Tampere University
Tampere University of Applied Sciences

Euroopan unioni
Euroopan aluekehitysrahasto

Vipuvoimaa EU:lta 2014–2020

GHG LCA of Conventional Vehicles vs. Battery Electric Vehicles

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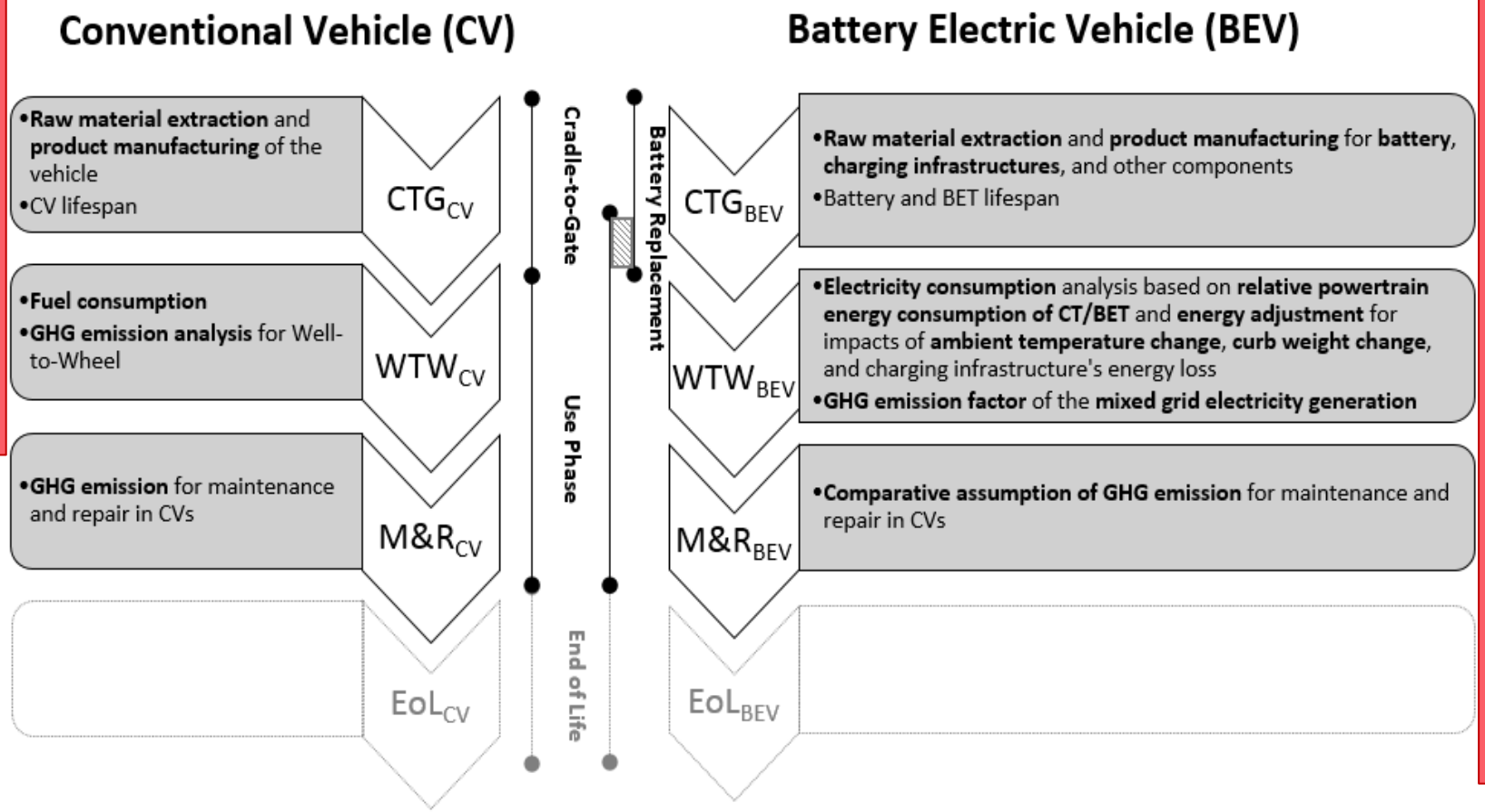
SECLOG
SMART ELECTRIC CITY LOGISTICS

Data Analysis

System boundary and variables

1. CV's CTG GHG emission
2. CV lifespan
3. Fuel consumption rate
4. WTW GHG intensity of fuel
5. TTW energy consumption
6. CV's M&R GHG emission



1. BEV's CTG GHG emission (except battery)
2. Charger's CTG CHG emission
3. BEV lifespan
4. Battery lifespan (CC, etc.)
5. Battery's CTG GHG emission
6. Relative powertrain energy consumption CV/BEV
7. Ambient temperature change
8. Charger energy loss
9. Curb weight change
10. GHG intensity of the electricity (GHG emission factor of the mixed grid electricity generation)
11. BEV's M&R GHG emission

Data Analysis
Delivery Van

GVW: 1.8 t

Payload capacity: 0.5 t

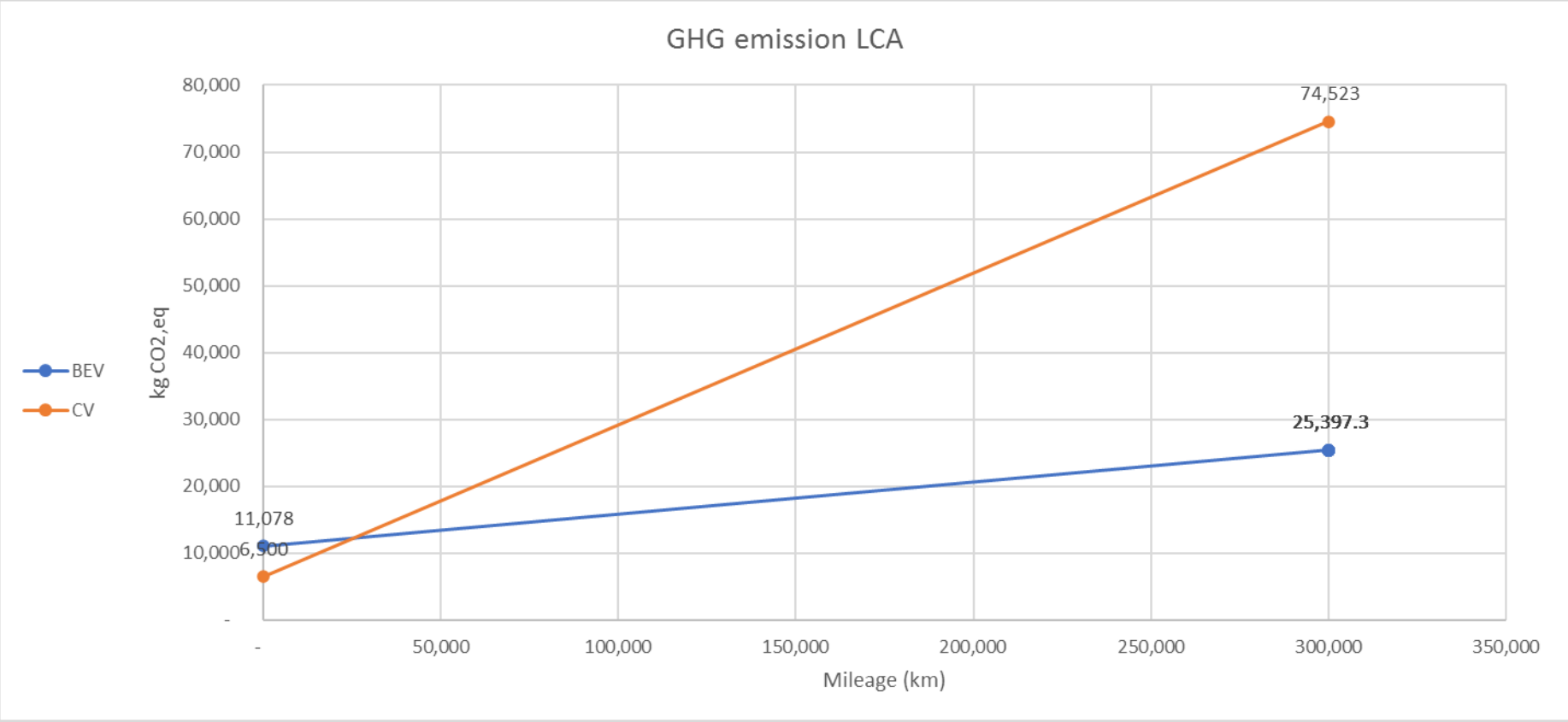
Fuel consumption rate: around 7 l/100km

Fuel type: diesel

Laden share: 50% of payload capacity

Battery capacity: 60 kWh (185 km range)

BEV➔66% GHG reduction



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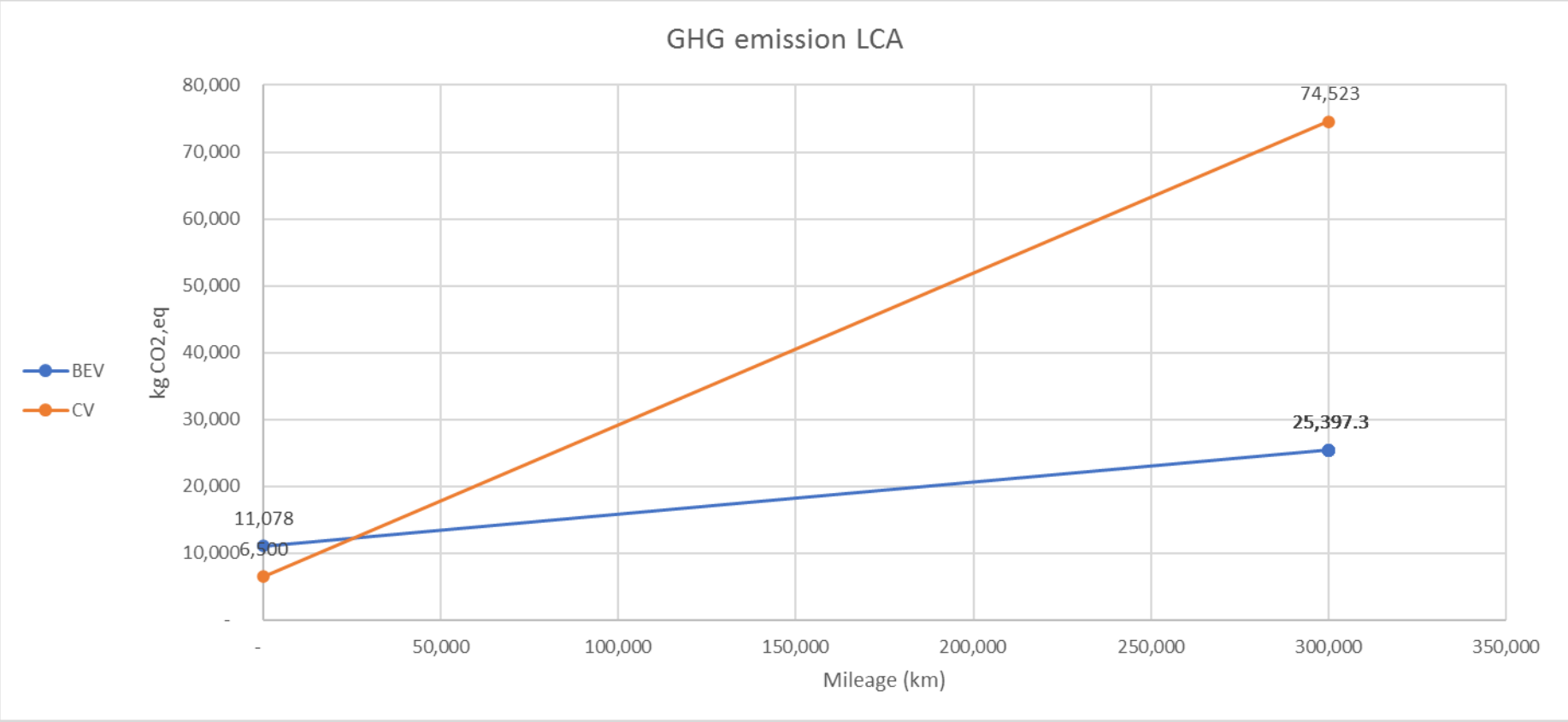


Data Analysis
Taxi Van

GVW: 3.5 t

Payload capacity: 0.66 t

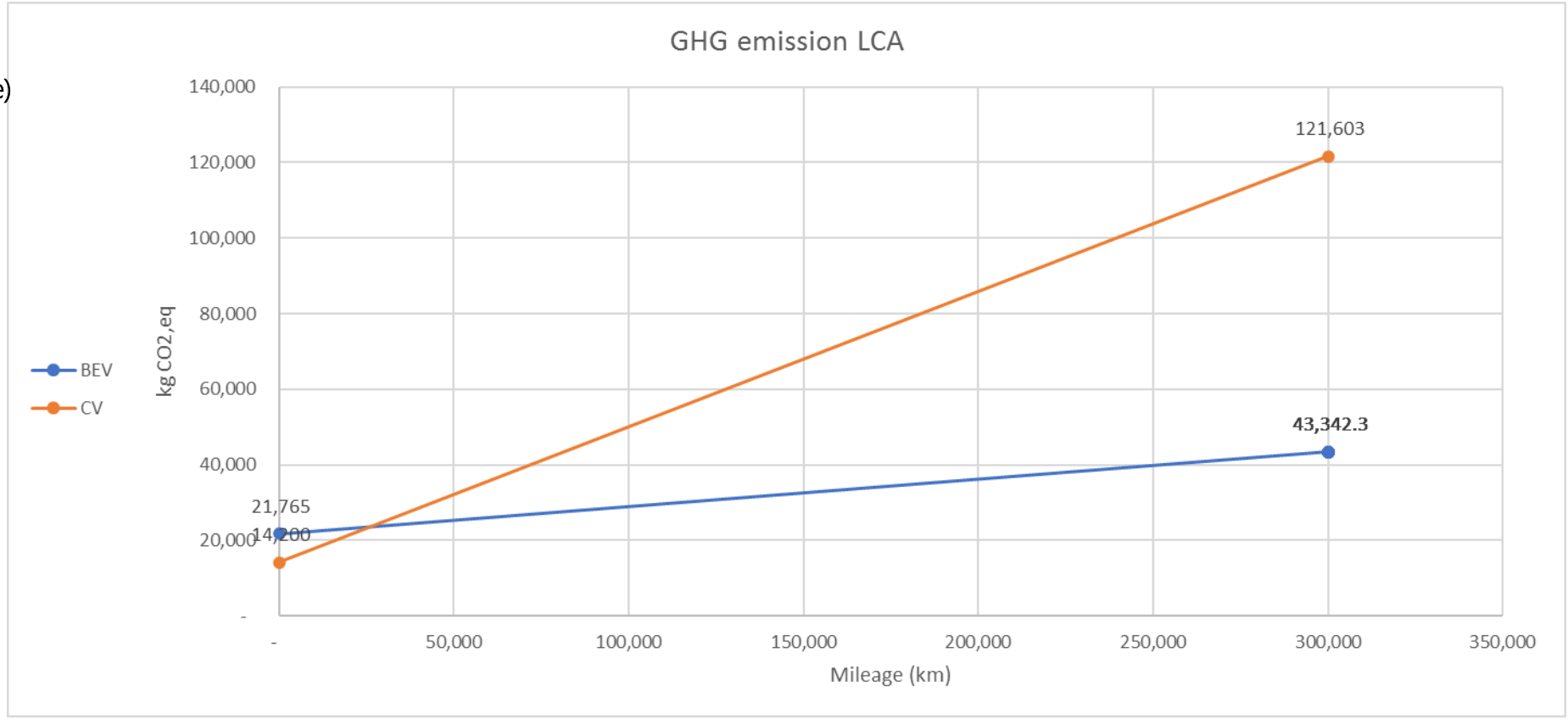
Fuel consumption rate: around 11.34 l/100km

Fuel type: diesel

Laden share: 50% of payload capacity

Battery capacity: 100 kWh (191 km range)

BEV➔64% GHG reduction



Data Analysis
Minibus

GVW: 5 t

Payload capacity: 1.55 t

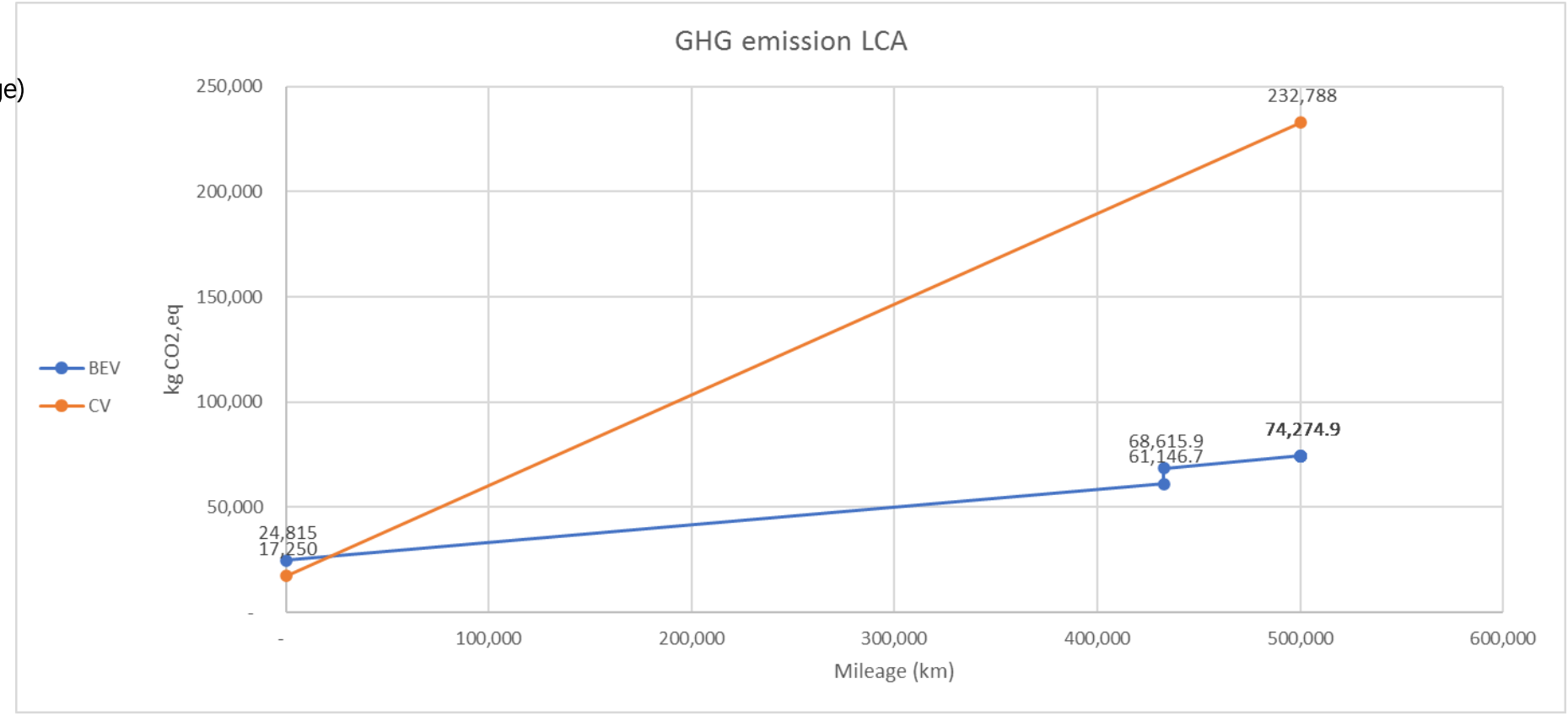
Fuel consumption rate: around 13.73 l/100km

Fuel type: diesel

Laden share: 50% of payload capacity

Battery capacity: 100 kWh (160 km range)

BEV➔68% GHG reduction



Data Analysis

Medium-duty Truck (16 t)

GVW: 16 t

Payload capacity: 10 t

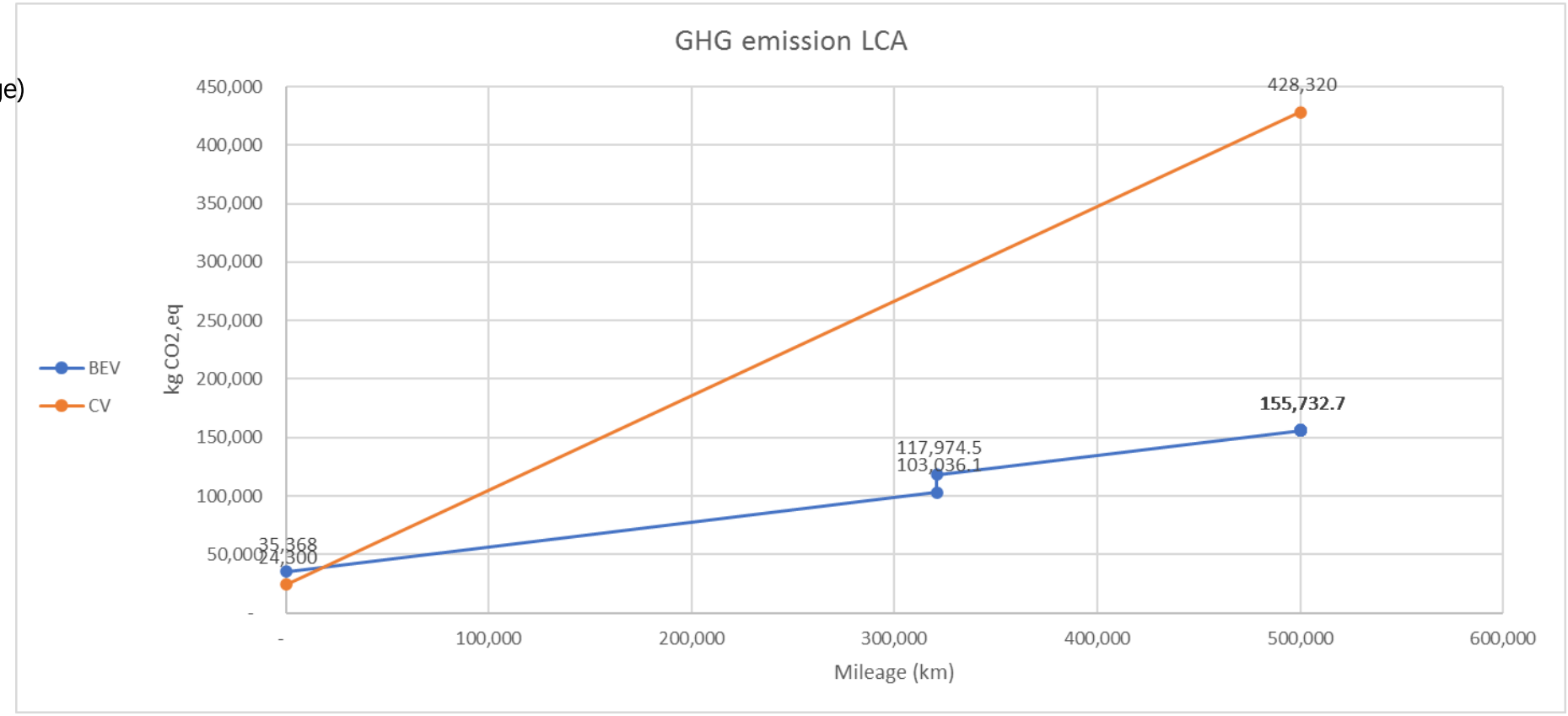
Fuel consumption rate: around 26.1 l/100km

Fuel type: diesel

Laden share: 50% of payload capacity

Battery capacity: 200 kWh (119 km range)

BEV➔64% GHG reduction



Data Analysis
Heavy-duty Truck (26 t)

GVW: 26 t

Payload capacity: 16 t

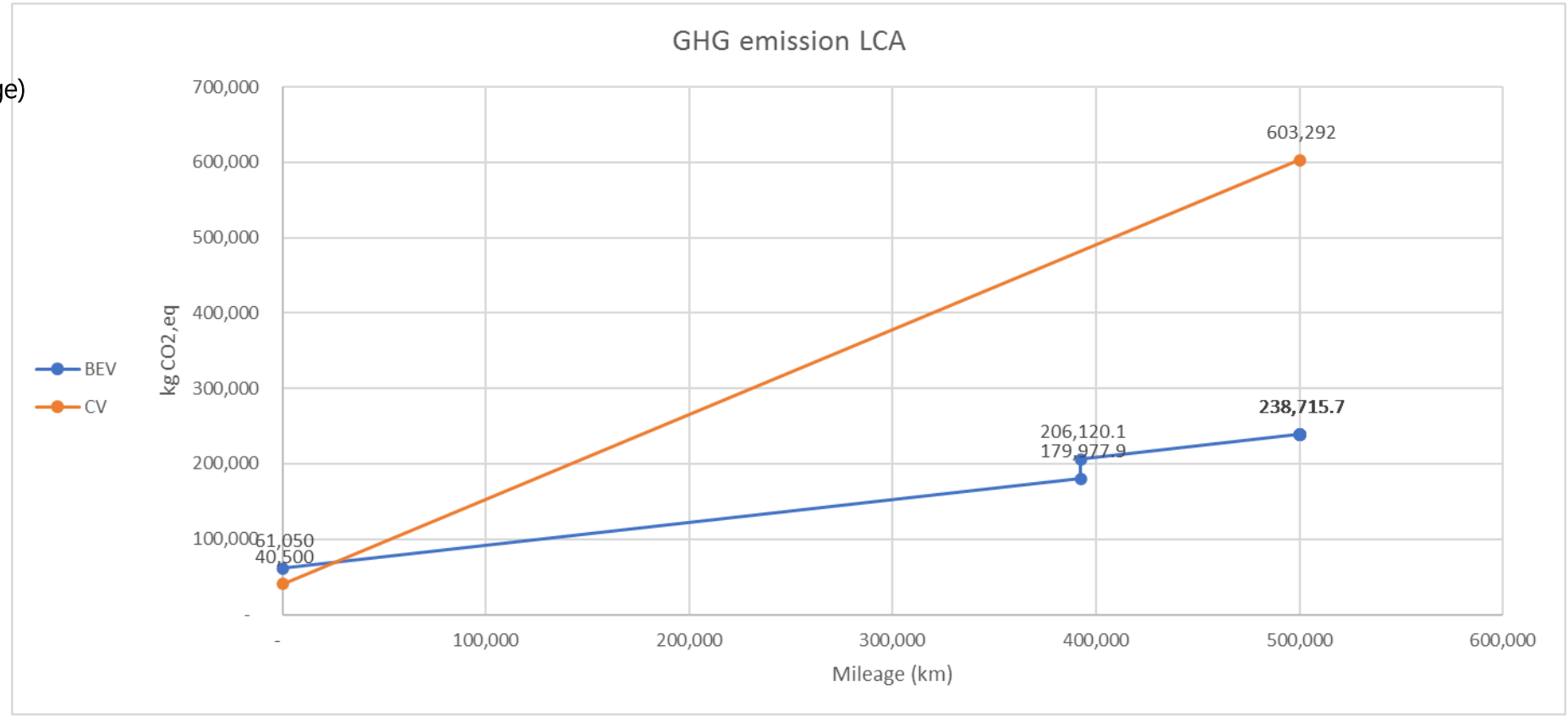
Fuel consumption rate: around 36.1 l/100km

Fuel type: diesel

Laden share: 50% of payload capacity

Battery capacity: 350 kWh (145 km range)

BEV➔60% GHG reduction



Data Analysis
Heavy-duty Truck (40 t)

GVW: 40 t

Payload capacity: 25.7 t

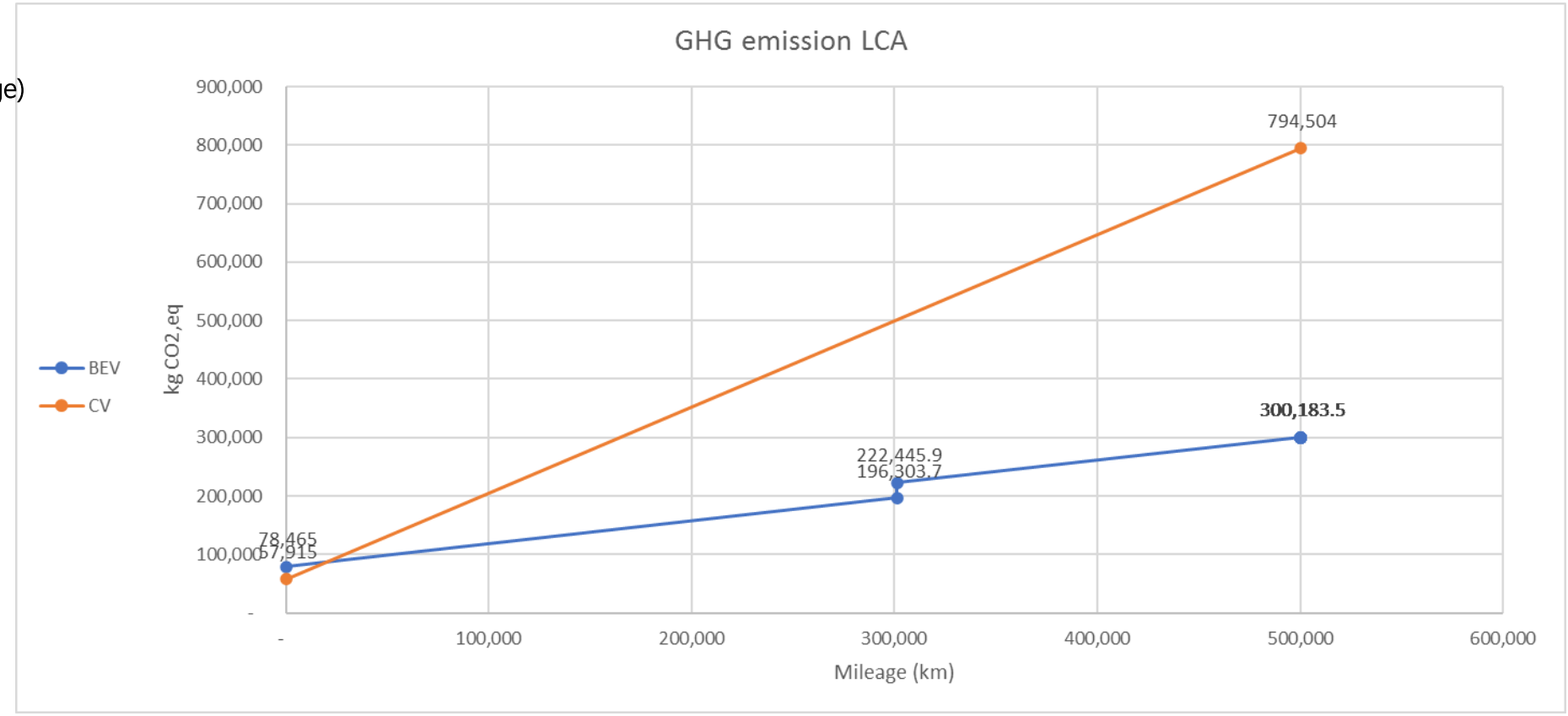
Fuel consumption rate: around 47.5 l/100km

Fuel type: diesel

Laden share: 50% of payload capacity

Battery capacity: 350 kWh (112 km range)

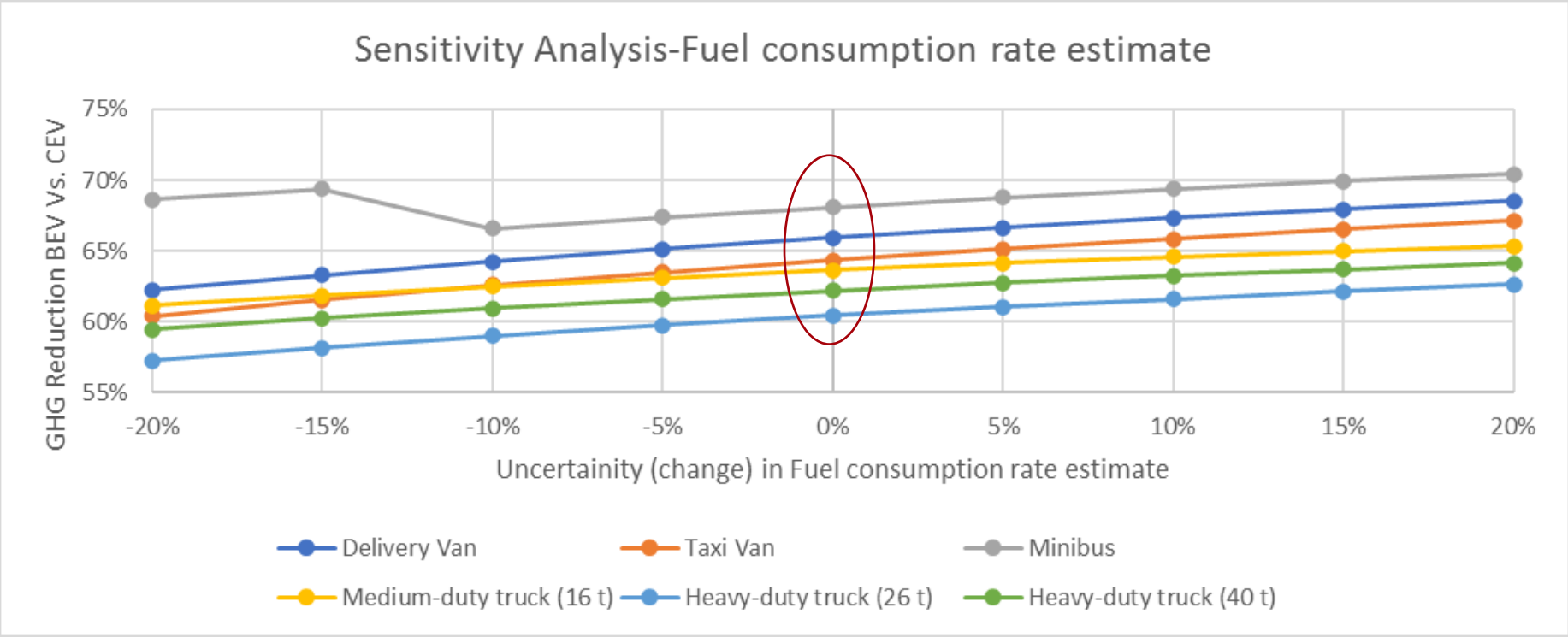
BEV➔62% GHG reduction



Data Analysis
Sensitivity Analysis

Lifetime mileage for Delivery Van and Taxi Van: 300,000 km

Lifetime mileage for minibus and different trucks 500,000 km



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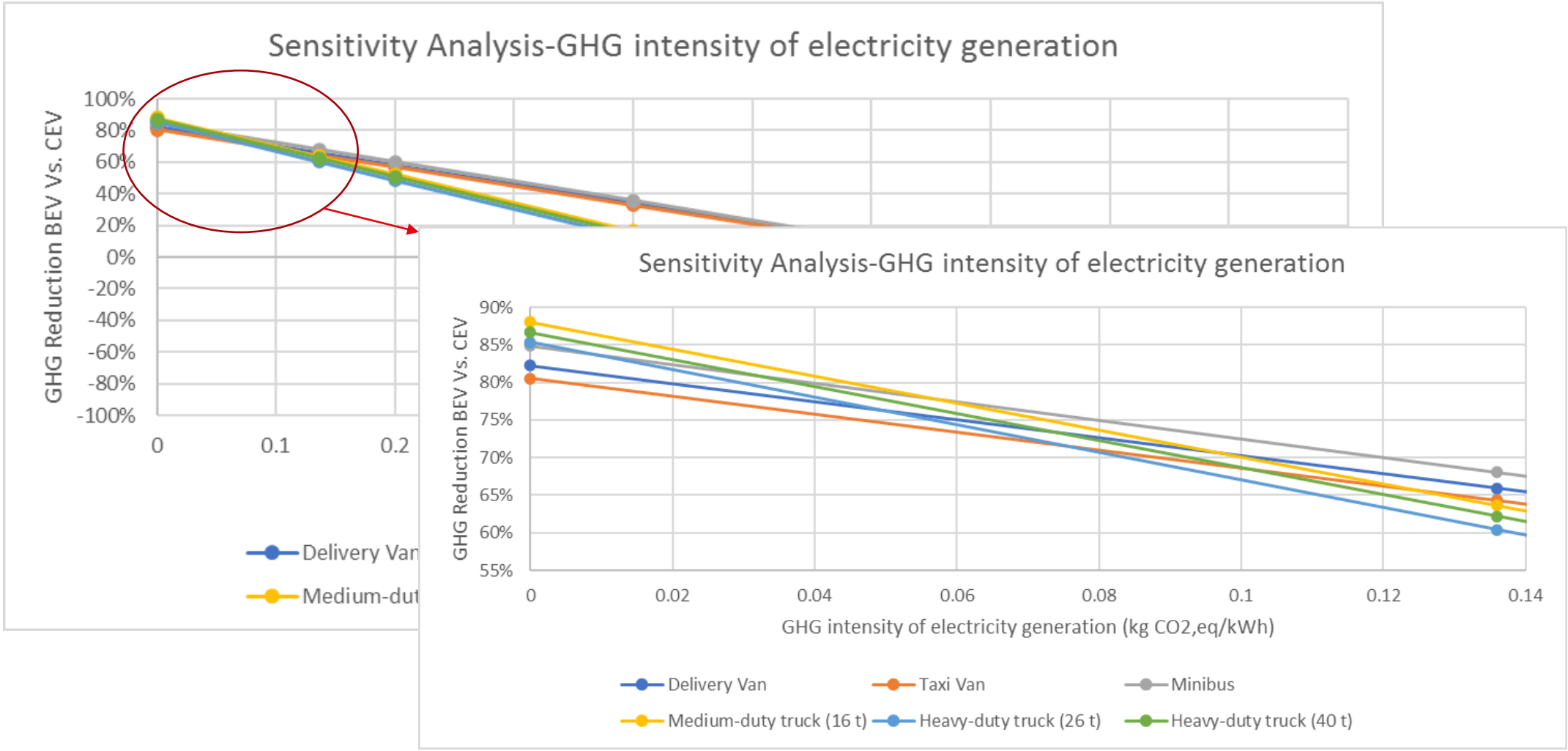

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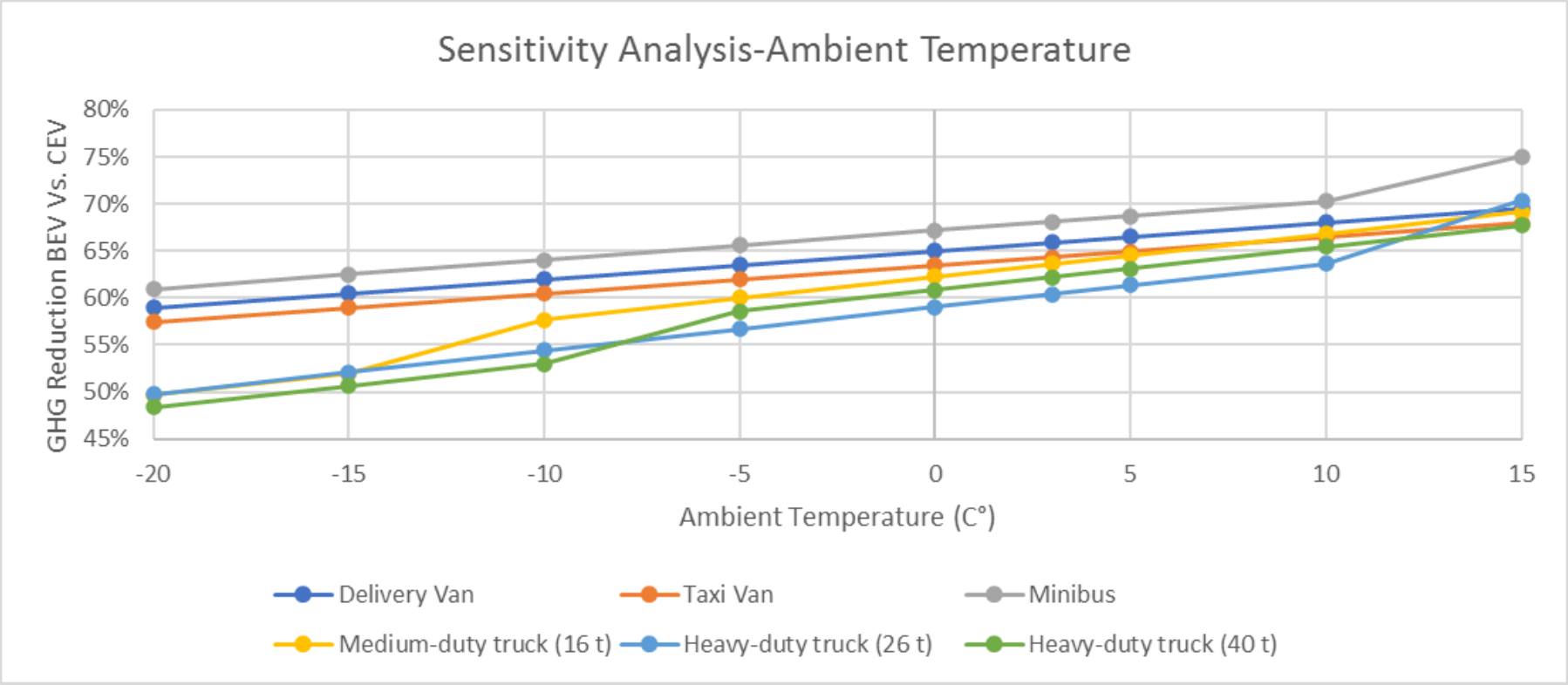

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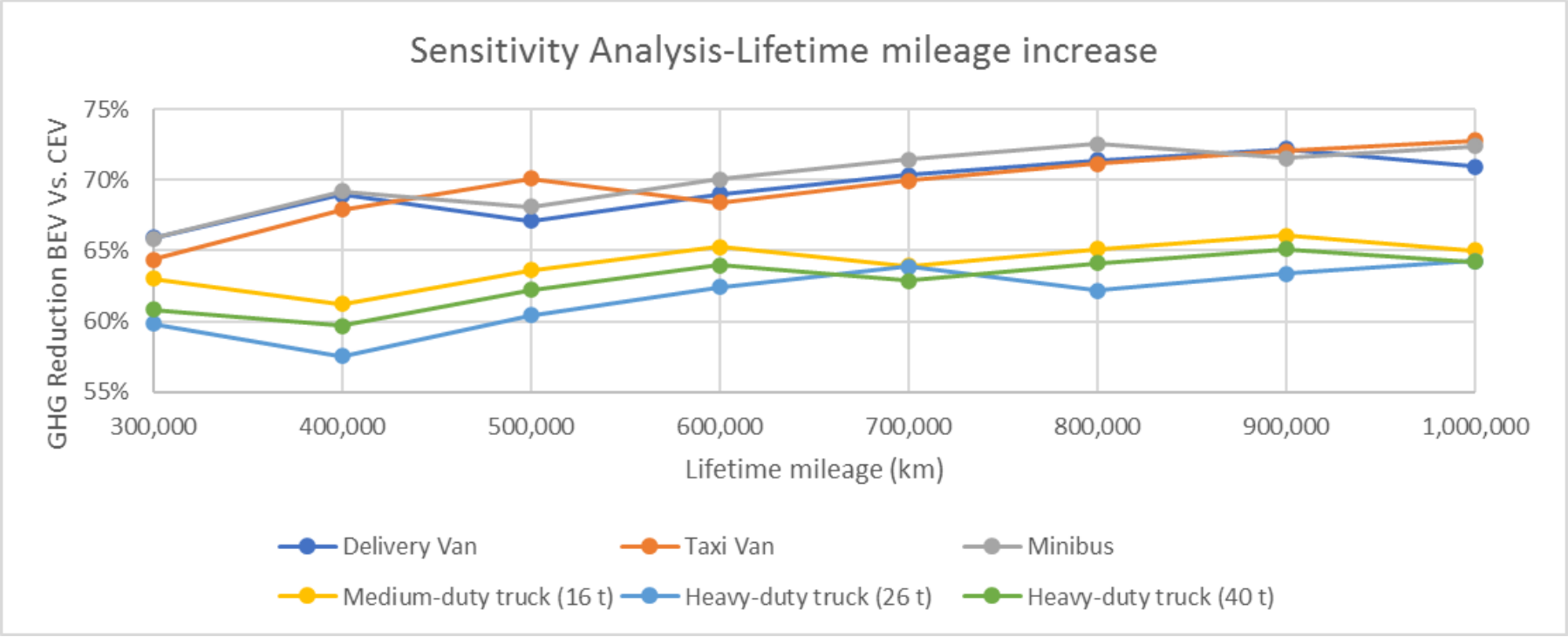

Data Analysis
Conclusion

- BEV in different Vehicle categories in Finland with the average annual ambient temperature of:
  - 3 C° (default) ➔62% to 68% GHG emission reduction
  - -5 C° ➔57% to 66% GHG emission reduction
  - -10 C° ➔53% to 64% GHG emission reduction
  - -15 C° ➔51% to 62% GHG emission reduction
- Carbon neutral sources for electricity generation (battery charging and battery production)➔ 81% to 88% GHG emission reduction
- On average every 100,000 longer lifespan for BEVs in different Vehicle categories in Finland ➔ +0.3% to +0.9% GHG emission reduction
- On average +/- 10% inaccuracy in fuel consumption estimate for CVs in different Vehicle categories in Finland ➔ +/- 0.5% to +/- 1.7% GHG emission reduction

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Thank you!

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