



Feasibility of electric buses in public transport

Olli Vilppo

Tampere University of Technology (Finland)

Nordic Electric Bus Initiatives 2

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Buyers perspective city of Tampere



Research (TUT):

1. Independent study for city of Tampere, Summer 2014
2. Publication: Vilppo, Markkula, Feasibility of Electric Buses in Public Transport, EVS28 Korea, May 2015

Consultation (Robustco):

1. Procurement preparation, Winter 2014-2015
2. Reading tenders submitted by manufacturers, Autumn 2015



How to proceed?

Bus line parameters

- Route length
 - Speed/stops
 - Schedule
 - Number of vehicles
 - Other (passenger count, heating/cooling)
- Vehicle and charger requirements

Cost comparison

- Bus price
 - Charger price
 - Infra building cost
 - Operating costs
 - Battery wear cost
- Compare the options

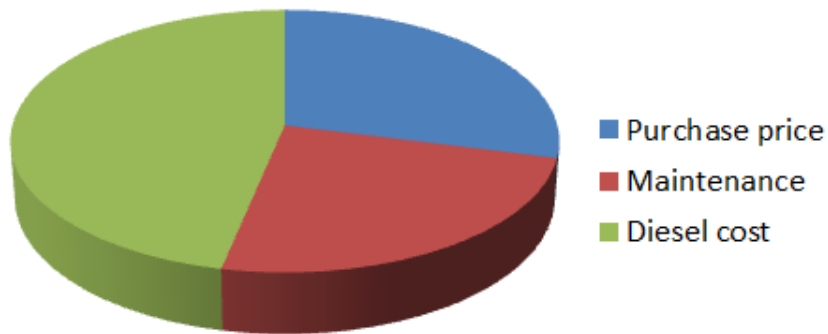
Purchase and start project

- Procurement
- Contracts
- Permissions
- Infra building

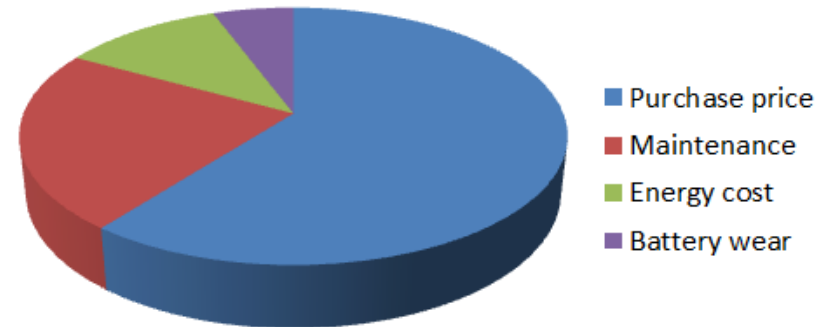


Total cost of ownership (TCO)

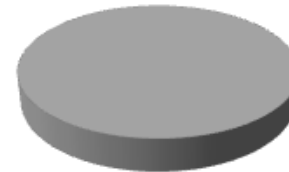
Diesel



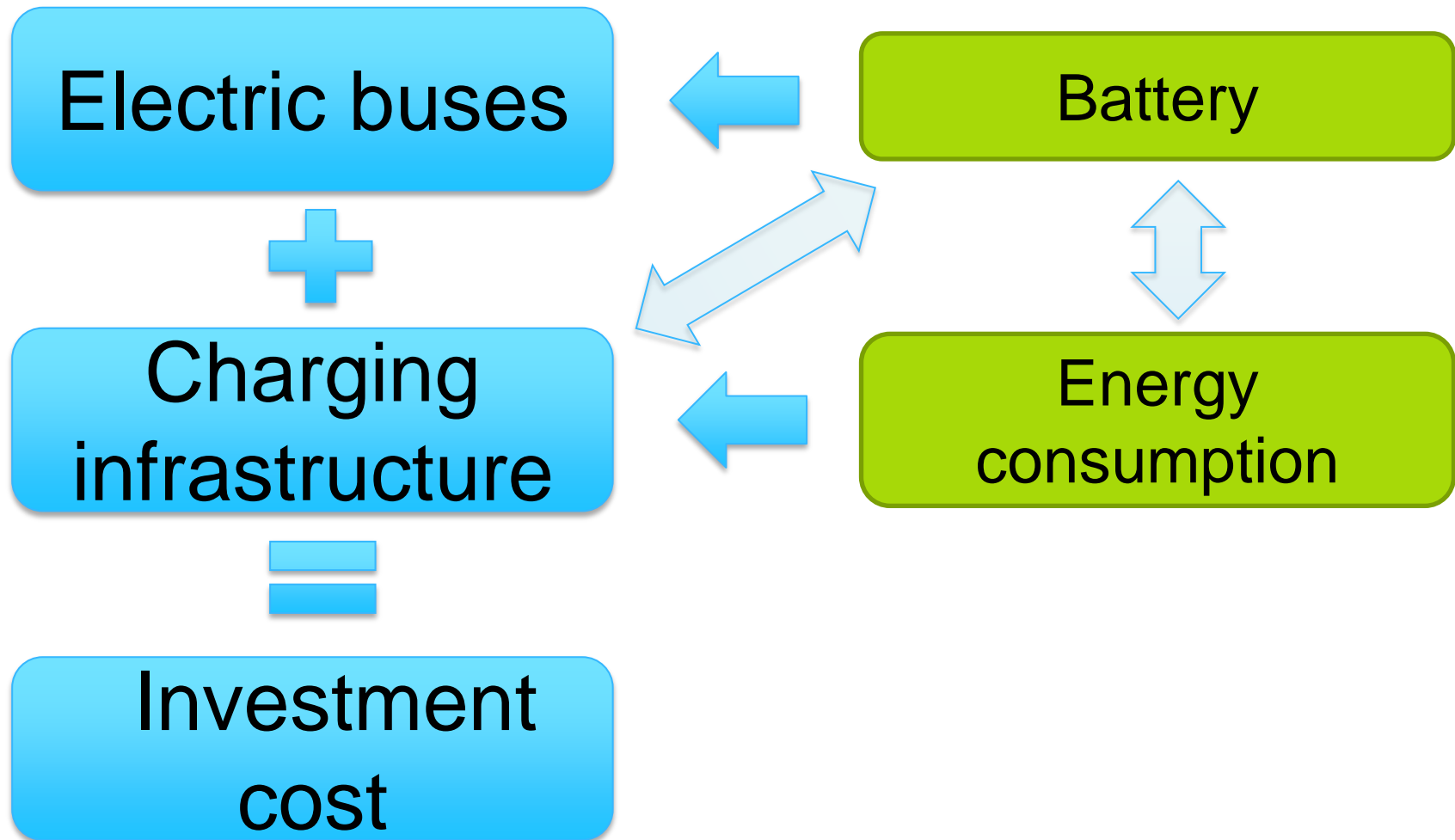
Electric



Charging infra cost



eBus system building blocks



Finding lowest cost

Bus line parameters

- 4 Vehicles
- 265 km/day
- End stop time 5-10 min
- 2 X 10 km



End stop charging

→ reasonable infra cost & sufficient space for passengers inside bus

Low energy consumption

- Electricity cost (€)
- Speed of battery wear (€)
- Time spend at end stop exceeding normal break (€€€)

Small battery

- Weight and space decrease
- Less invested capital
- Battery prices dropping



Table: Cost of 4 eBuses operating the line

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Buses	1629	91	91	91	91	91	309	91	91	91	91	91
Infra	224	4	4	4	4	4	4	4	4	4	4	4

Electric Bus Total Cost : 2.9 M€

Table: Cost of 4 diesel buses operating the line

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Buses	1204	204	204	204	204	204	204	204	204	204	204	204

Diesel Bus Total Cost : 3.1 M€



Procurement in Tampere

- PTA and city owned PTO joining forces
- **Goal:** Tender pointing based on TCO calculations
- Market dialogue with manufacturers

Selecting between:

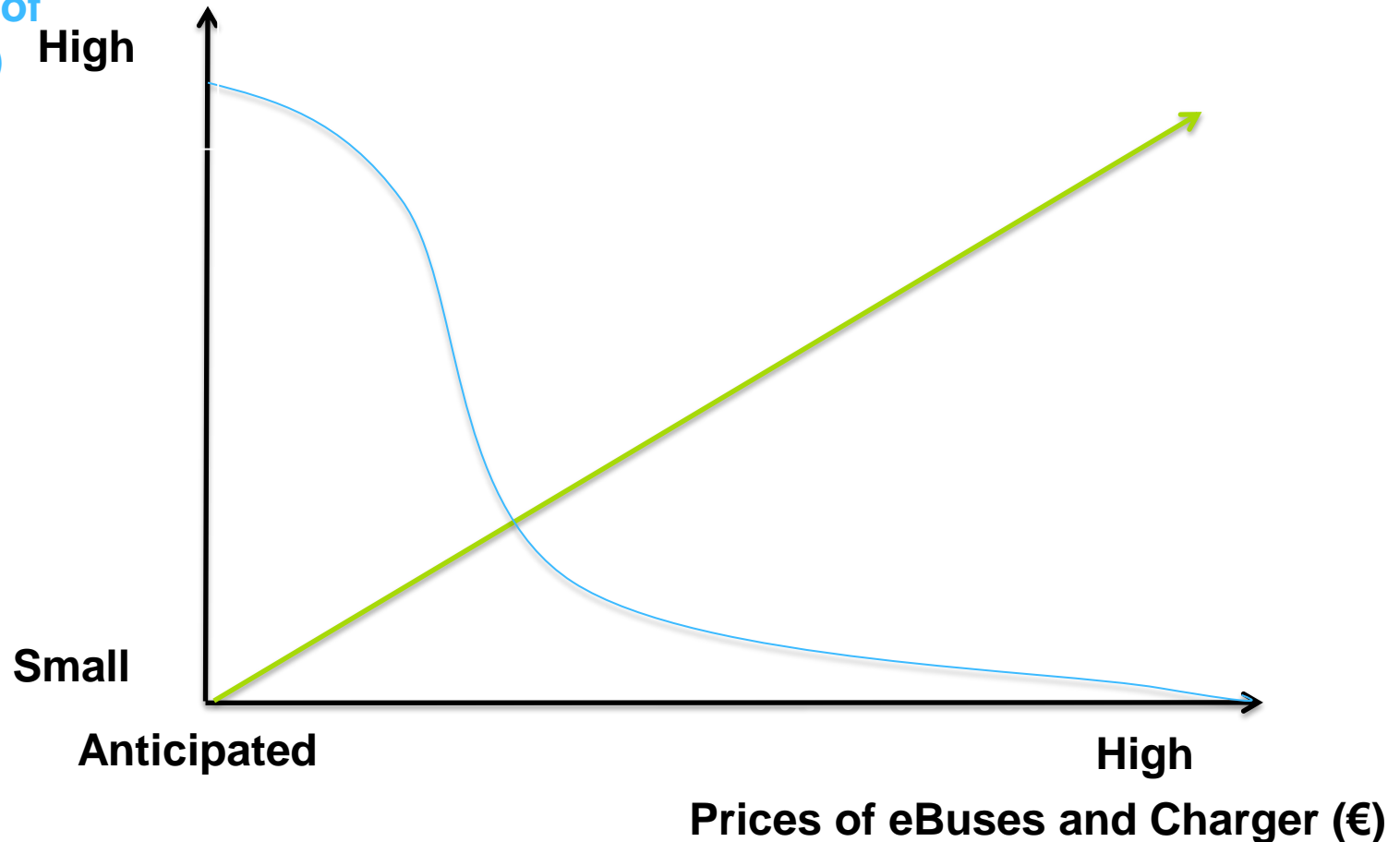
1. Open Tendering or Competitive Dialogue?
2. Fast charger and eBus: Separately or together?



What if new technology fails?

Probability density function, (Days out of operation) High

Sanctions for the manufacturer (€)



Risk reduction

Manufacturers in pilot cities

- Real data needed: Uptime of fast chargers and eBuses



Reduce buyers distrust



Lower sanctions for manufacturers

Tendering City

- Sharing reserve diesel bus fleet
- 2 fast chargers on a line
- Cap for sanctions



Reduce cost of failing equipment for city



Lower prices/pcs for city



Summary

- End stop charging most economical
- Learning curve: prices will get lower and reliability proven
- At this time: Assuming part of new technology risk to the city → Probably lowers the TCO
- eBuses will be the cheapest solution in public transport



Thank you!

Q&A

