Energy consumption of heavy-duty BEVs depending on GVW, payload and temperature

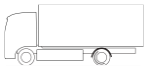
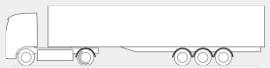
Mikaela Ranta

30/09/2025 VTT – beyond the obvious

Research questions

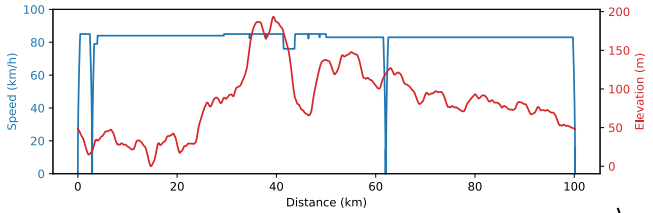
- What is the energy consumption of an electric truck?
- How does the energy consumption depend on the vehicle configuration, payload, environmental conditions etc.?
- What is the payload capacity of an electric truck?

Vehicle categories

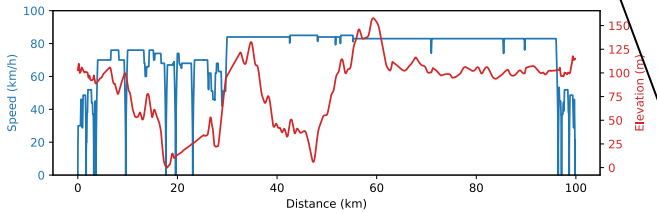
Truck category	GVW	Vehicle configuration	Length of cargo space	Air drag CdxA
A	8 – 14		7.4	5.42
B	14 – 18		7.4	5.52
C	18 – 28		7.82	5.65
D	28 – 33		8	6.5
E	33 – 45		13.6	6.05
F	45 – 60		7.82 + 13.6	9.1
G	60 – 76		7.82 + 13.6	9.1
H	76 – 90		13.6 + 13.6	13.3

Vecto long haul cycle

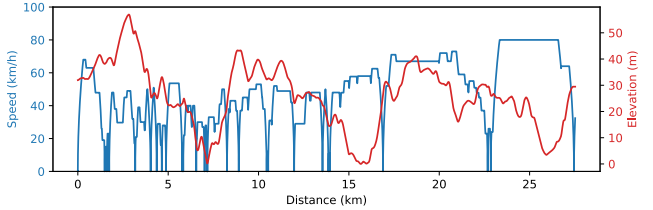
VECTO Long haul



VECTO regional delivery



VECTO urban delivery



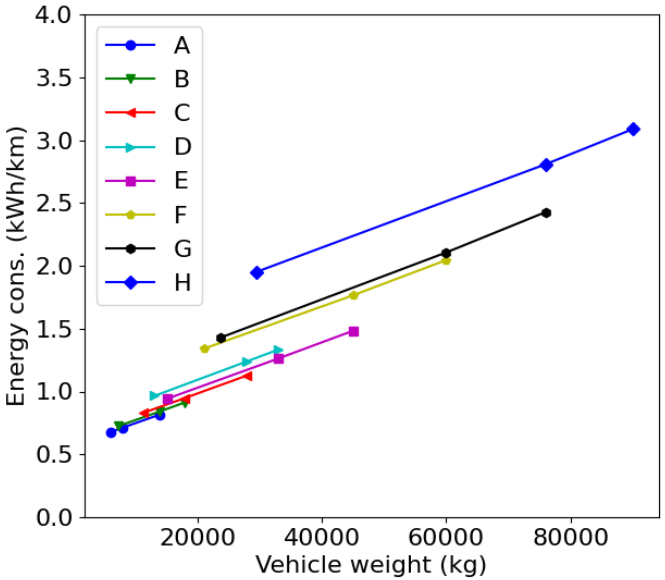
Truck category	GVW (tons)	Energy cons. (kWh/km)
A	14	0.82
B	18	0.91
C	28	1.13
D	33	1.33
E	45	1.48
F	60	2.05
G	76	2.43
H	90	3.09

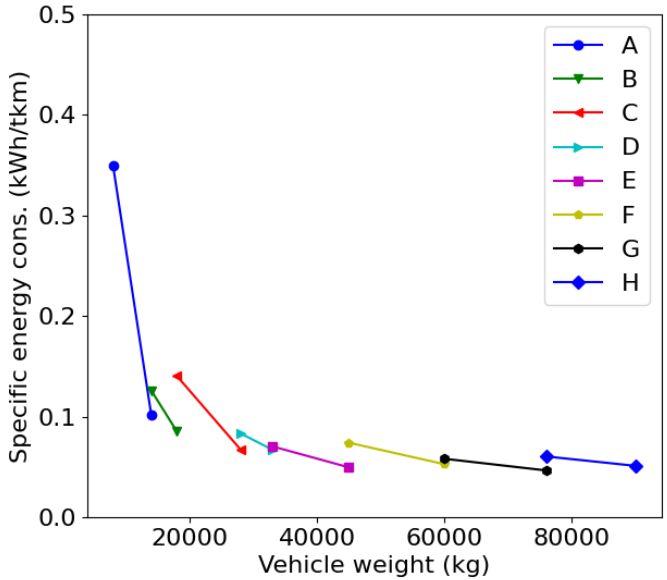
Long haul cycle – battery dimensioning

Truck category	Diesel empty weight (kg)	Battery capacity (kWh)	BEV empty weight (kg)	Payload capacity BEV vs. diesel (%)
A	6811	349	7326	92.8
B	8681	390	8900	97.6
C	10815	482	10970	99.1
D	12647	570	12970	98.4
E	15250	634	15927	97.7
F	20815	874	22402	95.9
G	22647	1038	24703	96.1
H	27248	1320	30366	95.0

- Battery density: 5 kg/kWh
- Diesel powertrain: 8.03 kg/kW
- BEV powertrain: 1.07 kg/kW
- 4.5 hours operation

Long haul cycle - energy consumption



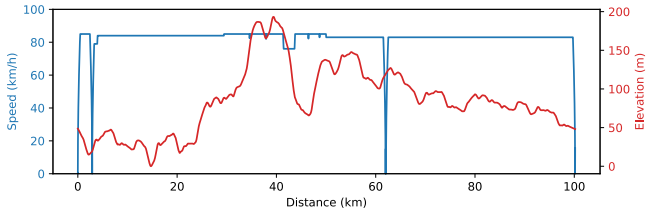


Consumption with:

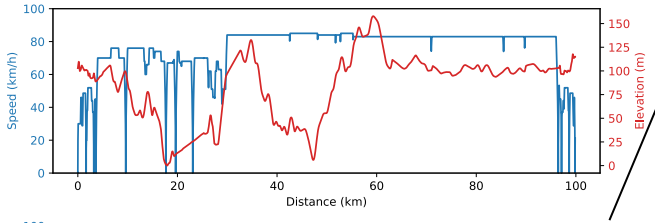
- no load
- half of max load
- max load

Vecto urban delivery cycle

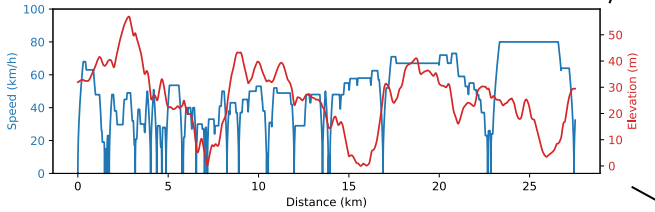
VECTO Long haul



VECTO regional delivery

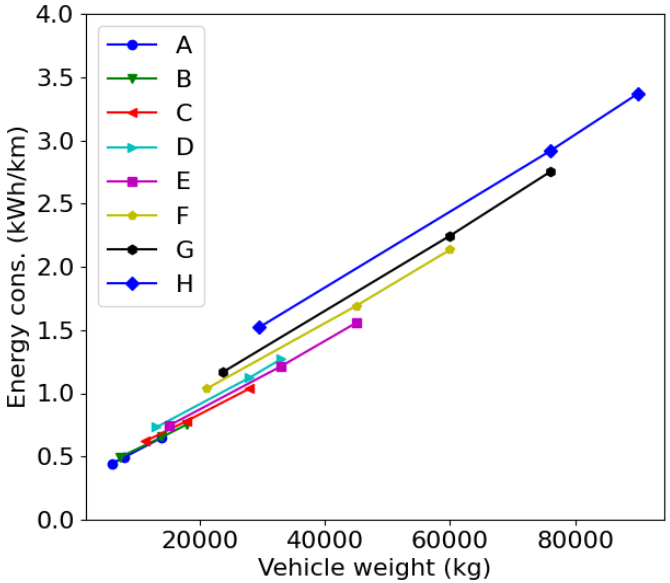


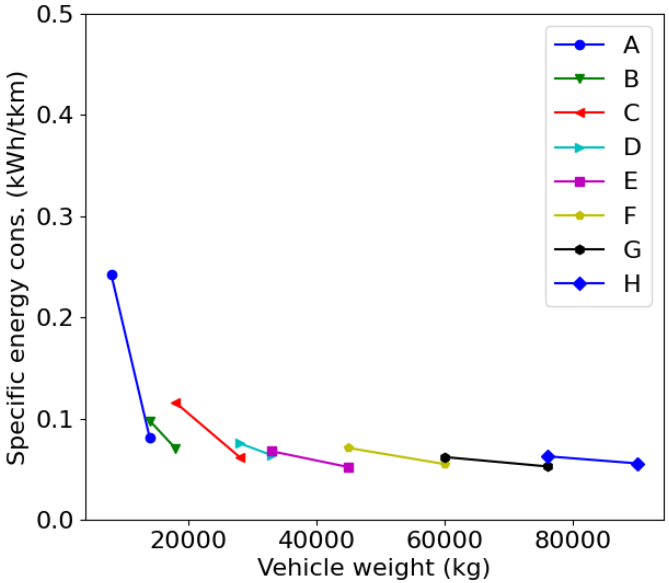
VECTO urban delivery



Truck category	GVW (tons)	Energy cons. (kWh/km)
A	14	0.65
B	18	0.75
C	28	1.04
D	33	1.27
E	45	1.56
F	60	2.13
G	76	2.75
H	90	3.37

Urban delivery cycle – energy consumption

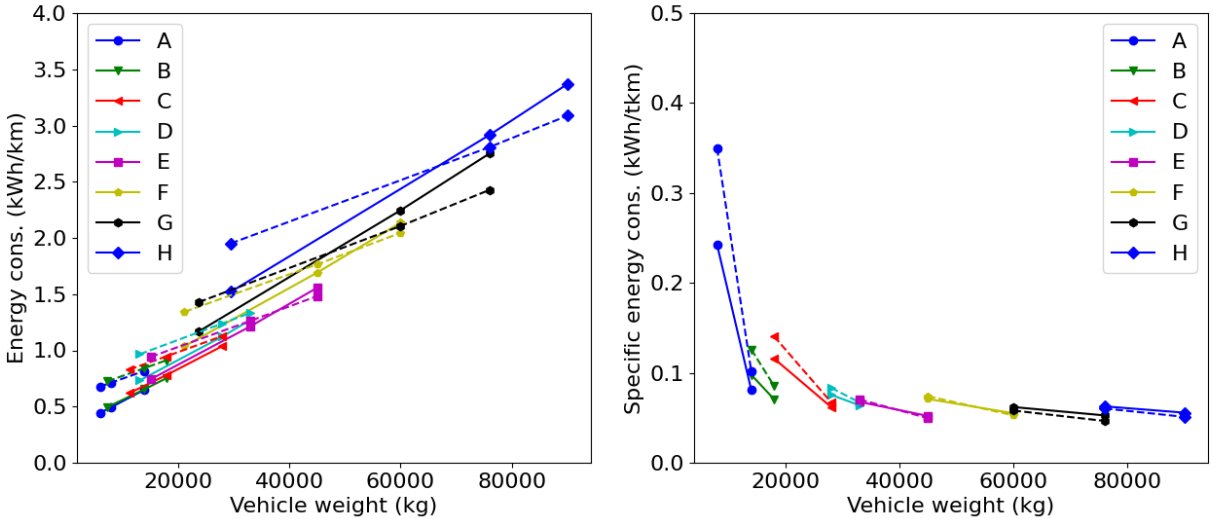




Consumption with:

- no load
- half of max load
- max load

Urban and long haul cycles



Consumption with:

- no load
- half of max load
- max load

Solid line: urban cycle
Dashed line: long haul cycle

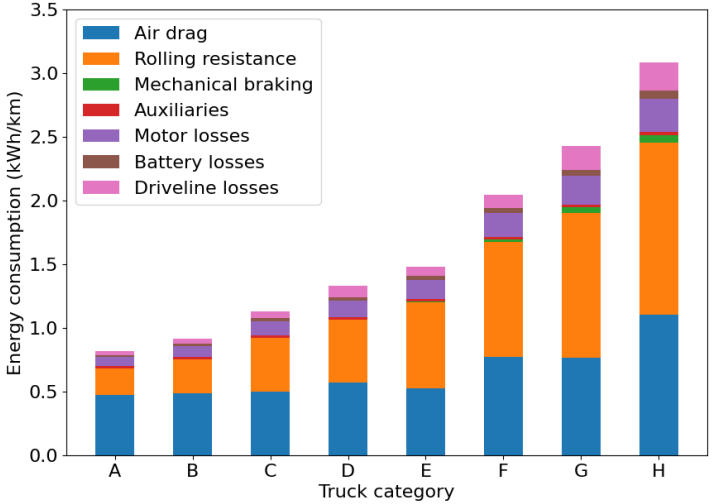
Urban delivery cycle – battery dimensioning

Truck category	Diesel empty weight (tons)	Battery capacity (kWh)	BEV empty weight (tons)	Payload capacity BEV vs. diesel (%)
A	6811	110	6128	109.5
B	8681	127	7584	111.8
C	10815	175	9436	108.0
D	12647	214	11192	107.2
E	15250	263	14071	104.0
F	20815	360	19832	102.5
G	22647	464	21836	101.5
H	27248	568	26610	101.0

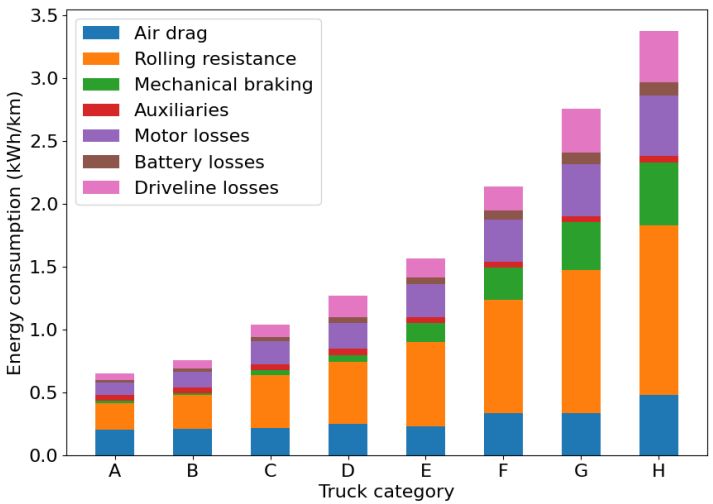
- Battery density: 5 kg/kWh
- Diesel powertrain: 8.03 kg/kW
- BEV powertrain: 1.07 kg/kW
- 4.5 hours operation

Energy breakdown

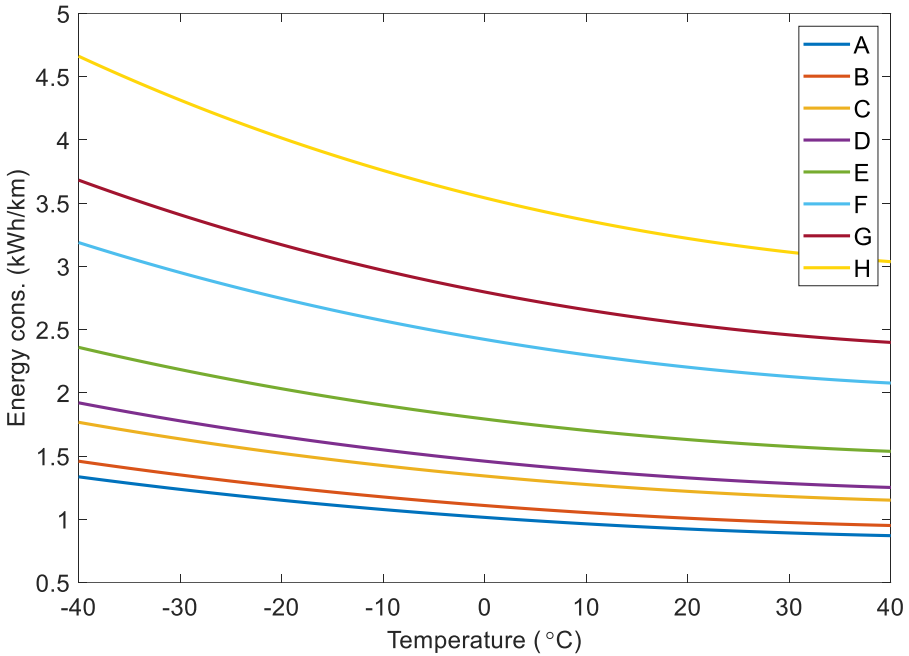
Long haul cycle



Urban delivery cycle



Impact of temperature



- Operation on ESCALATE Jyväskylä – Vuosaari cycle
- Driving resistances increase in cold temperatures → higher energy consumption

VTT

beyond

the obvious

- **Thank you!**

- vttresearch.com