On the production costs of large-scale charging as a service

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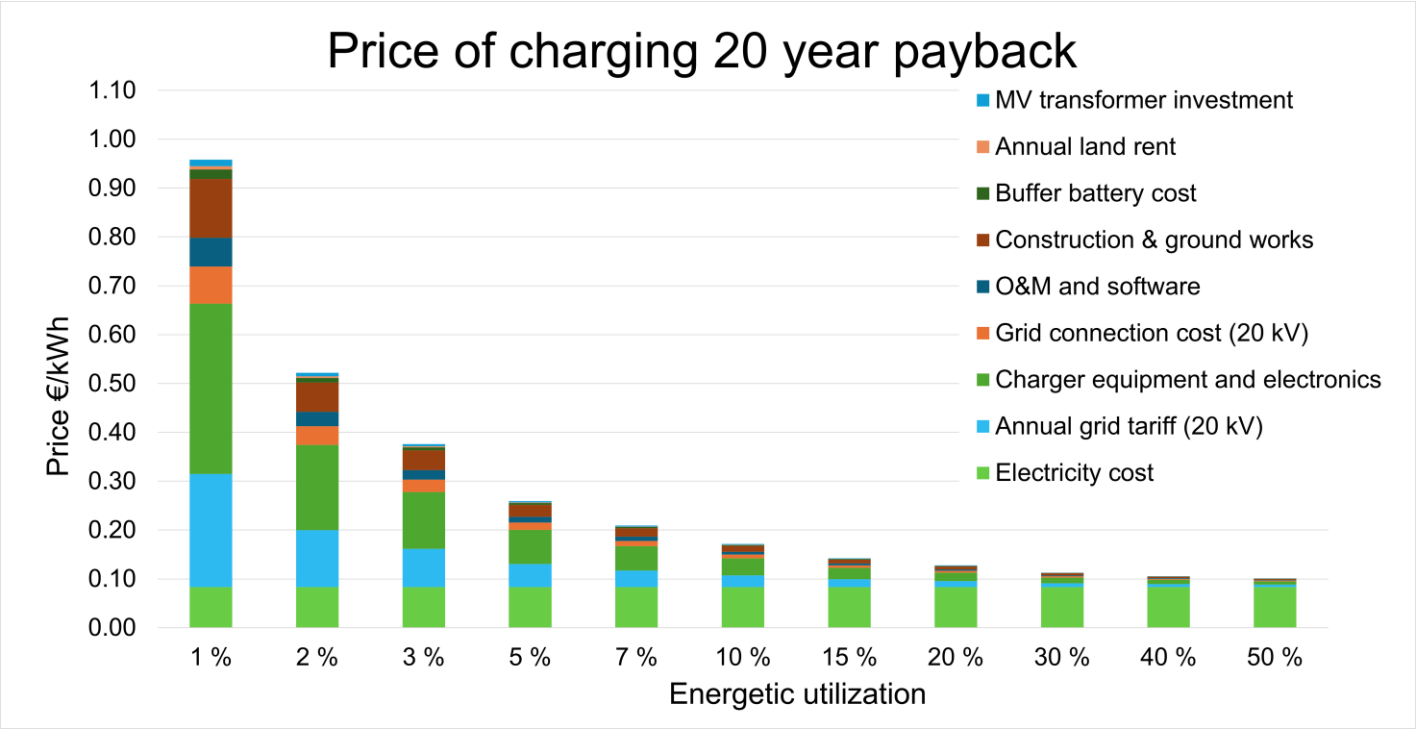
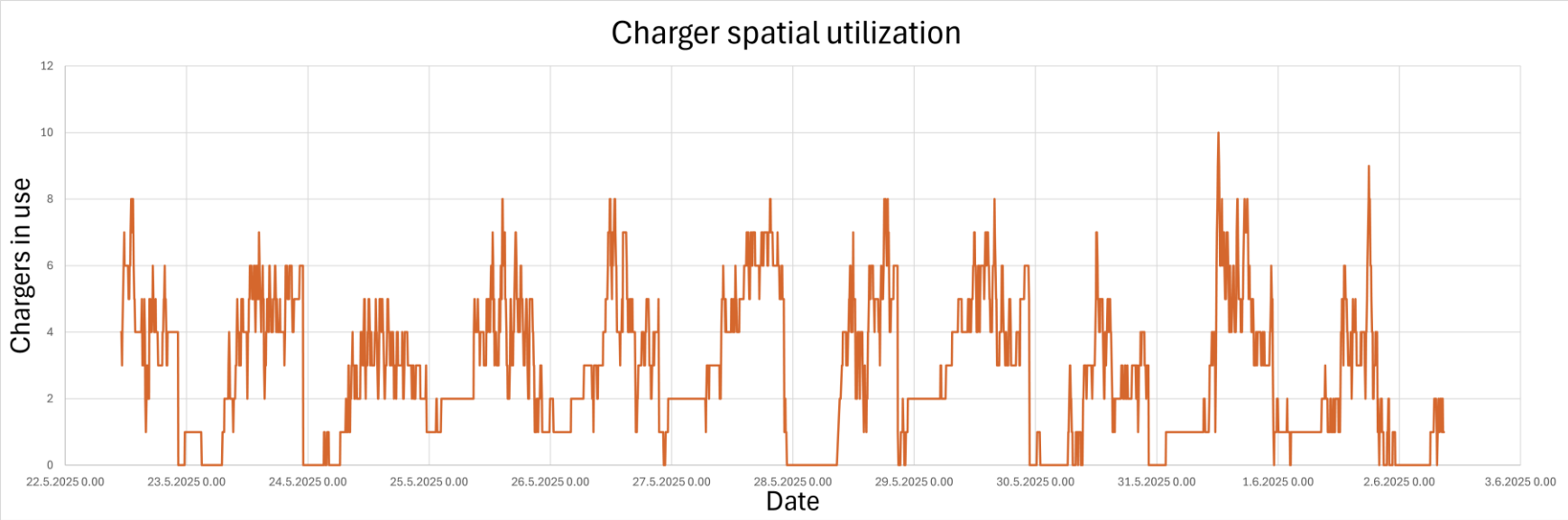
Research questions

- What are the production costs associated with public charging infrastructure for electric cars and trucks?
- Is investing in battery storage a smart choice for electric vehicle charging sites?
- What are the advantages of locating electric car and truck charging at the same site?

How the cost of charging varies based on usage



Example location, 17 high-power chargers



Example sites used in this thesis

Charger	150 kW	300 kW	1000 kW
Large site	16	8	8
Small site	8	4	4

- Both trucks and cars use the same charger site
- Studies 3 charger users:
  - on-demand truck charging
  - overnight truck charging
  - electric vehicle charging
- Previous SIXHOVE* data show that on-demand truck charging has 2-2.5 times more **visits** compared to overnight charging

*Charging demand for the medium and heavy-duty battery electric trucks in Finland (2025)

Truck visits overtime 10x10km grid*

Areas	Charge per truck (kWh)	2030 Scenarios (visits/day)	2050 Scenarios (visits/day)
Low growth	75	0.6W, 3.1A, 5.7B	3.0W, 7.9A, 12.9B
Average growth	117	3.9W, 21.4A, 39.0B	26.5W, 68.6A, 110.8B
High growth	128	23.6W, 127.1A, 230.6B	194.2W, 398.0A, 801.9B

- W-worst case
- A-average case
- B-best case

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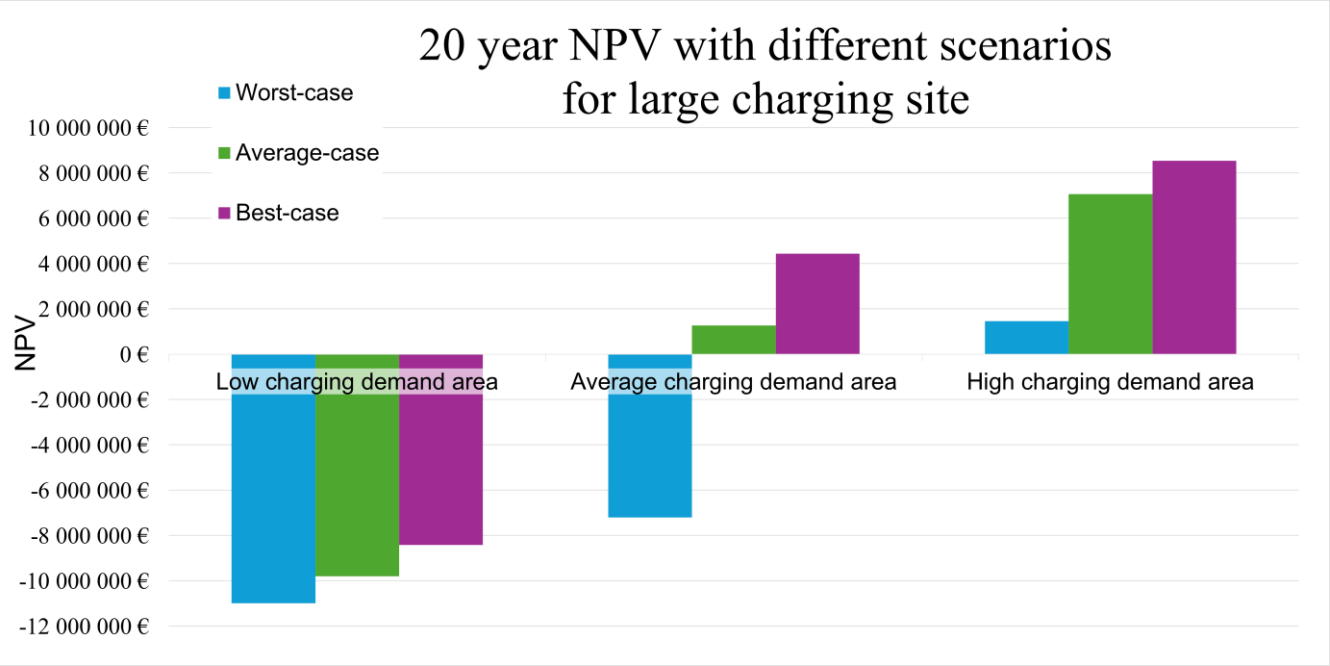
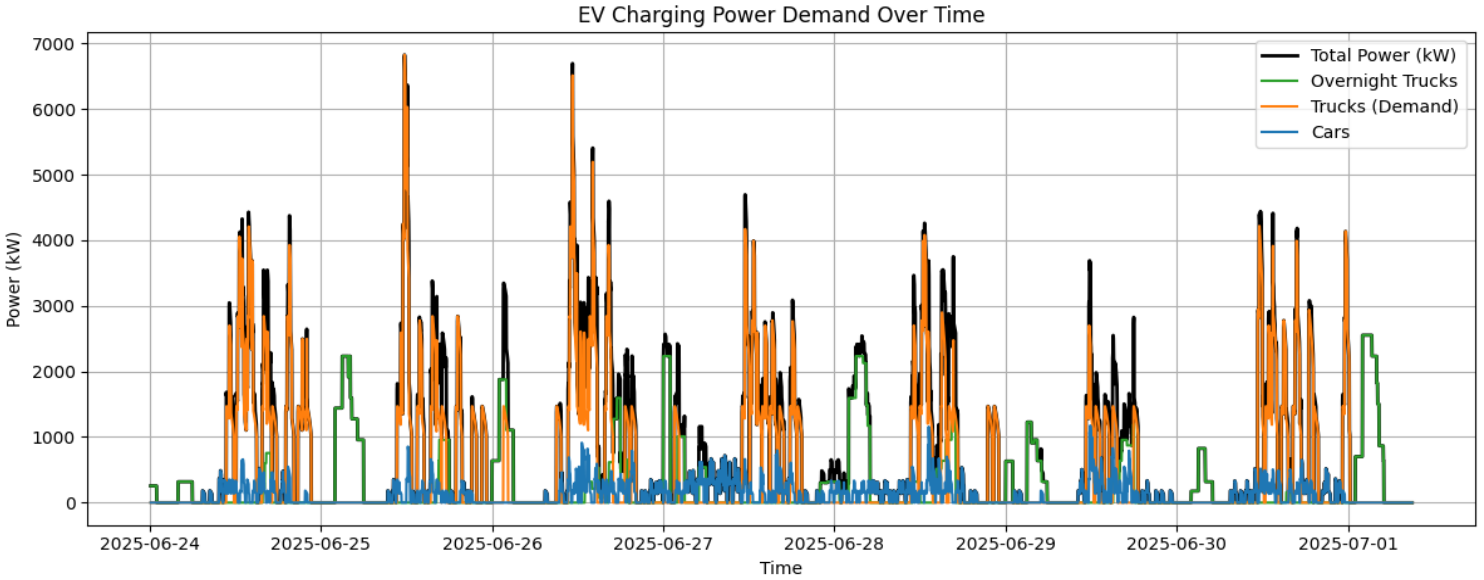
Profitability of charging site



- No profit assumed, 6% discount rate, site has all user types cars charge 49kWh truck charge ~230 kWh

Benefits of combining electric vehicle and truck charging



- Trucks charge 400 kWh cars 49 kWh, 46 average daily truck visits, 57 car
- Overnight trucks charged during lowest spot price during 11h break, on demand truck charge 40min, cars 20min

BESS profitability example situation

Category	Peak Count	Other Vehicles Charging	Capture Rate (%)
Overall	13	Cars: 3, Overnight: 7, Trucks: 3	105.0
Cars	7	Cars: 7, Overnight: 1, Trucks: 2	115.8
Overnight Trucks	8	Cars: 3, Overnight: 8, Trucks: 0	36.0
Trucks	5	Cars: 2, Overnight: 1, Trucks: 5	128.7

Metric	Value (1 year)
Total cost no battery	397 092 €
Total electricity cost	120 651 €
Peak power	2377.4 kW
Average electricity price	36.7 €/MWh

Metrics change	500 kW/kWh	1000 kW/kWh	2000 kW/kWh
Total cost change	+29 391 € (+7.4%)	+58 923 € (+14.8%)	+179 398 € (+45%)
FEC	678	641	382
Peak reduced	500 kW	1000 kW	1632 kW
Electricity cost	-15 937 € (-13%)	-29 121 € (-24%)	-34 195 € (-28.3%)
Export	Yes	Yes	Yes

- 23 truck + 57 car visits on average day, 250kWh charged for trucks and 49 kWh for cars (work in progress…)

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Thank you!

Questions?

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