Needs for providing charging infrastructure for urban logistics

The case of Amsterdam

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Research partners:

Buck Consultants International

CE Delft

DISTRICON

Hogeschool van Amsterdam

Panteia

TNO

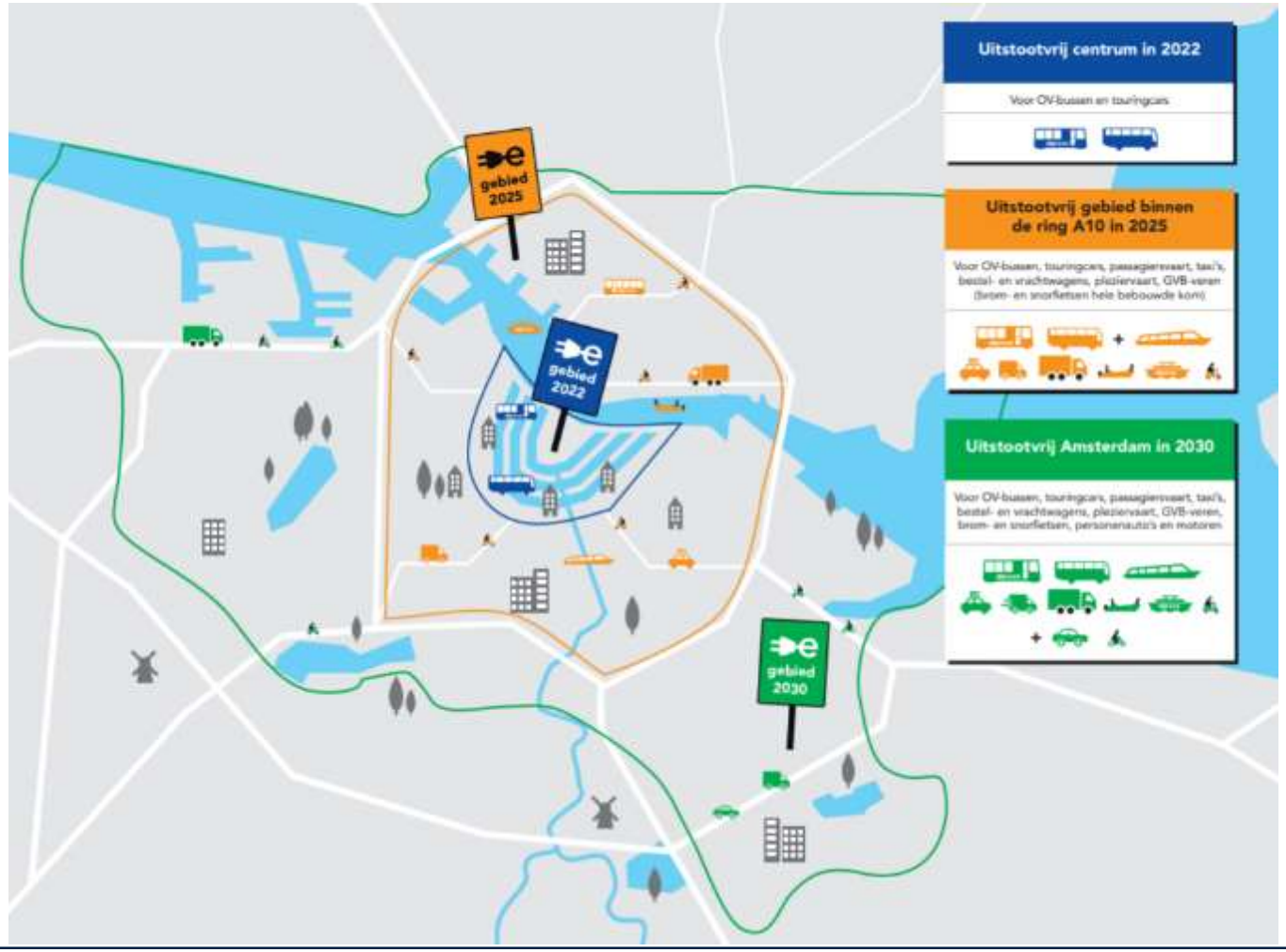
In assignment of:

Connekt

Topsector Logistiek

Case of Amsterdam: Environmental Zone 2025

Progressive electrification in (i) sectors, (ii) geographic region



Ambition: Urban logistics electrified by 2025

- ~30.000 commercial vans
- ~5.000 freight trucks

Questions:

- How to electrify current operations?
- Where and how to charge?
- Impact on grid?

Urban logistics: CO2 emissions

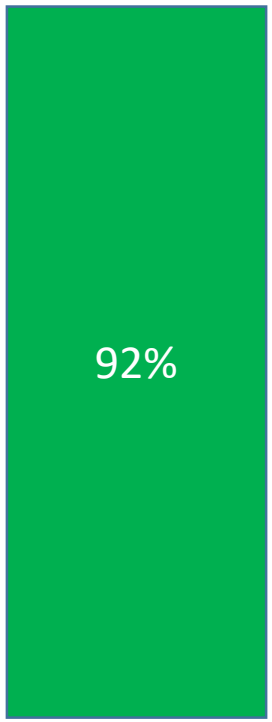
Topsector Logistiek

Zero Emission Stadslogistiek

Climate ambitions: 1 Megaton less CO2 emission by 2030

segment		bestelauto	vrachtauto/trekker	totaal
	post | pakketten | express	0,10	0,02	0,12
	gekoeld	0,12	0,32	0,44
	handel	0,37	0,93	1,30
	afval	0,00	0,22	0,22
	diensten	0,31	0,05	0,36
	bouw	0,73	0,12	0,85
	overig (bv thuisservice)	0,27	0,00	0,27
totaal incl. overig		1,9	1,7	3,6

Typical daily trips for commercial vans (entering Amsterdam)



Less that 100km per trip

100-150 km per trip

150-350 km per trip

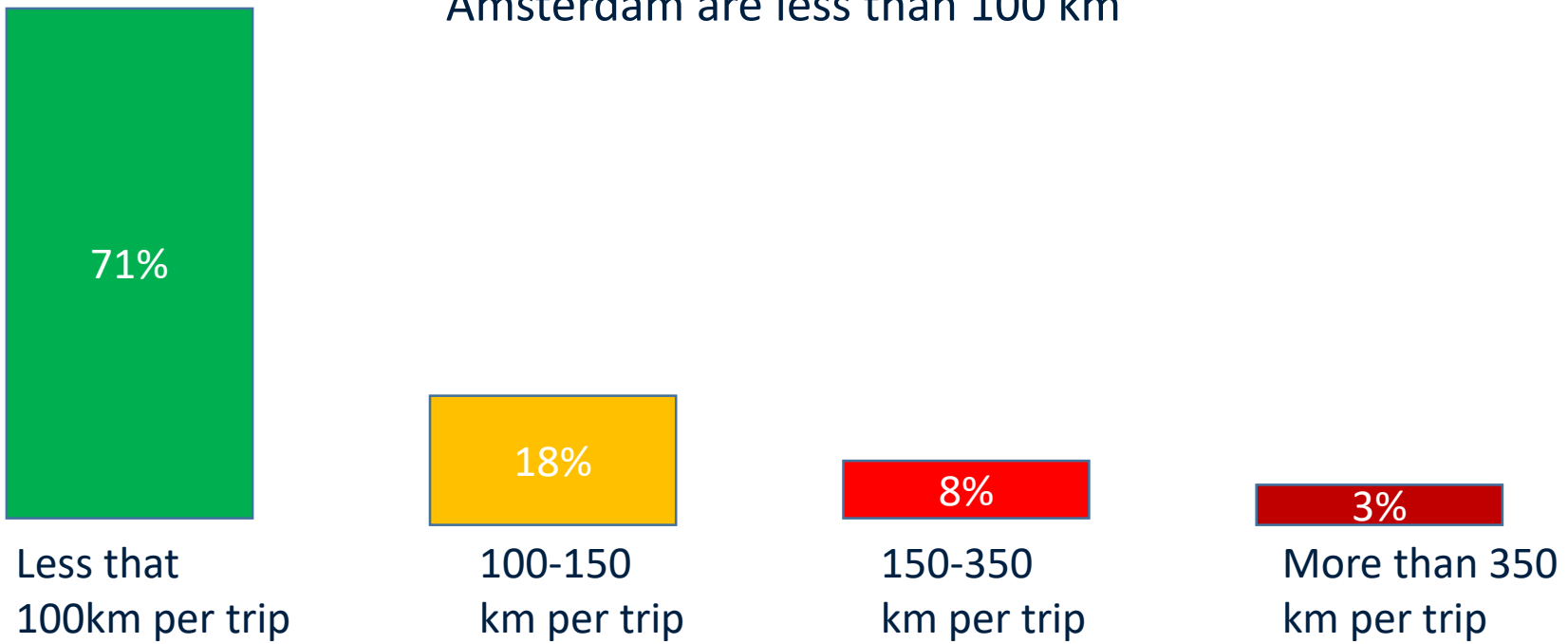
More than 350 km per trip

- 92% of all trips to and from Environmental Zone of Amsterdam are less than 100km

Questions: sufficient vehicles available? TCO?

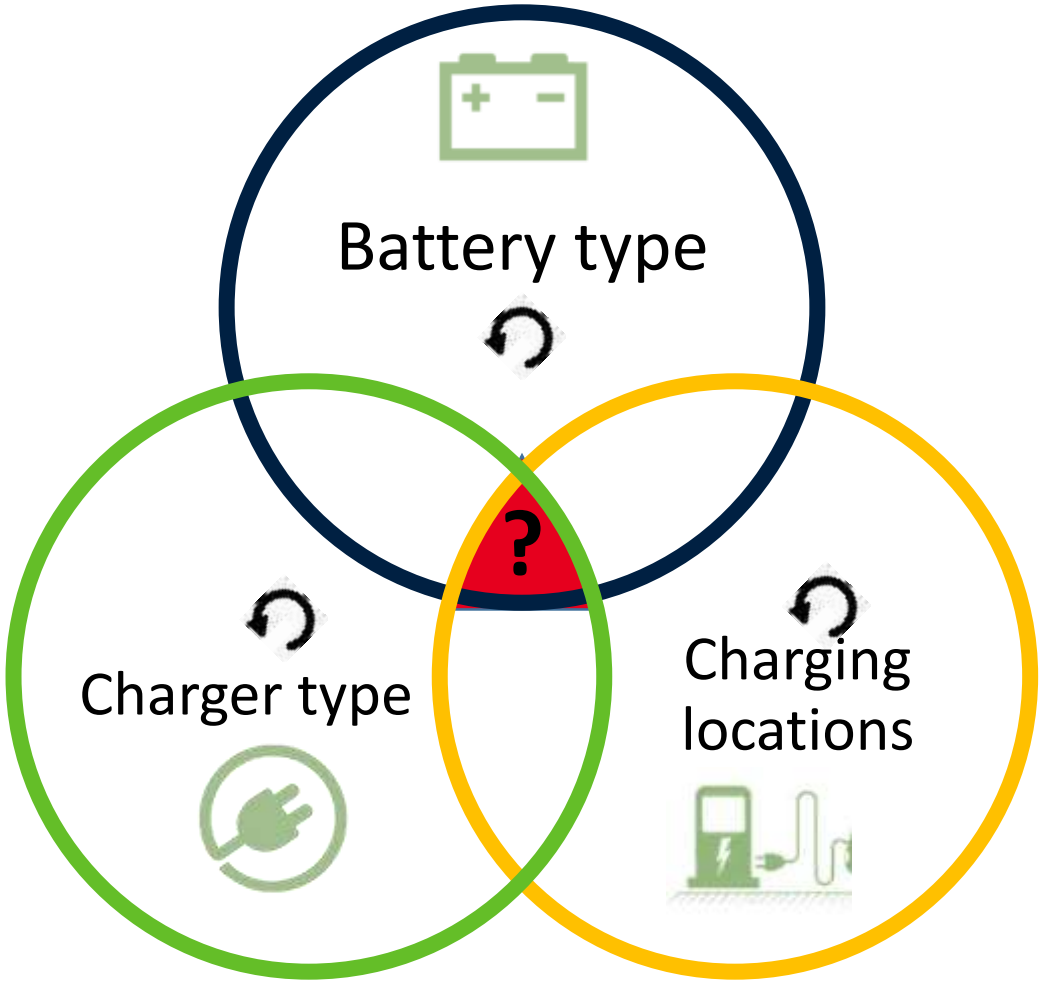
Typical daily trips for freight logistics (Amsterdam)

- 71% of all rides to and from Environmental Zone of Amsterdam are less than 100 km



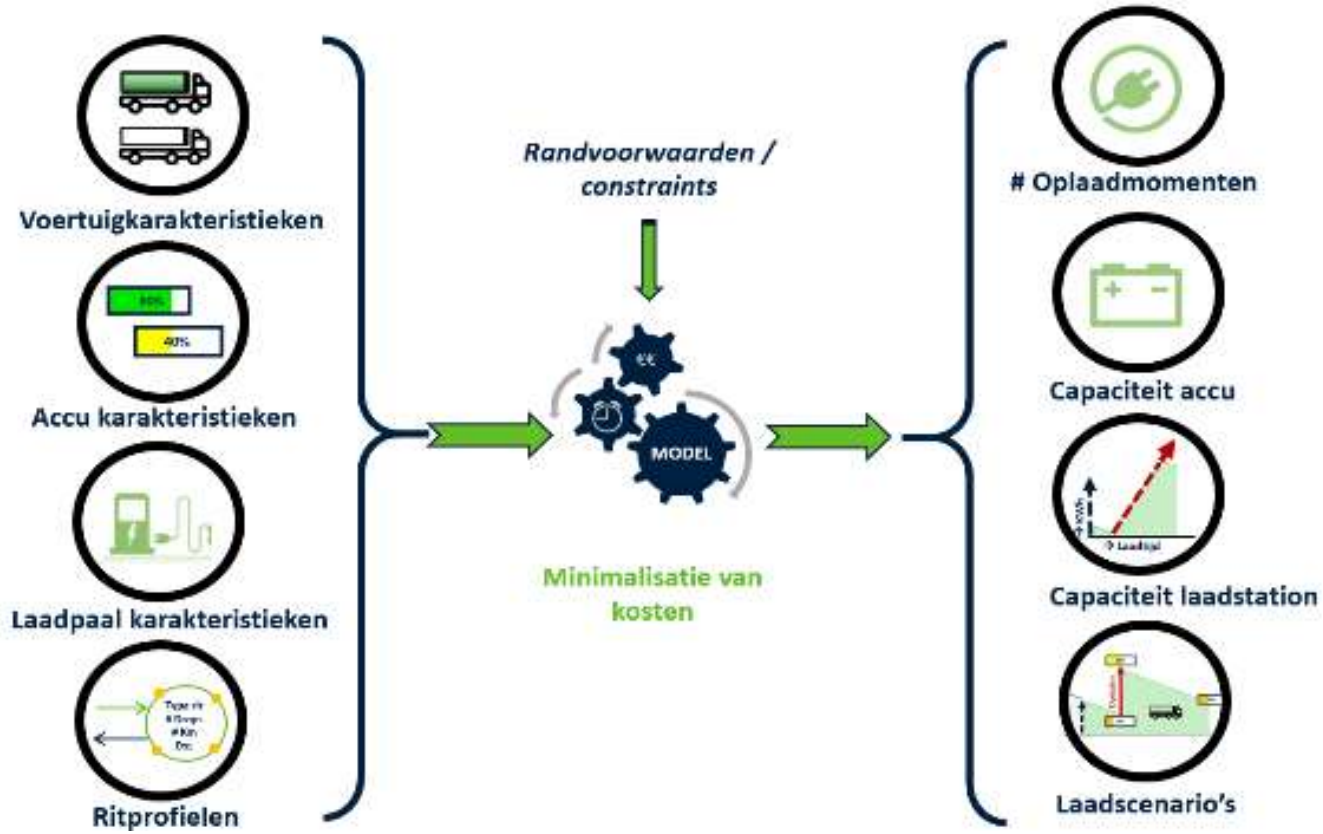
Questions: sufficient vehicles available? TCO?

The right charging strategy: a lot of questions

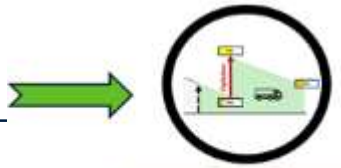


Optimalisation charging strategy for electric urban logistics

- **Location** where to charge & number of charging moments
- **Type of charger** (fast/slow).
- **Size of battery** in the vehicle



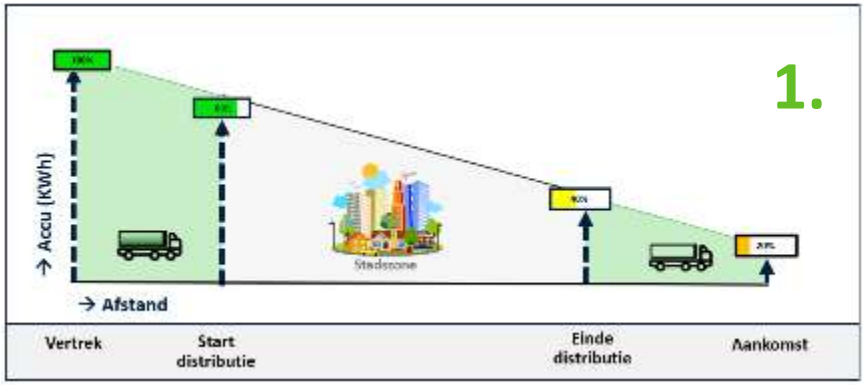
Charging scenarios

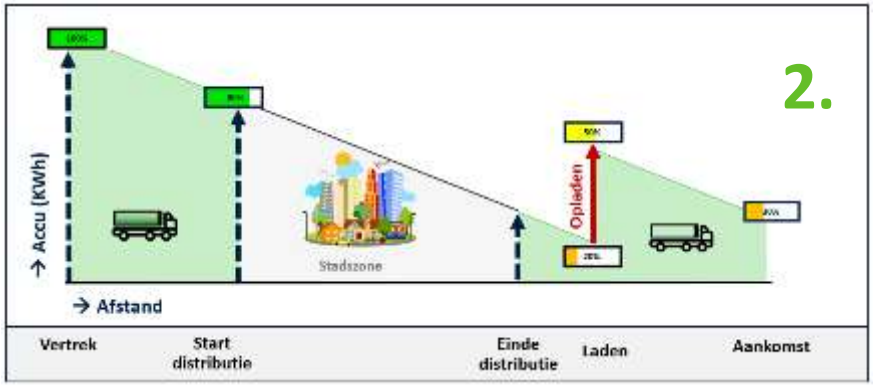


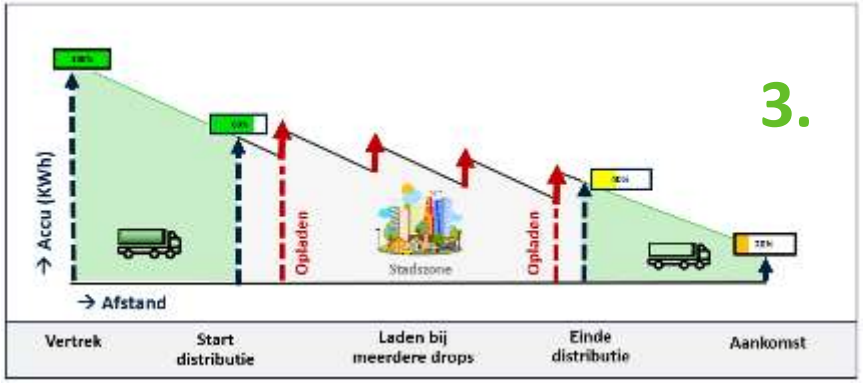
Input = Trips

Three charging options:

1. Without intermediate charging
2. Intermediate charging
3. Charging during deliveries (opportunity charging)







Results

- Total cost of ownership
- Charging per type (public, depot, fast)
- Locations of charging

Total cost of ownership:
Integral part of the decision making process

Vehicle/transport operations

Scenario:
- Type of vehicle
- Annual operation distance (km)/duration (hrs)
- Service lifetime

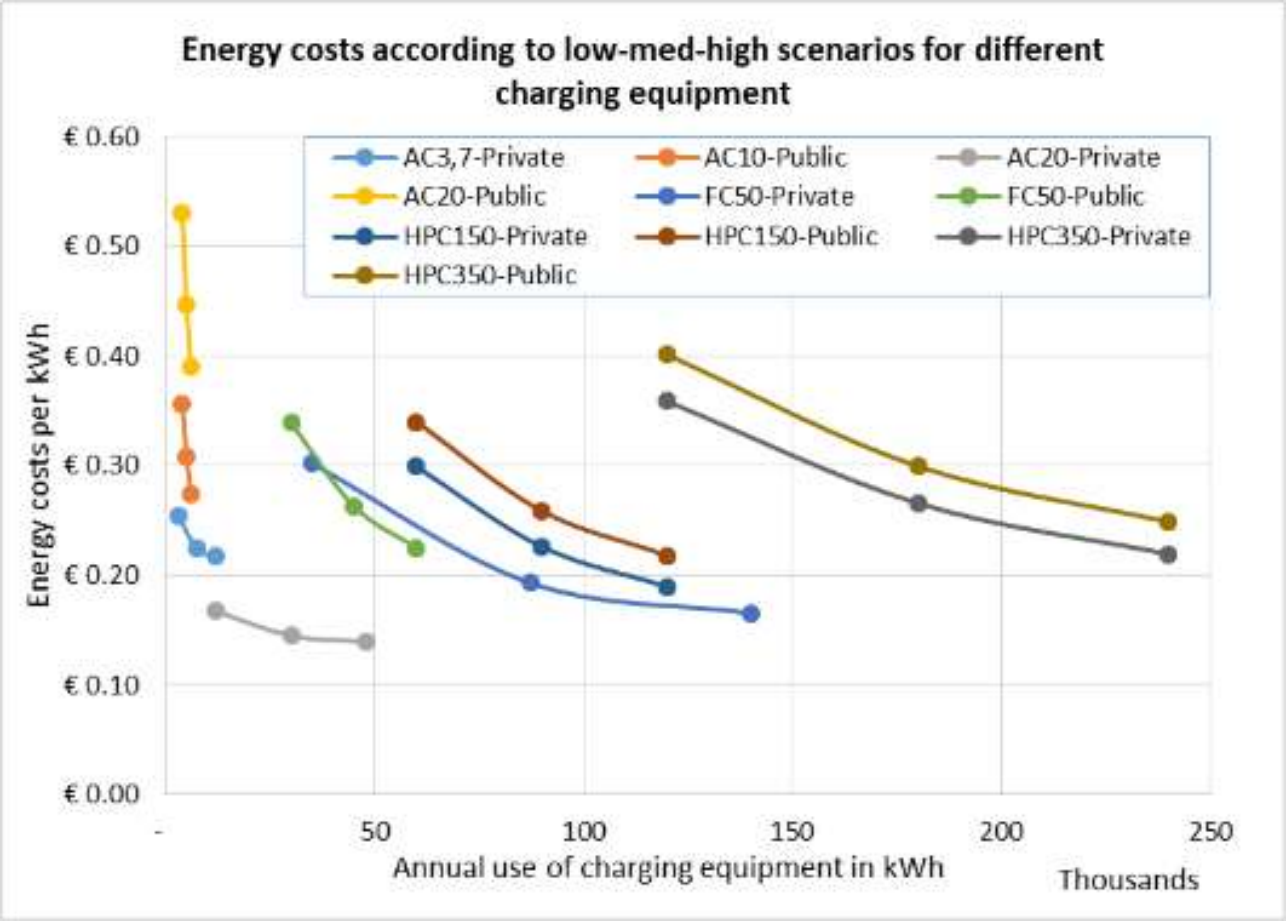
Vehicle system	**Fixed cost per year** Vehicle road tax (input) Toll Interest (vehicle purchase loan) Insurance
	Variable costs per km Vehicle depreciation costs Battery depreciation costs Energy costs:Fuel/Electricity Repair/Maintenance
Private charging system	Purchase & Installation Operational costs
Driver	**Driver costs**
Overhead	**General costs**
Indicators transporters use to negotiate rates	**Total costs** **Costs per km** **Costs per hour**

Charging equipment

Scenario:
- Type of charging equipment
  Annual use of charging equipment (kWh)
- Service lifetime

Purchase/installation	Purchase Installation Civil works Connection costs
Operational costs	Annual connection costs ICT costs Insurance (damage) Repair/maintenance Customer service
Energy costs	Supplier fee Energy costs
Private charging costs (volume dependent)	**Fixed costs (per year)** **Variable costs per kWh**
Public charging costs (volume dependent)	**Energy price per kWh** **(Subscription fee)**

TCO-based pricing of charging



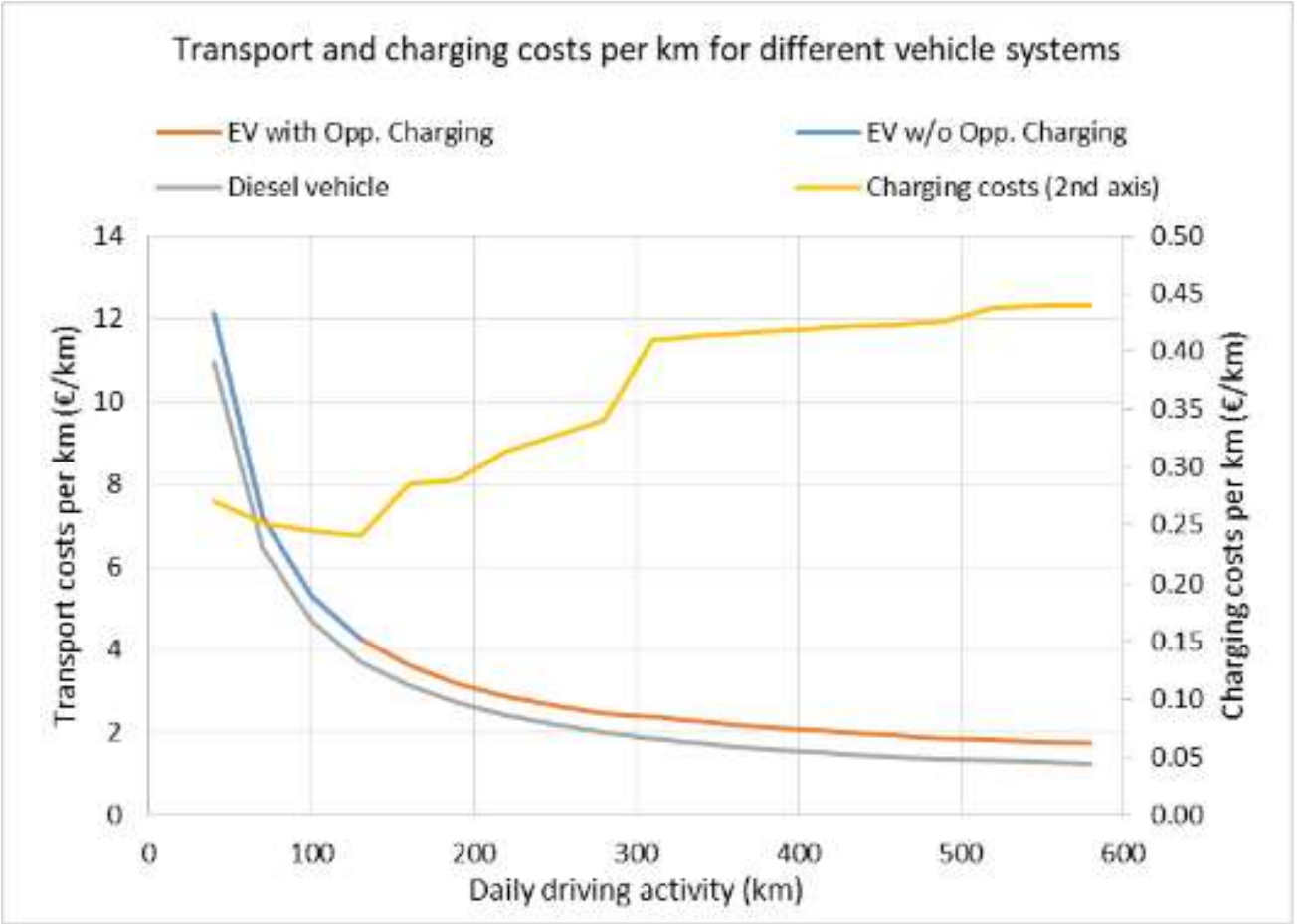
Assumptions

- On-site charging uses existing utility provider and network
- Low-med-high use based on literature, limits of power and potential charging duration.

Remarks

- Need to include profit margin (e.g. a fast charging provider had 20% margin)
- Synergies/constraints of multi-installation
- Real data would be helpful to improve the TCO accuracy

Combined TCO of vehicle and charging systems



Assumptions

- Medium use scenario for charging systems (i.e. fixed charging costs per charging system)
- Truck trailer combination, 260 days use, service lifetime 8 years.
- Max. driving range includes multiple shift, loading/unloading time

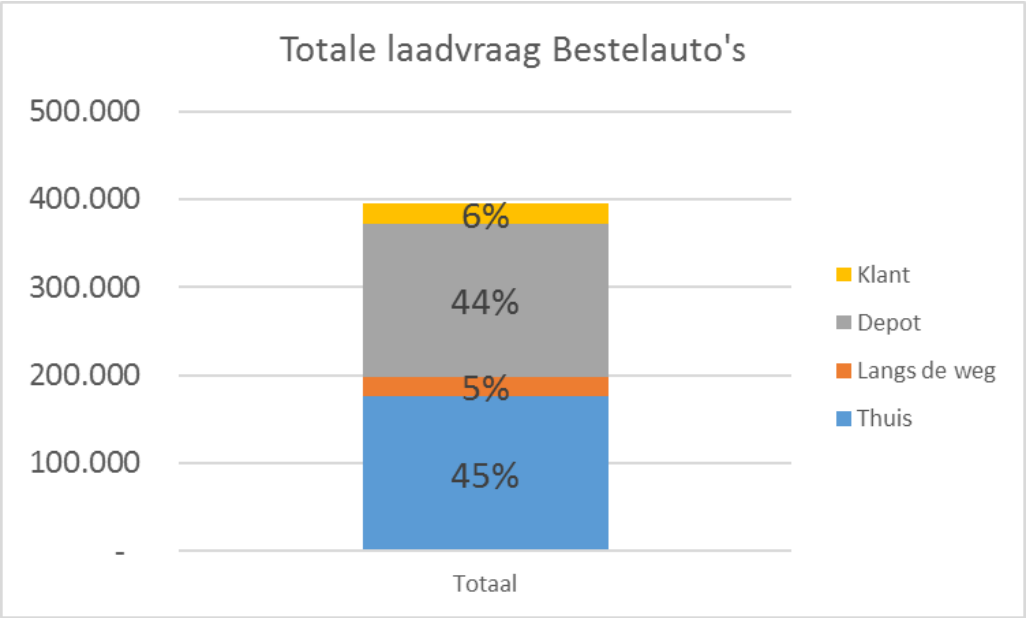
Remark

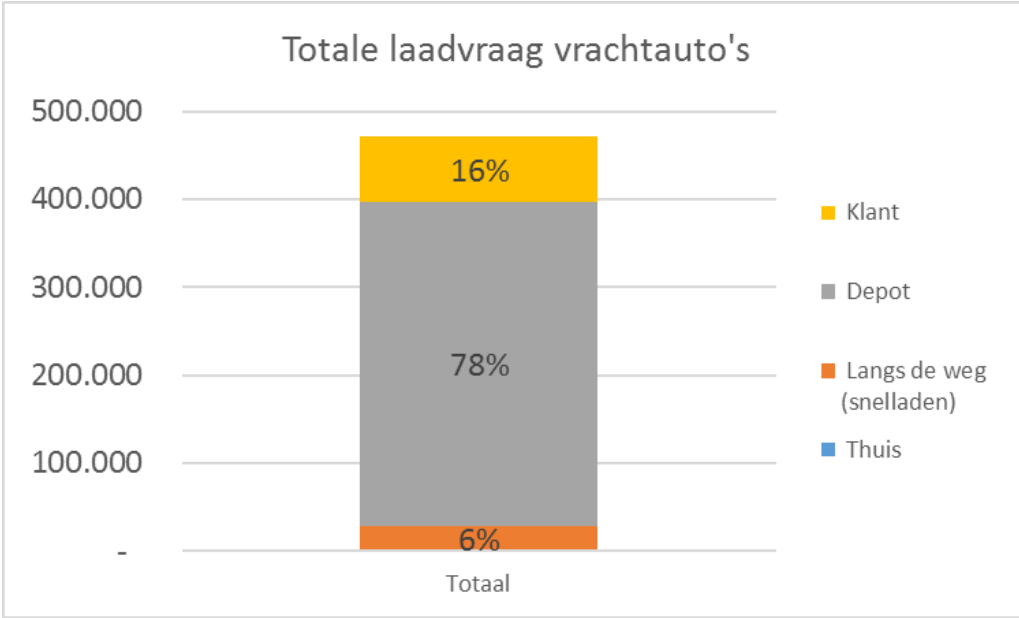
- Without opportunity charging, max range is 130 km.
- Opp. charging extends driving range, but there is still a cost difference with diesel.

- Data needed: electric truck maintenance costs, updated with 2019/2020 truck models

On which locations is charged most? (kWh)

(i) at home, (ii) fast, (iii) depot, (iv) at client





Commercial vans largely charge at home or at depot.

Limited fast charging (due to costs and time) and customer (short stops)

Note: Home charging should be made possible

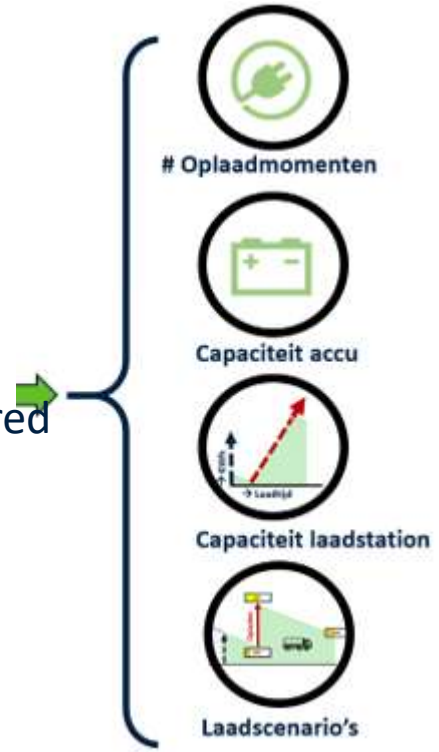
Trucks charge largely at depot.

Fast charging limited (6%); client charging optional (16%)

No home charging, given that trucks stay at depot.

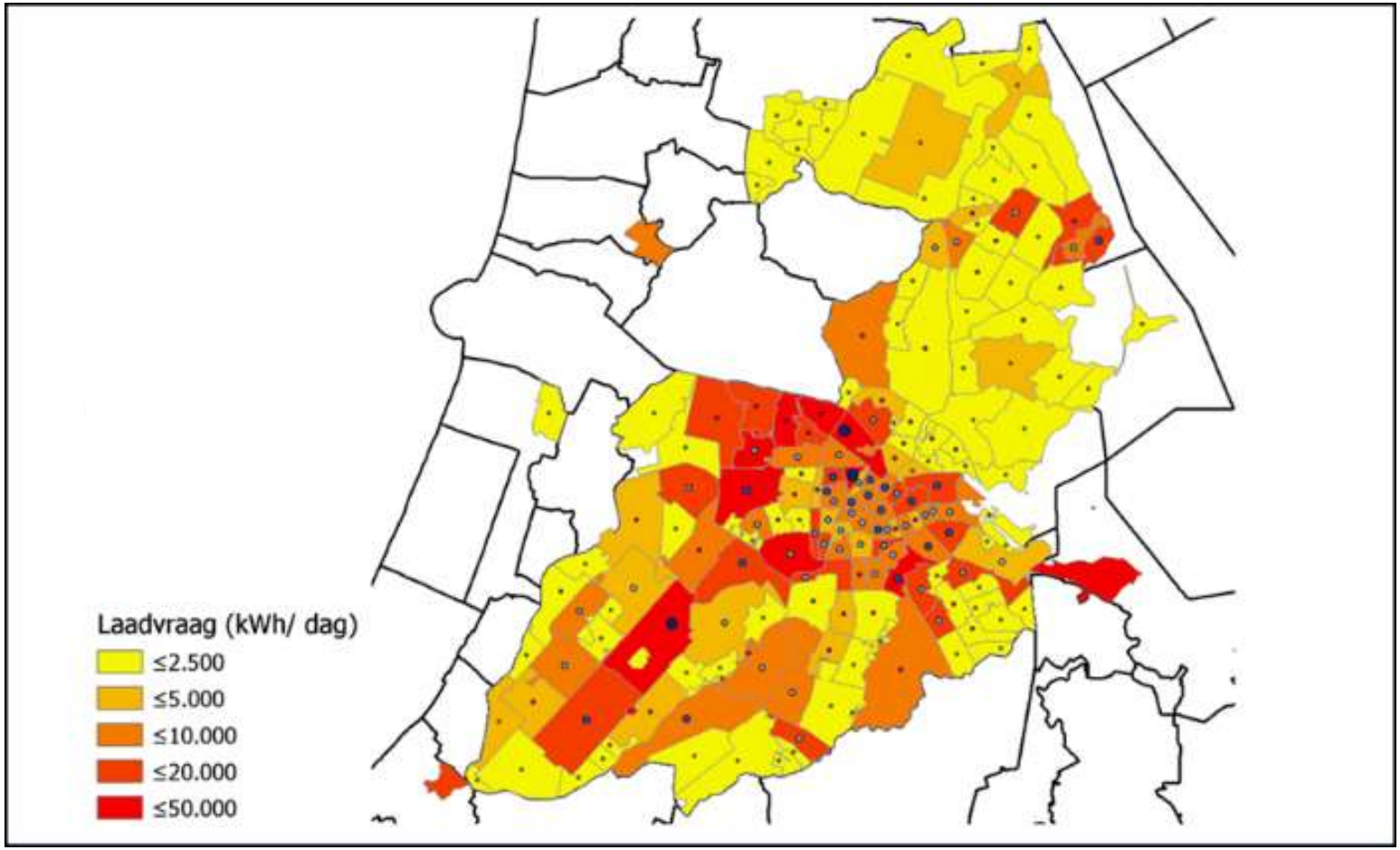
Charging per sector

- **Retail food and non-food:** Depot dominant. For long trips (>100km) charging at clients likely.
- **Building sector:** Commercial vans dominant at home. Trucks at depot. Charging at building sites optionals – requires innovation.
- **Postal services:** Mostly at home and at depot. Fast charging not required due to limited range.
- **Service logistics :** Home charging dominant.

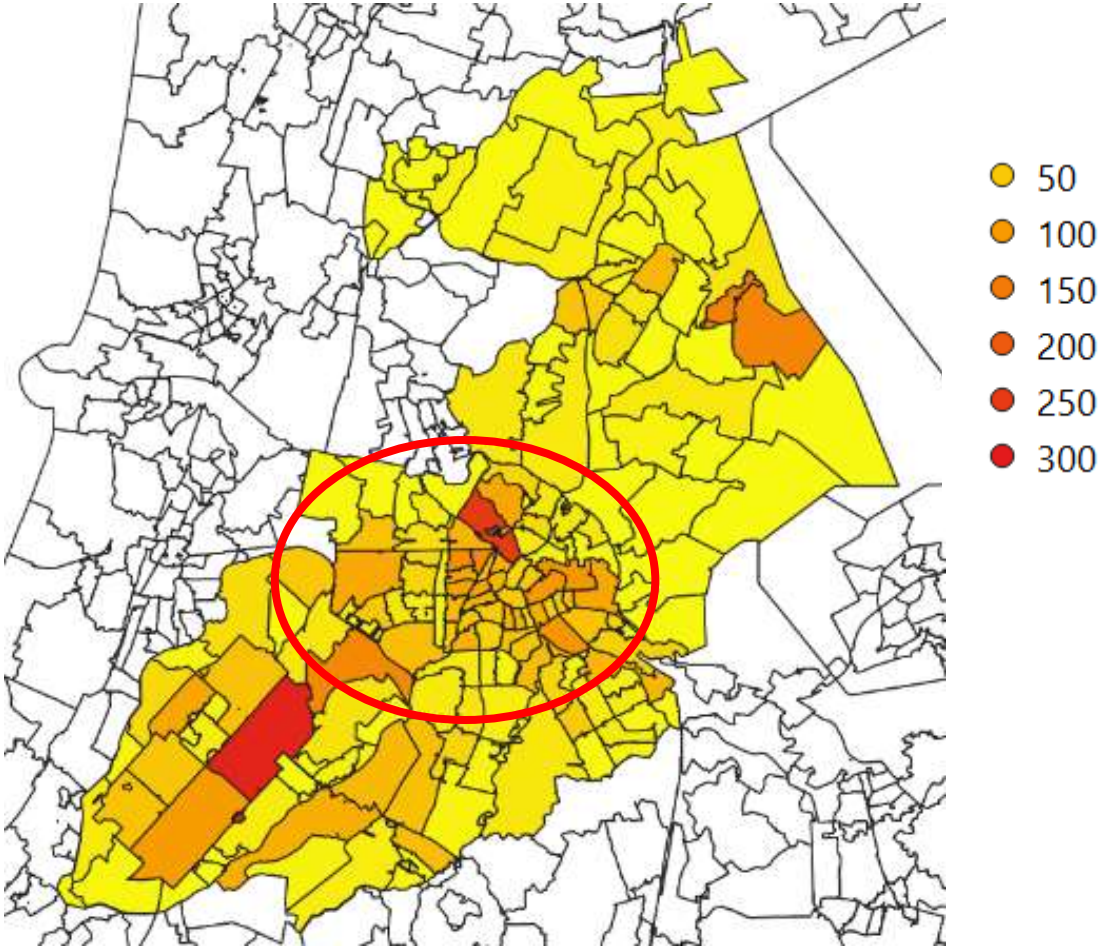


Consequences for charging demand:

Depots require major charging infrastructure investments



Public chargers:
Mainly required outside city center



1. A majority of public chargers required outside the environmental zone.

2. Largely due to commercial vans of service logistics and building sector.

3. Requires involvement of neighbouring municipalities

Conclusions

- Environmental zone will impact 30.000 commercial vans and 4700 trucks.
- Strong differences in charging needs per sector.
- Requires major investments in (i) depot charging, and (ii) home (public) charging

- Fast charging? In current conditions a limited factor, however:
  - Prices (may improve)
  - Charging time (will improve)
  - Home charging assumed to be faciliated (remains to be seen)
  - Depot charging assumed to develop (idem)
  - Shift in dominant charging regime may still occur

Questions