residual value (5-year period)	Diesel: €47,756; Electric: €170,467
Subsidy for electric truck	€125,256

Cost Component	Diesel (€)	Electric (€)
Tolls	19,800	14,950
Total Operating Cost	**415,330**	**328,694**

External Benefits

Benefit Type	Value (€)
CO_2 savings (360 t)	36,000
Health savings	4,000
Cost savings (TCO diff.)	86,636
Residual value gain	122,711
Total Societal Benefit	**€249,347**

Result Summary

- **Net Societal Benefit:** €249,347
- **Benefit-Cost Ratio (B/C):** 0.76

CURRENT STATE OF TRUCK ELECTRIFICATION

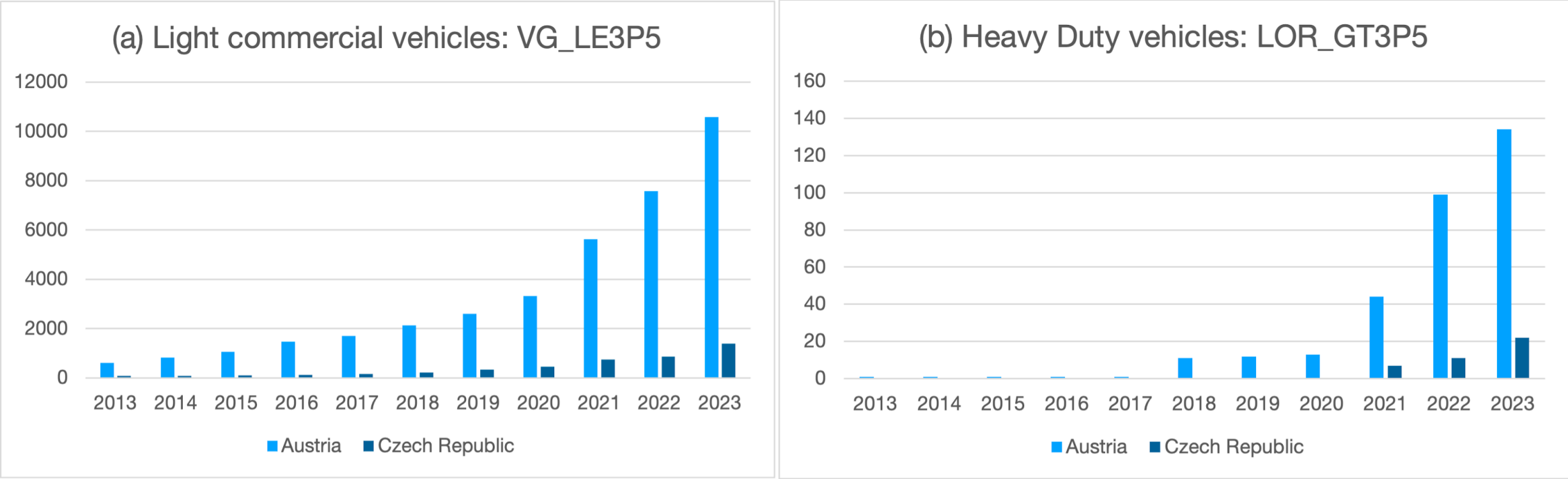


Figure 4: Yearly evolution of the electric truck fleet for light (a) and heavy (b) category in Austria and Czech Republic. Created with EU Commission dataset

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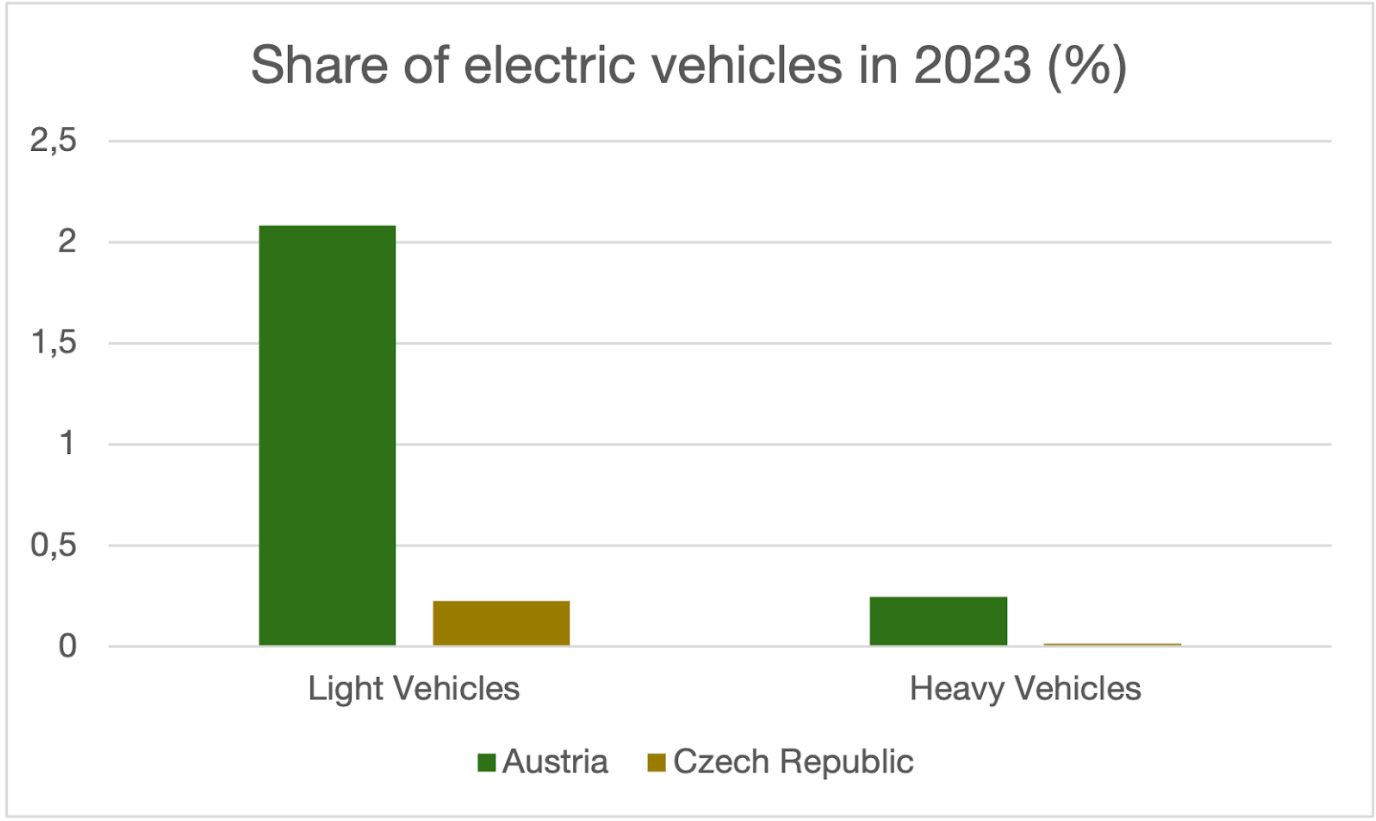

Figure 5: Share of electric commercial vehicles in Austria and Czech Republic 2023. Created with EU Commission dataset

KEY CHALLENGES

- Financial challenges : it requires investment public /private
- Infrastructure
- Electricity mix: czech republic

NEW MODELS OF HEAVY-DUTY VEHICLES

- Mercedes-Benz eTrucks
- Volvo Electric Trucks
- MAN Electric Trucks
- Tevva Electric Truck

THANK YOU FOR THE ATTENTION