Electric Buses in Public Transport in Oslo and Akershus

Pernille Aga
Project Manager
Ruter

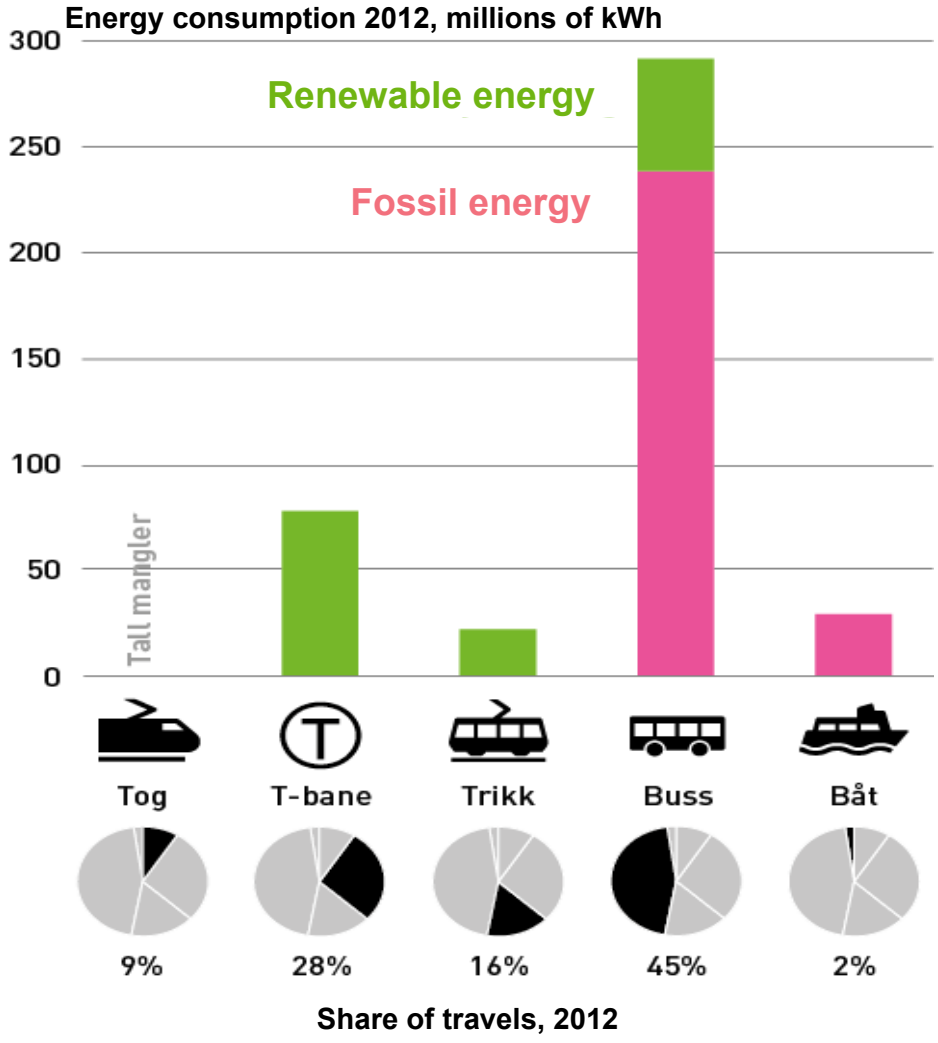
1 The growth in regional personal traffic is to be met by public transport, combined with cycling and walking

Ruter#

2

All public transport is to run on only renewable energy in 2020

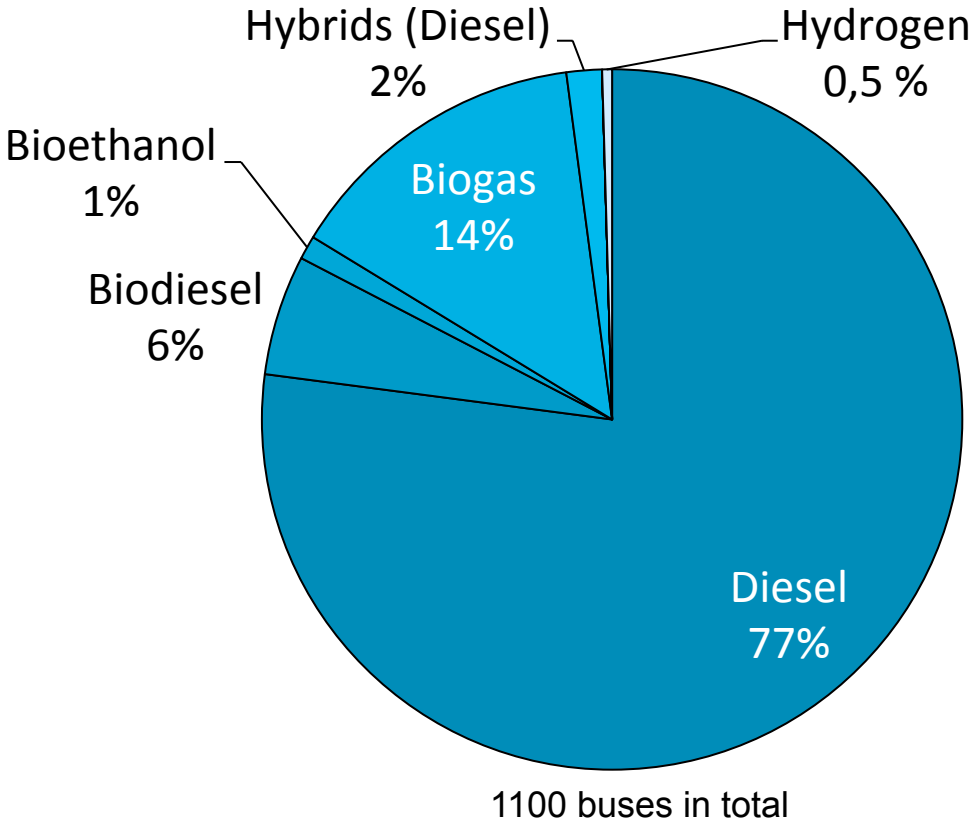
Ruter#



Buses and ferries run on fossil fuel

Ruter#

Fuels – as share of bus fleet in 2015



Ruter#

Clean Hydrogen in European Cities (CHIC)

5 Fuel Cell Buses (Van Hool)

- 35 kg H_2 per bus ~ 300 km
- Fuel cell + battery
- Zero emissions

H_2 station (Air Liquide)

- Electrolyses + green electricity
- Production: 250 kg H_2/day
- Refuels a bus in 10 min

Oslo AKERSHUS FYLKESKOMMUNE Forskningsrådet transnova CHIC FCH Ruter#

Fossil Free 2020

Renewable energy:

- ✓ Electricity with renewable energy certificates
- ✓ Biofuels that comply with the sustainability criteria of the Renewable Energy Directive: 50-60% CO_2-e reduction

Technology alternatives:

Internal combustion engine with biofuels	• Biodiesel • Biogas • Bioethanol
Hybrid bus – combination of electric and combustion	• Biofuels + electric • Rechargeable electric + biofuel (= plug-in)
Electric	• Battery – recharge overnight • Battery - opportunity recharging • Fuel cell with hydrogen

Ruter#

Fossil Free 2020 strategy developement

Mapping of relevant solutions

Market dialogue, market survey, desktop research, interviews pilot projects

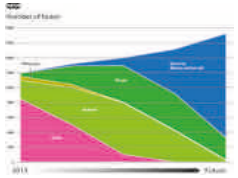
Which solutions are suitable?

Compared to operational set-up, line and route structure

What is preferred?

Level of ambition, risk, cost

Scenario 1



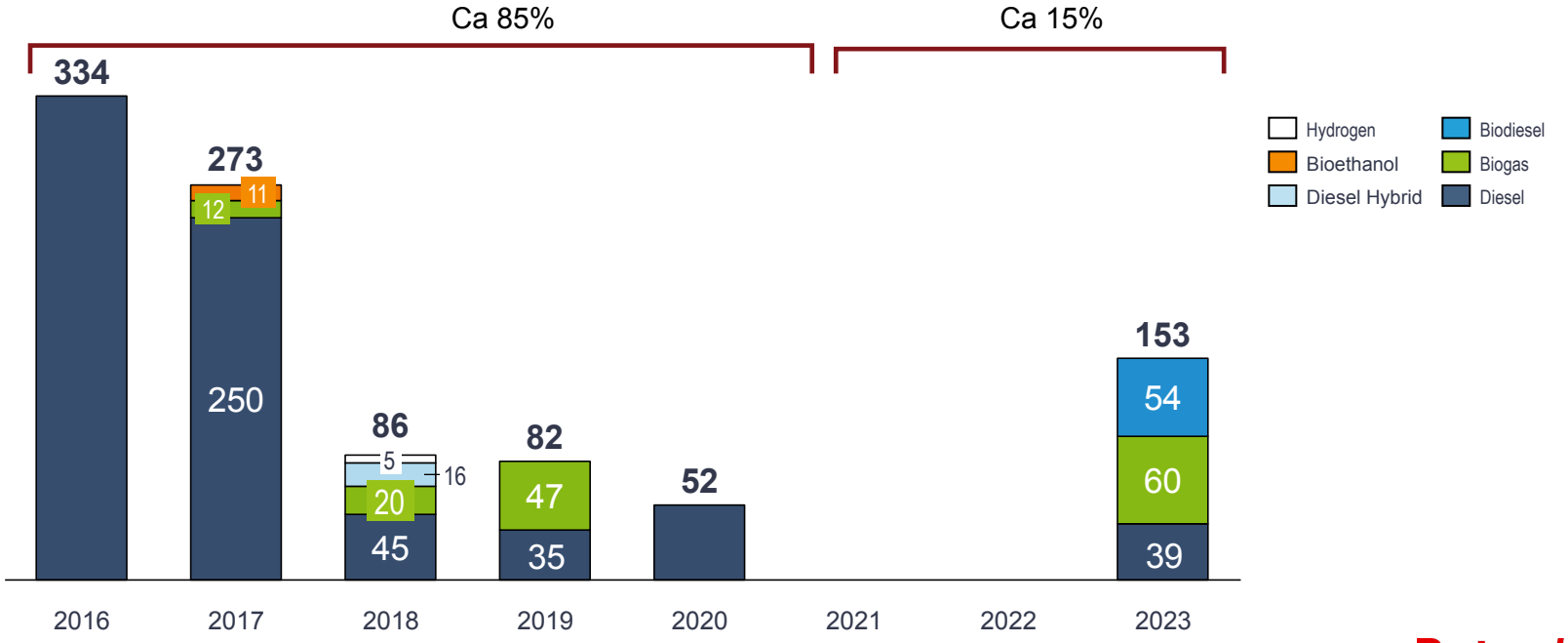
Scenario 2

Scenario 3

Ruter#

85%[1)] of buses have contracts which can be terminated before 2021, 60% if full prolongation

No. of buses changed each year if minimum contract duration is used only

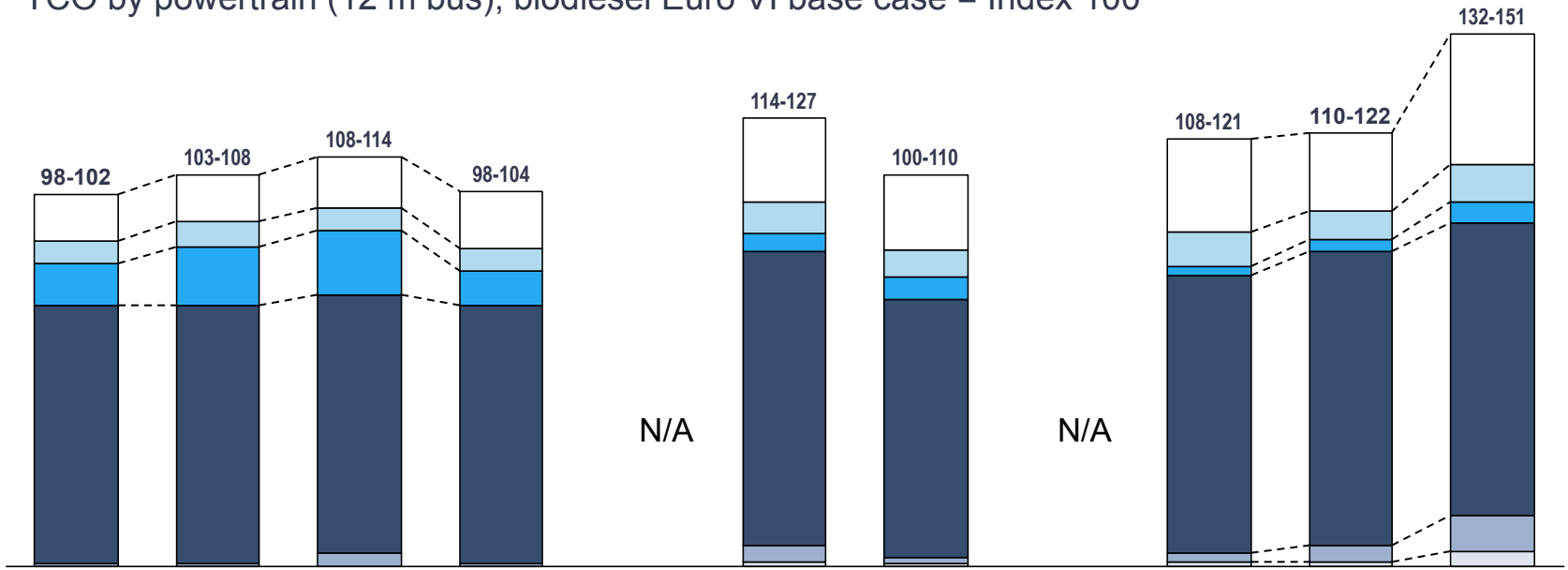


1) No. of buses exclude special transport and spare buses

Ruter#

Cost: Total cost of ownership per powertrain 2020

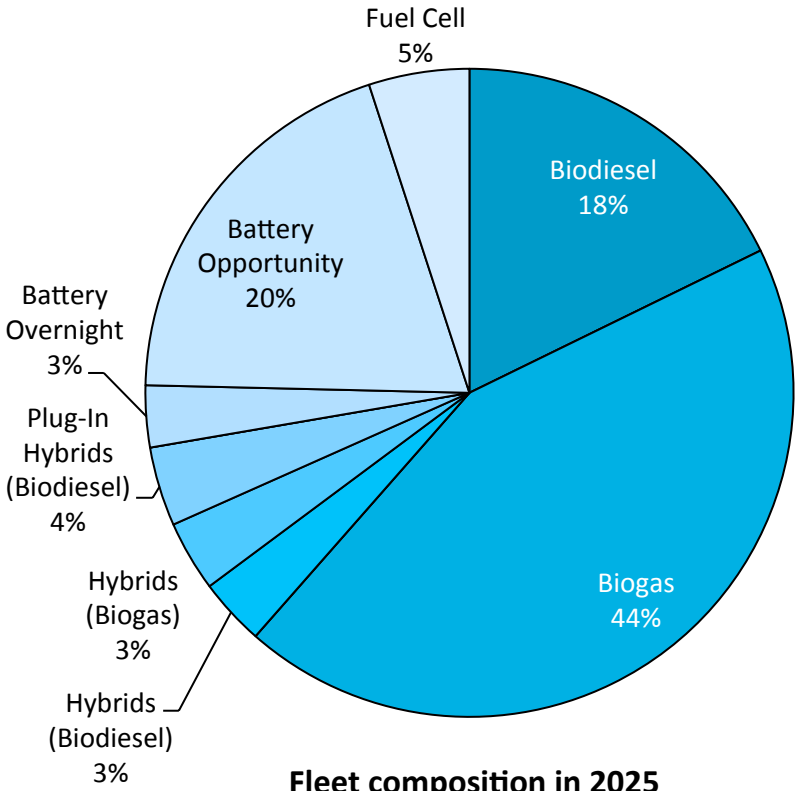
TCO by powertrain (12 m bus), biodiesel Euro VI base case = Index 100



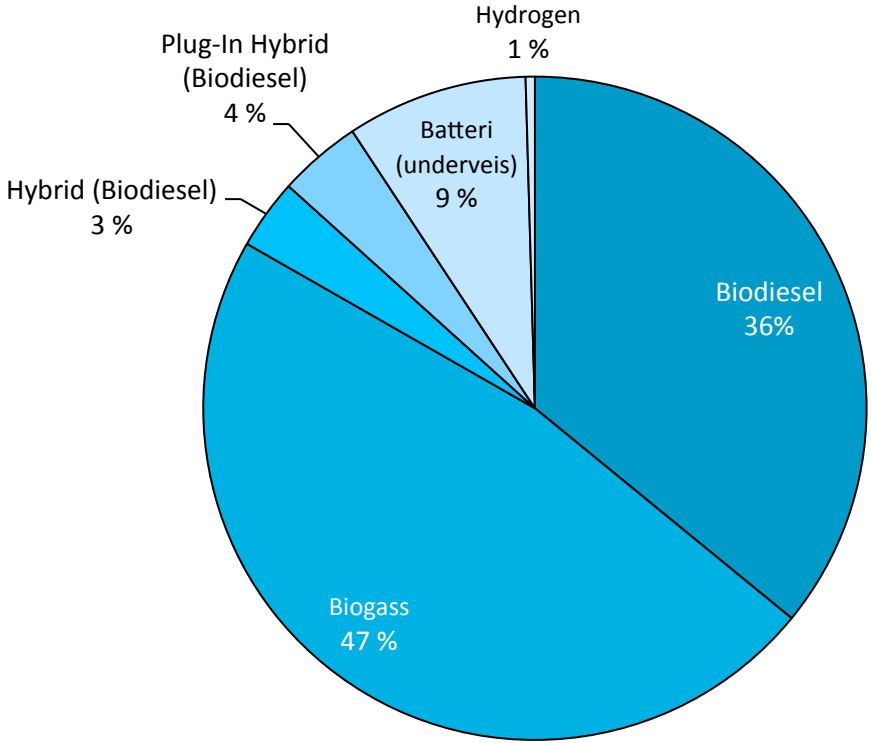
*Plug-in hybrid with opportunity charging
** Plug-in hybrid without opportunity charging

Ruter#

Strategic target for bus fleet in 2025

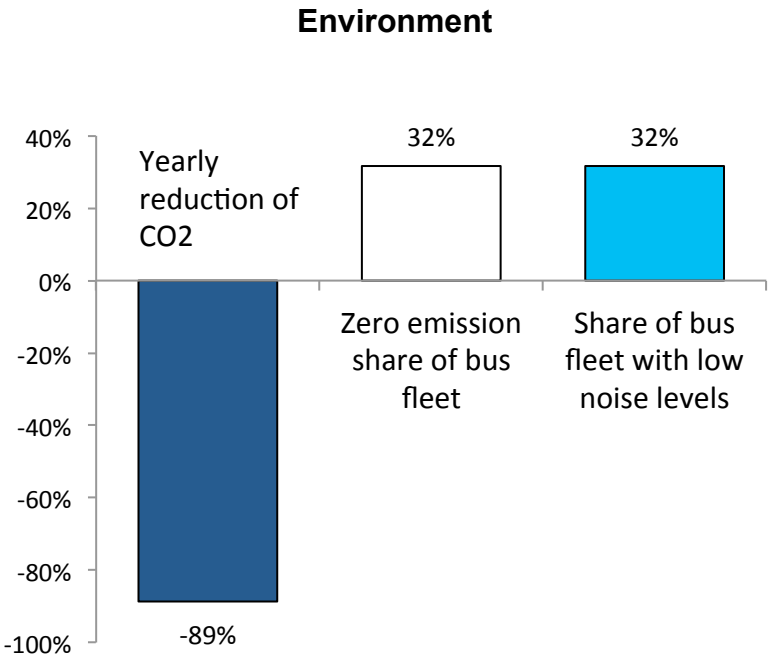


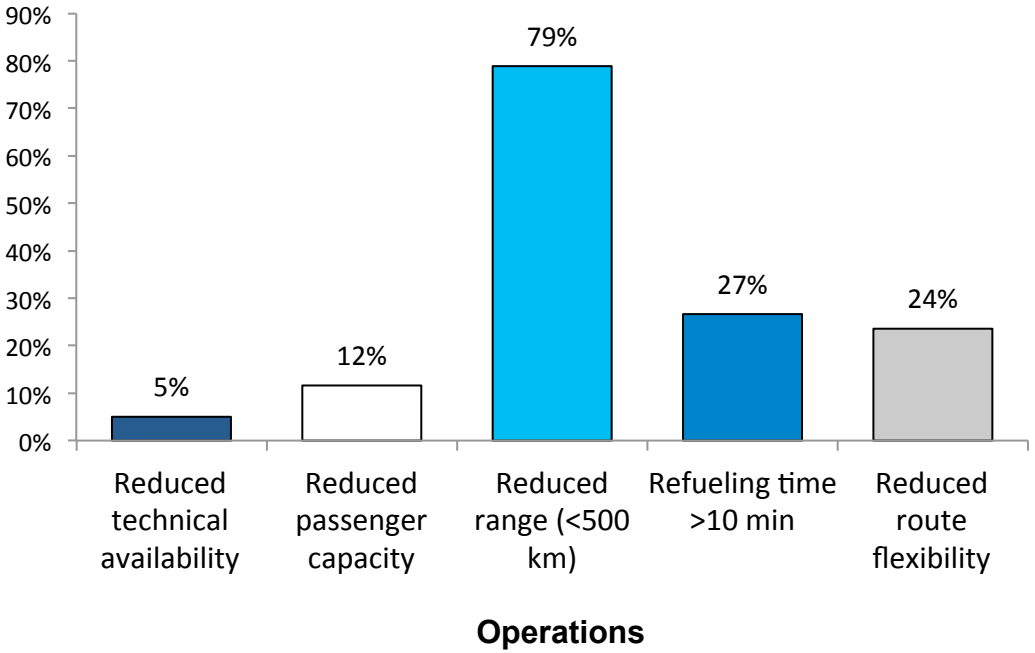
Fleet composition in 2025



Fossil free fleet in 2020

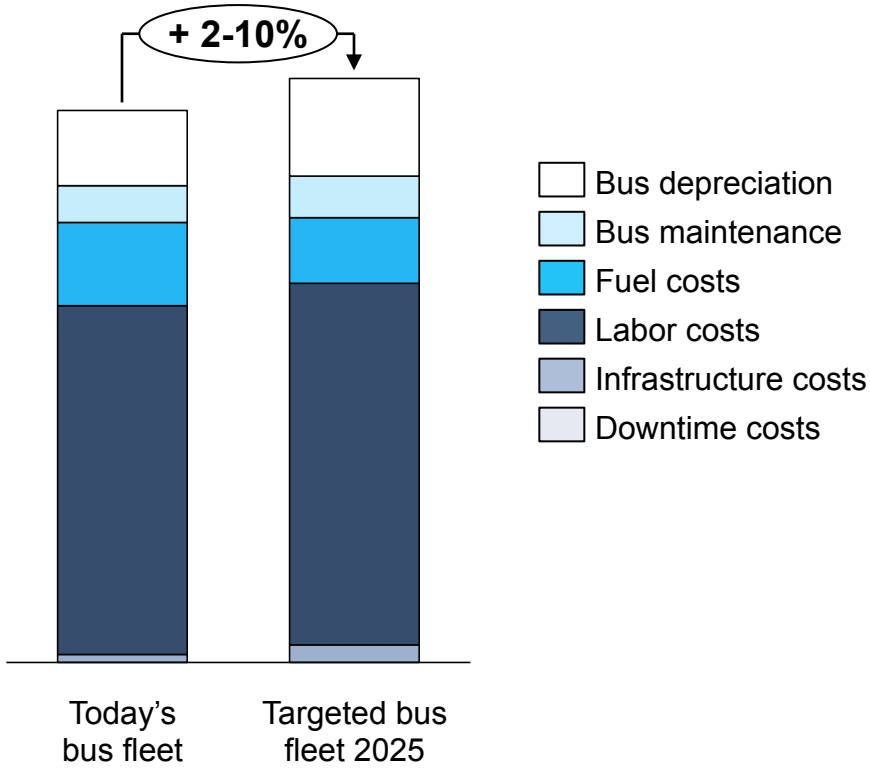
Results of 2025 bus fleet





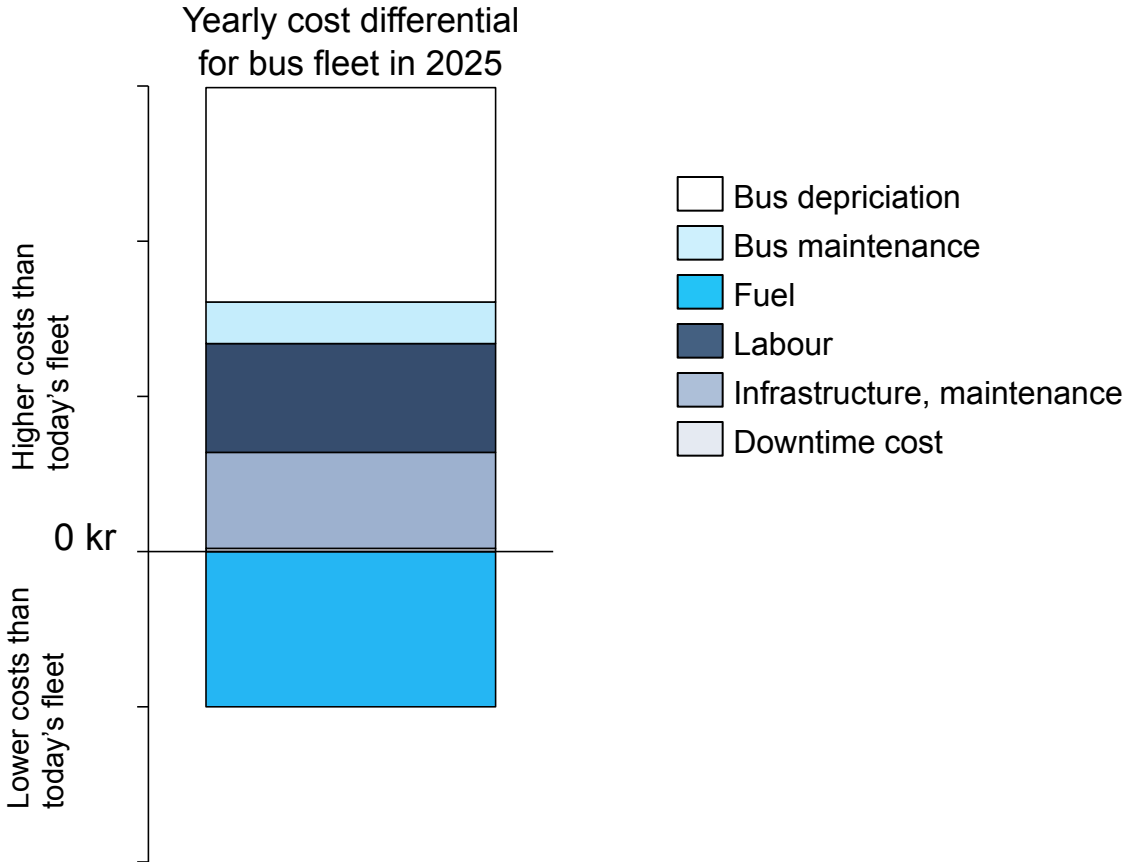
Ruter#

TCO bus fleet in 2025



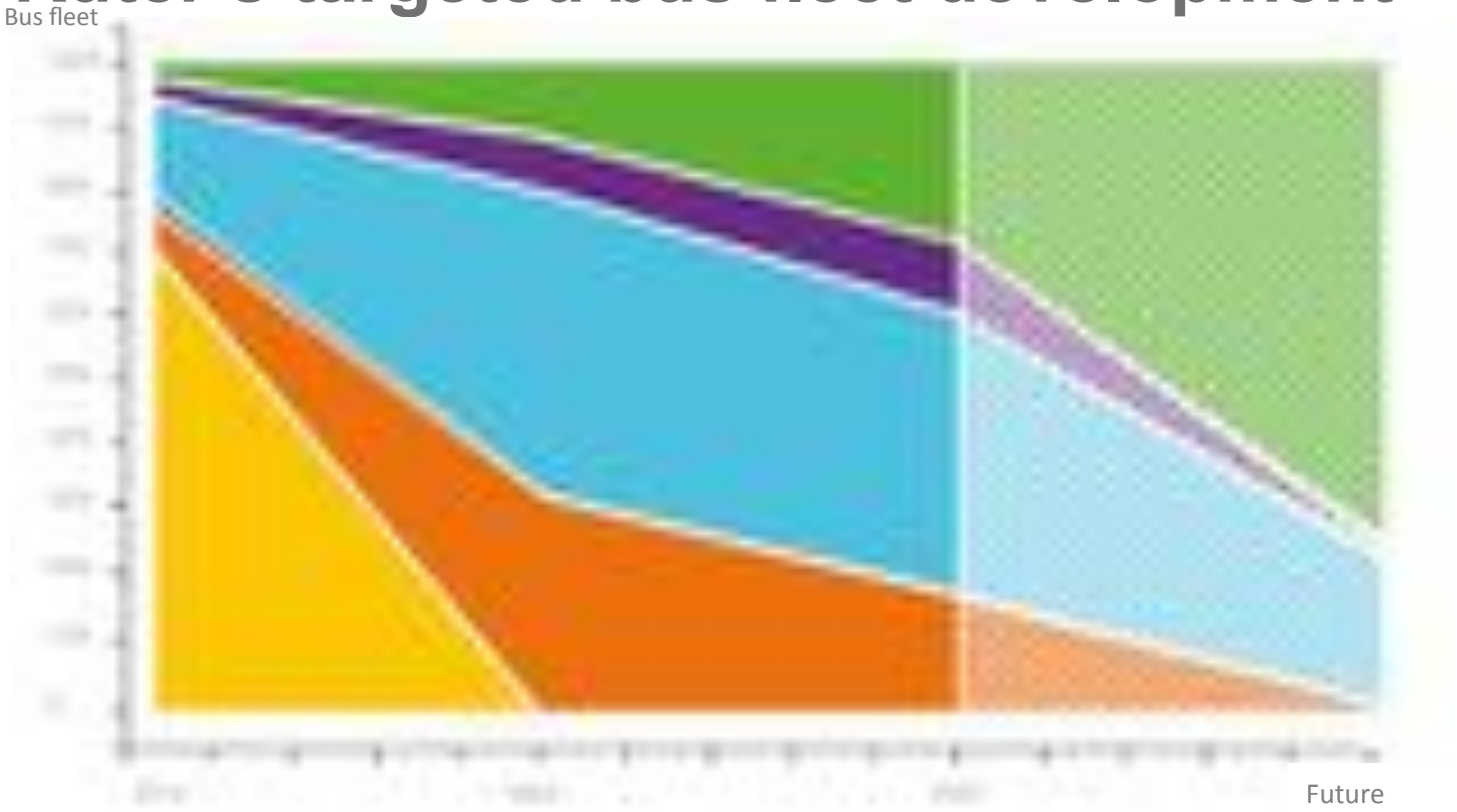
Ruter#

Higher costs for bus, infrastructure and labour - lower for fuels



Ruter#

Ruter's targeted bus fleet development



Ruter#

Key learnings

Bus technology and operations

- There are a number of bus options available that can meet the needs Ruter
- Time of expected commercial readiness of bus models is important
- It is possible to have a considerable number of battery electric (including hybrids) buses around 2020, primarily inner city
- Electrification is part of the long-term solution, but not the only solution
- Charging system and infrastructure more uncertain than the bus technology

Ruter#

Key learnings

Recharging and infrastructure

- Opportunity recharging seems most efficient solution today
- Charging Solution: Tendency towards conductive with pantograph
- Infrastructure recharging: Lacking standards and unknown life expectancy are main challenges
- Business model for ownership and operations of charging infrastructure not mature

Implementation

- Step-by-step roll-out
- No need for bus technology test but for systems test
- Need for Ruter to decide on technology solutions on a high level, until standards are in place or more mature solutions

Ruter#

Next steps:
Large scale testing

Need for co-operation

- To reduce risk and costs for public transport
- Enhanced collaboration on testing and data sharing
- Ruter's report available at www.ruter.no

Ruter#