LINKKER

TransSmart

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Linkker
Future Moves

Background

- Linkker was founded to integrate high-technology electric bus knowhow and bring competitive products to fast growing markets

- Background:
  - Research projects 2006-2014 (coordinated by VTT)
  - Energy efficient TCO optimized bus design
  - Strong partner network

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Linkker addresses today's mass transit challenges

Solutions for transition towards zero emission public transport

Emissions

Costs

Congestion

Linkker – benefits for cities and operators

Zero local emissions

Lower Total Cost of Ownership

Improved Passenger Experience

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Linkker milestones

6 Serial production

Type approval and start of serial production in Sastamala in co-operation with Fortaco Oy

5 Birth of Linkker

Organizing Finnish industry for commercialization of electric buses - Linkker electric bus systems

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4 Prototype out for tests

Prototype bus running laboratory and field tests

3 Full electric bus R&D

eBus operational feasibility project started. Members from industry, public sector and research organizations, project coordinator VTT

2 Hybrid bus

Hybrid bus development started at Kabus

1 Lightweight chassis

Lightweight construction city bus production started by Kabus & AVD

2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

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Serial production in Sastamala.

The first buses were delivered to Helsinki, Copenhagen and Turku in summer 2016.

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Linkker electric bus

1 Lightweight construction

Full aluminum body and chassis based on years of R&D

2 Energy optimized drive line

Energy optimized components, control and opportunity charging

3 Opportunity charging

Minized battery size

Optimized battery life time

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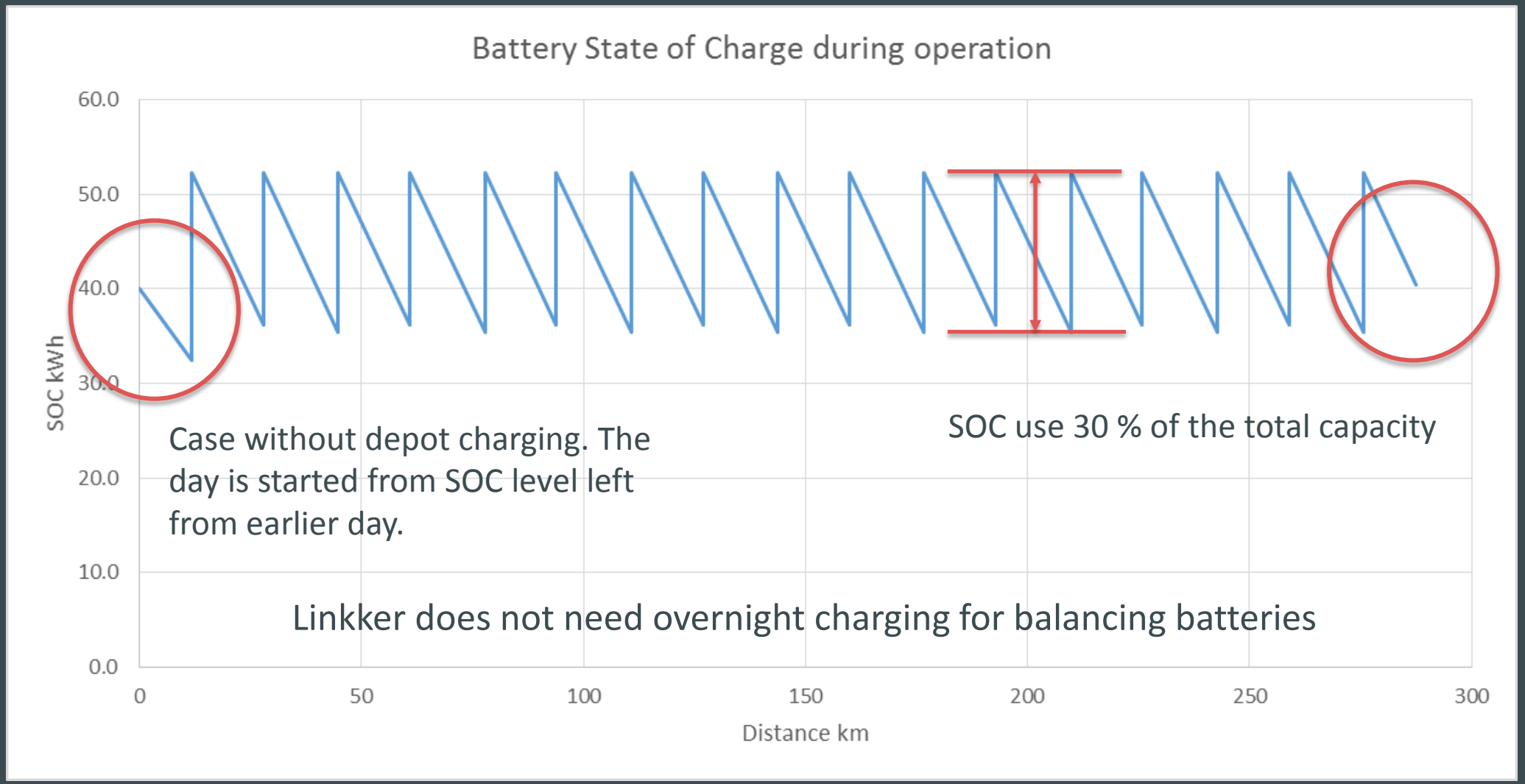
Example bus line from Helsinki 16 km bus line



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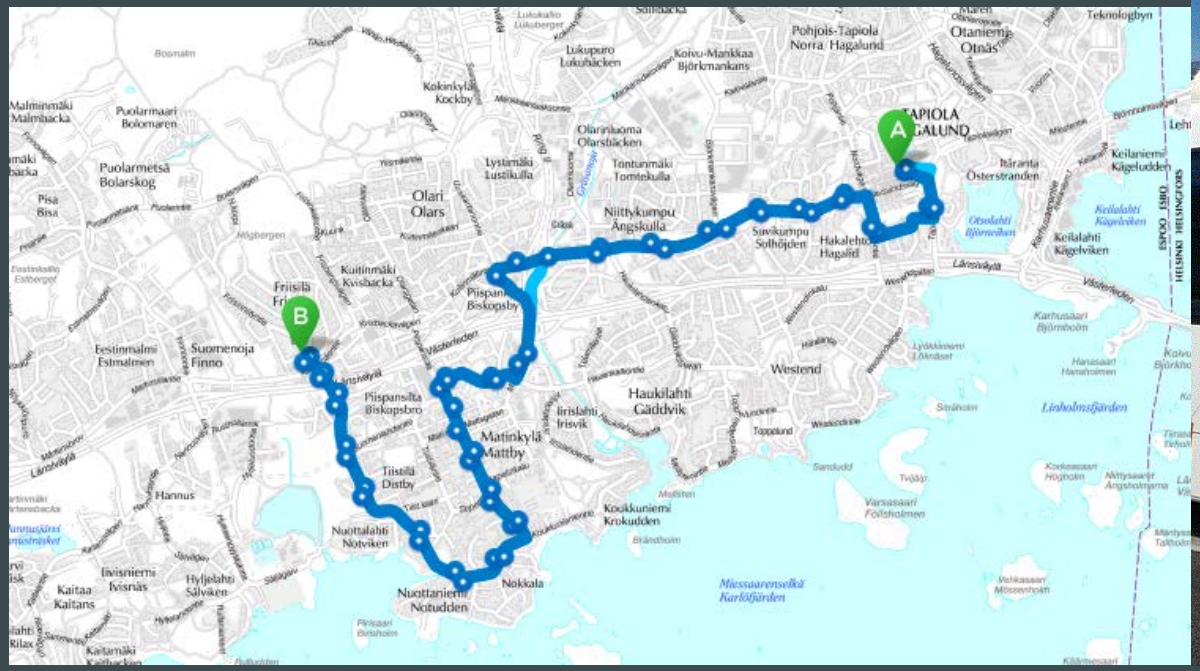
Case Espoo Line 11 (ePELI)



- Tapiola – Matinkylä - Friisilänaukio
- 19,2km line (A-B-A)
- Average speed 20 kmh
- 48 stops
- Daily mileage 160-240km

Electric Bus System

- 1x 350kW end-stop charging event
- Consumption 0.78-0.98kWh/km
- Charged energy 14.9-18.82kWh
- Charging time 4-5 min with

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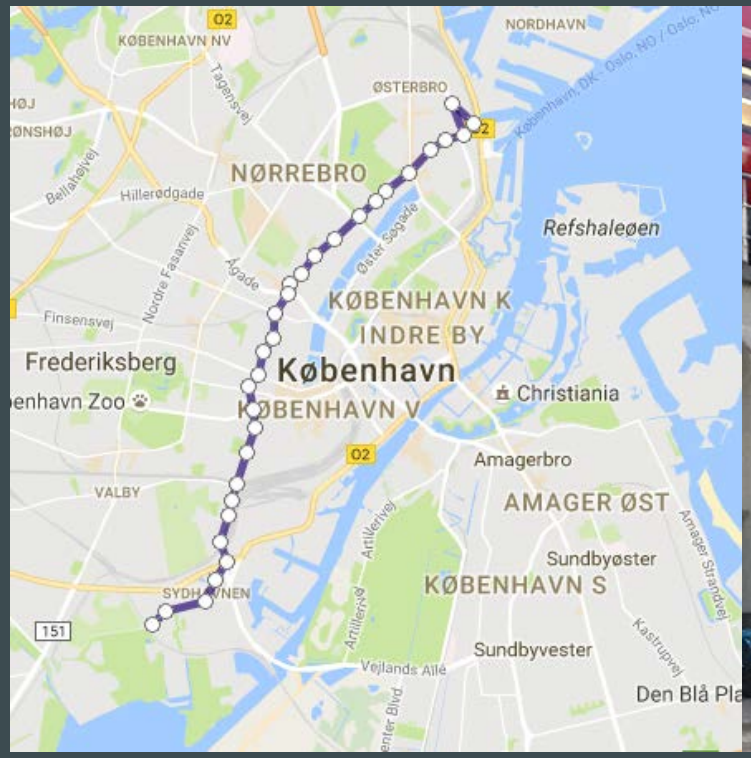
Case Copenhagen 3A



- Vallbypark - Nordhavn
- 10,9 km A→B
- Average speed 20 kmh
- 31 stops
- Daily mileage 160-240km

Electric Bus System

- 2x 350kW end-stop charging event
- Consumption Avrg . 1.1kWh/km
- Charged energy Avrg. 11.45kW
- Charging time 2.4min

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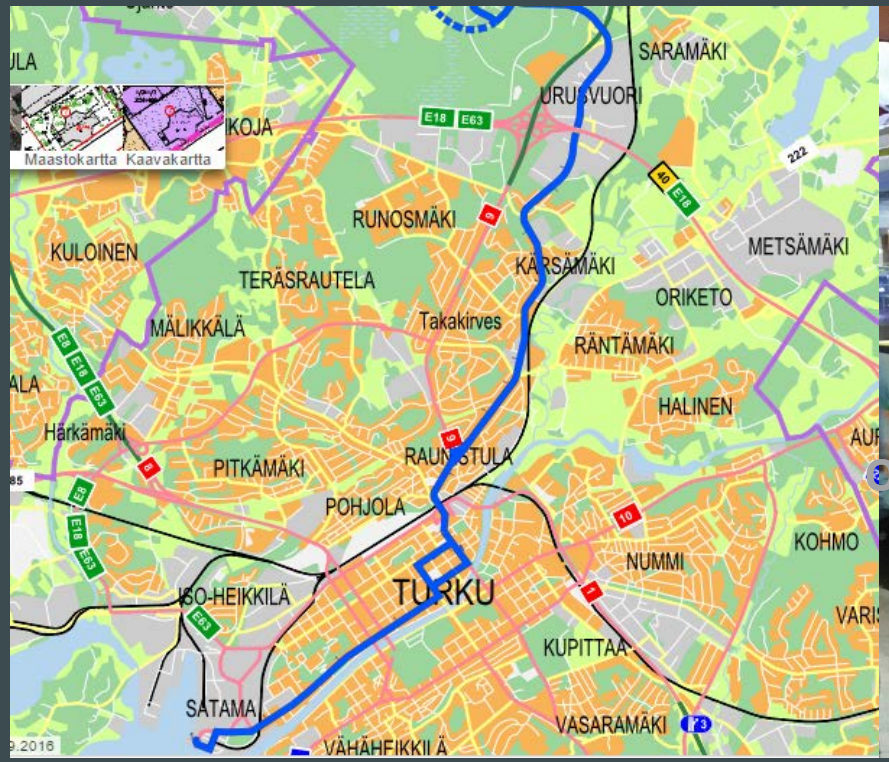
Case Turku 1



- Harbour – Airport
- 12,4 km A→B
- Average speed 20 kmh
- 35 stops
- Daily mileage 350km

Electric Bus System

- 2 x 350kW end-stop charging event
- Consumption Avrg .0.906kWh/km
- Charged energy Avrg. 11.2kW
- Charging time 2.4min

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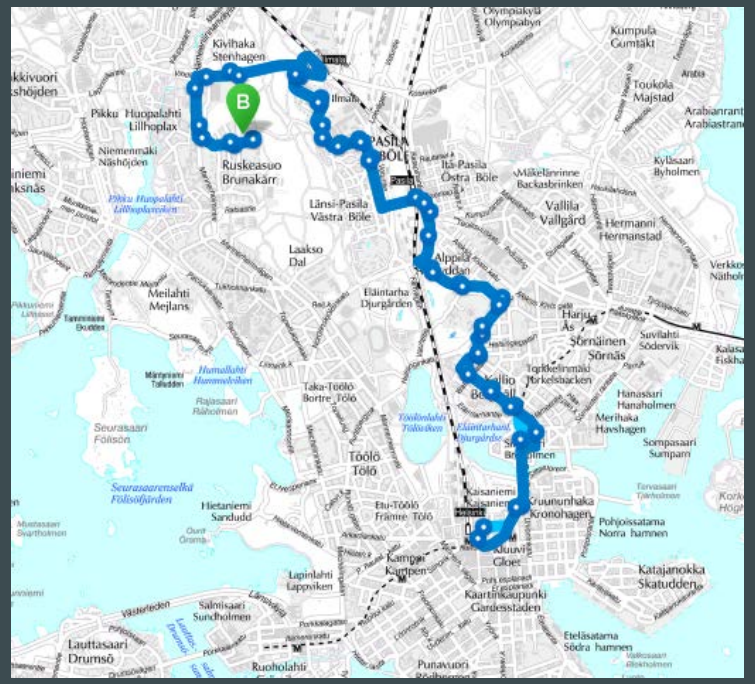
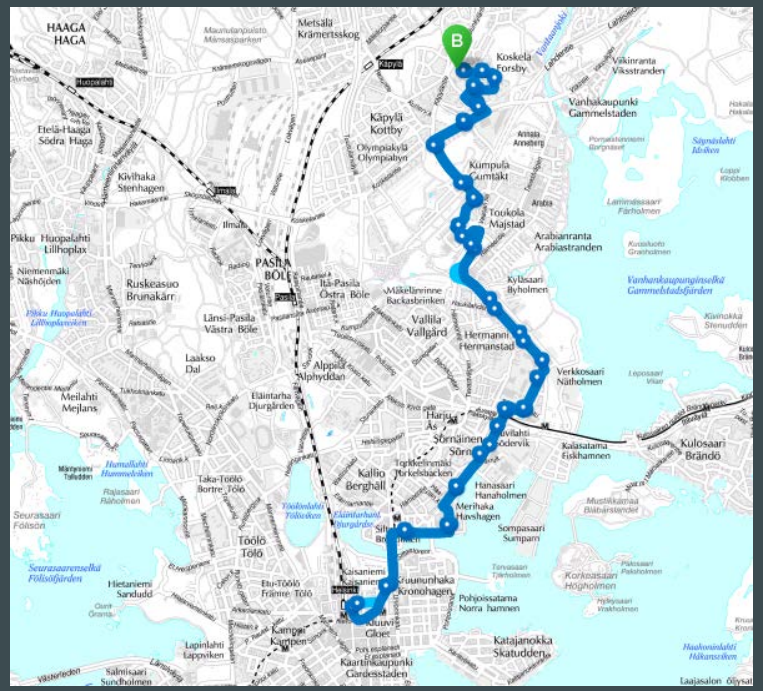
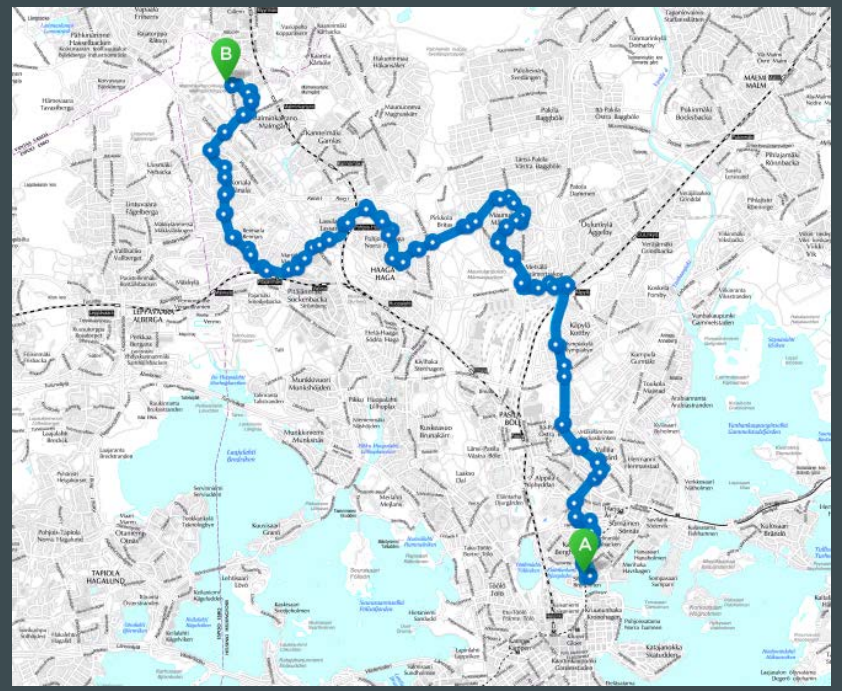
Case Helsinki (ePELI)



Line 23



Line 55



Line 51

Operating at bus line 23 was started in January 2017. Operating at line 55 will start soon and Line 51 later during the spring 2017.

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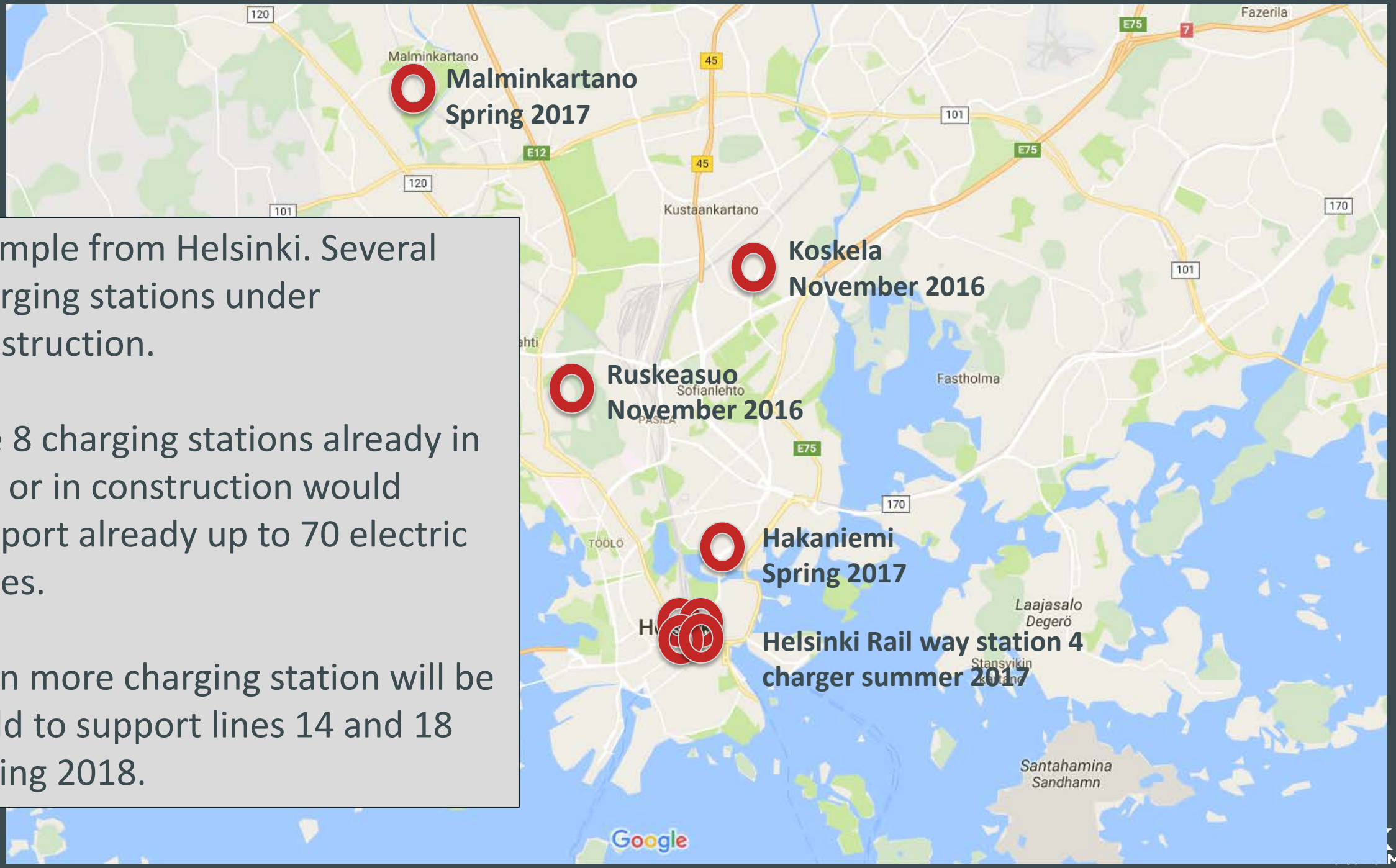
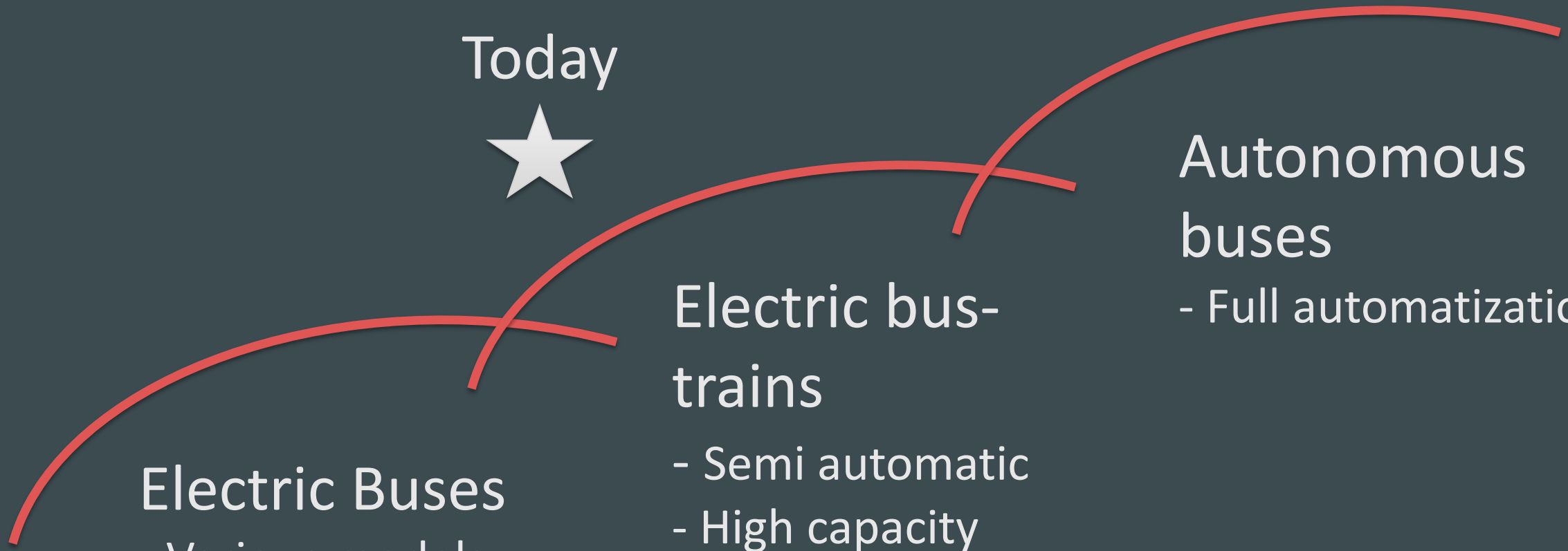


Example from Helsinki. Several charging stations under construction.

The 8 charging stations already in use or in construction would support already up to 70 electric buses.

Even more charging station will be build to support lines 14 and 18 during 2018.

Linkker R&D roadmap for the automatization



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Thank you for your interest!

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