Beyond aviation – electrification, autonomous vehicles and passenger drones?

Endre Angelvik, Executive VP Radical Innovations Ruter

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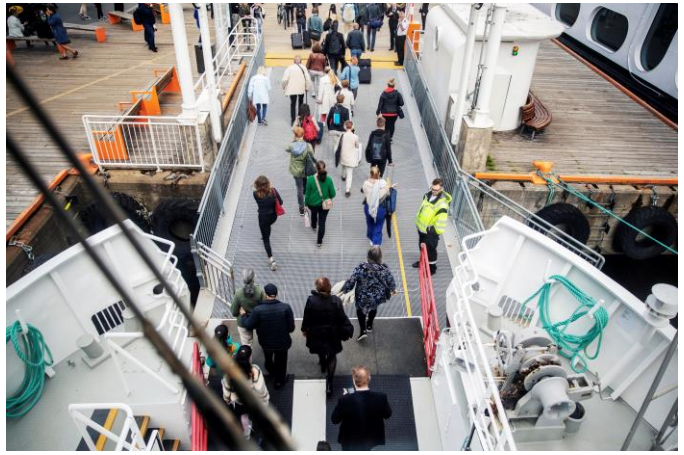
Ruter’s vision:

Sustainable freedom of movement

























Over 40 % of Norway’s population live their lives in the Oslo region.

Ruter’s service in numbers (2025)

187 mill.
trips by bus

106 mill.
trips by metro

55 mill.
trips by tram

4 mill.
trips by ferry

46 mill.
trips by train

Cooperation with:

- Taxi/minibus companies
- Micromobility providers
- Oslo City Bike



8 000
stations and stops



26 000
departures every day



7 000
demand-responsive transport trips every day



6
times around the globe every day



Transport is the biggest source of CO2 emissions in Norway

- The transport sector is responsible for more than 30% of Norway's CO2 emissions.
- National "zero-growth target" on private cars in urban areas.
- Oslo aims to reduce CO2 emissions 95 % by 2030, including a fully decarbonised transport sector.
- To decarbonise public transport is a large contribution to Oslos zero emission ambitions.

#



Ruter model – lead the transition

Ruter procures bus services as **a tender** (10+ years)

Ruter decides a **combination of minimum requirements and functional requirements**

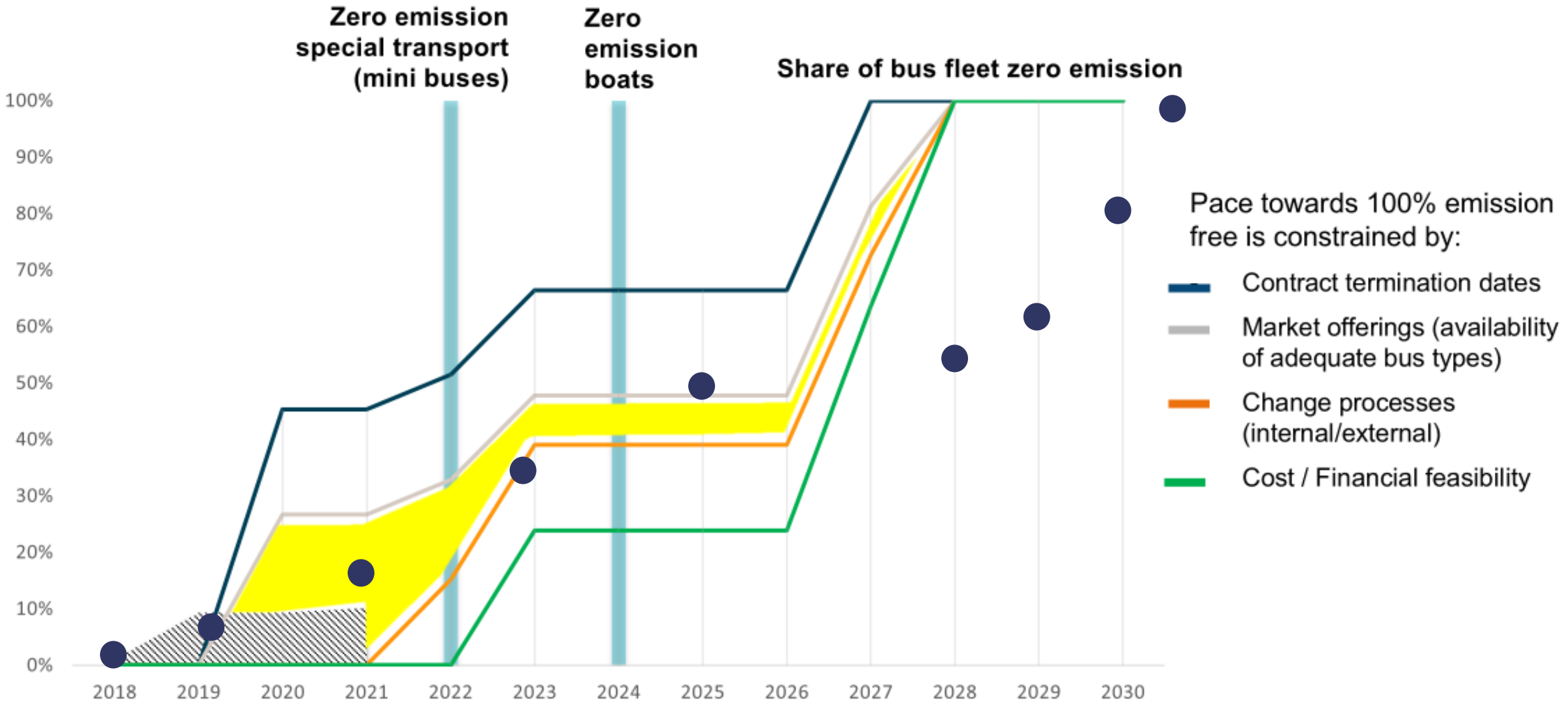
- The operators decides on **type of vehicle and energy carrier**
- "Zero-emission" has gone from **optional to required**

Good dialogue and interaction with operators and suppliers are important

Promotes **learning and innovation**

We want to **lead the transition**, rather than wait for the market to mature

Our target: Zero emission by ~~2028~~ 2031



Ruter#

Requirements shaped through market dialogue, testing, and gradual implementation

2017-2019

Pilot phase
Six buses to test whether operations were feasible.

2019-2020

Scaling up:
First large-scale deployment of electric buses as part of service contracts in Romerike and Western Oslo.

70 e-buses

2022

Beyond expectations
Ruter requested 25% zero-emission operations in Oslo South.

Received bids delivering close to 100% zero-emission coverage.

2023

Normalization
Four Oslo contracts reached 100% electric bus operations:

All bus contracts in Oslo are now zero-emission

Full transition
The remaining bus contracts in Akershus become zero-emission.

2025

Regional rollout
Four regional bus contracts reach 100% electric bus operations in Follo, Drøbak, Nesodden, Ski and Vestby.

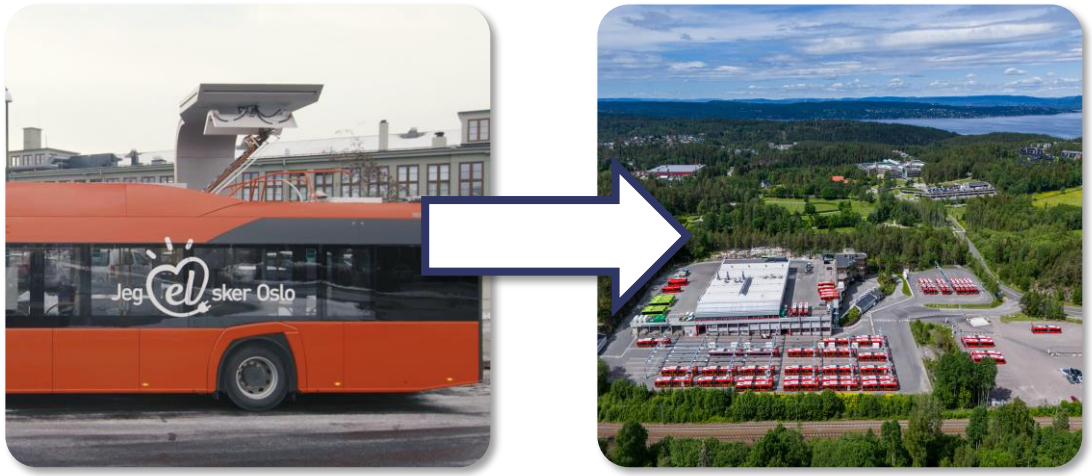
Total 680 e-buses + 400 mini e-buses



Trial and error is an integral part of **innovation** – often hand in hand with technology:



From **pantographs** to **charging cables**.



From **fast charging** to **depot facilities**.

Ruter model - charging

- Ruter (PTA) buys bus services from Operators (PTO's) as a tender (10+ years)
- Ruter plans routes and depots including 11kV grid connection and decides a combination of minimum requirements and functional requirements
  - The PTO's choose type of vehicle, energy carrier and energy infrastructure.
  - Charging plugs must be CCS2 (main choice). Pantographs must be bus mounted type (less used).
  - Ruter gets ownership of infrastructure after contract end. (offered for free in next tender)
- Good dialogue and interaction with operators and bus manufacturers / charging suppliers is important
- Promotes learning and innovation, requires higher competence at PTO's.





Photo: https://elbil.no

Key learnings from winter operations



Photo: www.nab.no

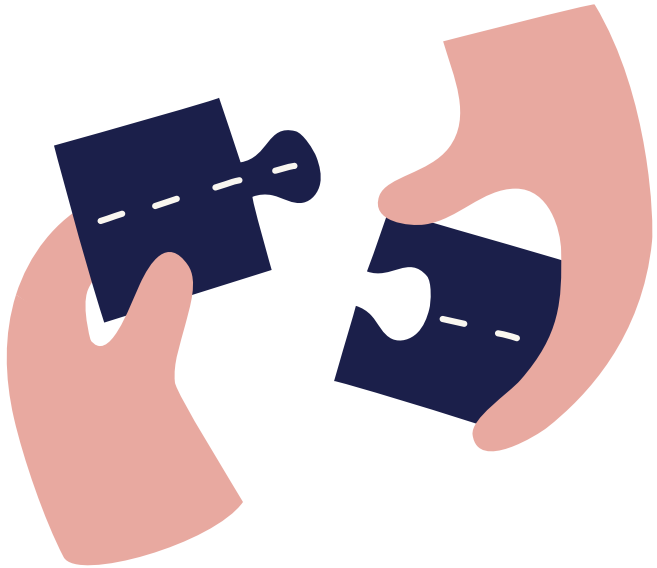
Key learnings summarized (1):

1. **Vulnerability and Dependencies:**
   - A system with 100% E-buses has less robustness and is more vulnerable
   - If any component fails, the consequences can be significant.
   - Car plans need to be more robust during winter.
   - Better planning and understanding of dependencies in the value chain are essential.
   - Adequate training of drivers essential to operation, both to operate the buses and to be able to drive in winter conditions.
   - Change and adjustment takes time and competent resources
2. **Start of contracts:**
   - Challenges where the new operator must be in full operation from day one.
   - Full-scale testing before the start date is difficult.
   - Lack of time for comprehensive testing can lead to operational issues.
3. **Charging Infrastructure:**
   - Charging infrastructure plays a crucial role.
   - Function testing and full-scale use are important.
   - Consider preheating buses 1-2 hours before charging.
   - Do not underestimate the number of chargers needed



Key learnings summarized (2):

4. **Energy Consumption and Batteries:**
   - The energy consumption was miscalculated, especially regarding electric heating of cabin and battery
   - Lack of experience-based data led to deviations.
   - Measurement standards for bus energy consumptions are less developed than for passenger cars.
   - Doors opening at all stops on city buses results in energy loss.
   - Increased rolling resistance on winter roads and unfamiliarity with electric buses affect energy consumption.
5. **Procurement:**
   - Ruter buys services, not buses nor charging infrastructure
   - We have to trust the operators, who trust the bus manufacturers, etc.
   - Better dialogue and interaction with operators and manufacturers





A path for future developments

- Lower Weight
- Weight impacts infrastructure negatively
- Charging infrastrukture
- Renewal of the fleet – incl 25 m long e-buses
- Security and emergency preparedness



Foto: Ruter As / Nucleus AS, Mathilde Spieler Palmers

Lessons learnt:

The climate challenges **requires rapid decarbonisation** of the transport sector.

Ruter uses **our purchasing power to lead the way** - and we want to share our experiences so others can follow.

We have had start-up problems in our 100% E-bus contracts – but the challenges are **not solely related to the E-buses.**

All the challenges can be solved; battery, heater, charging infrastructure - build in more back-up and robustness in the start up phase.

Change and adjustment takes time and resources.

Electric buses are the future - both for the climate and for well-being in urban environments.

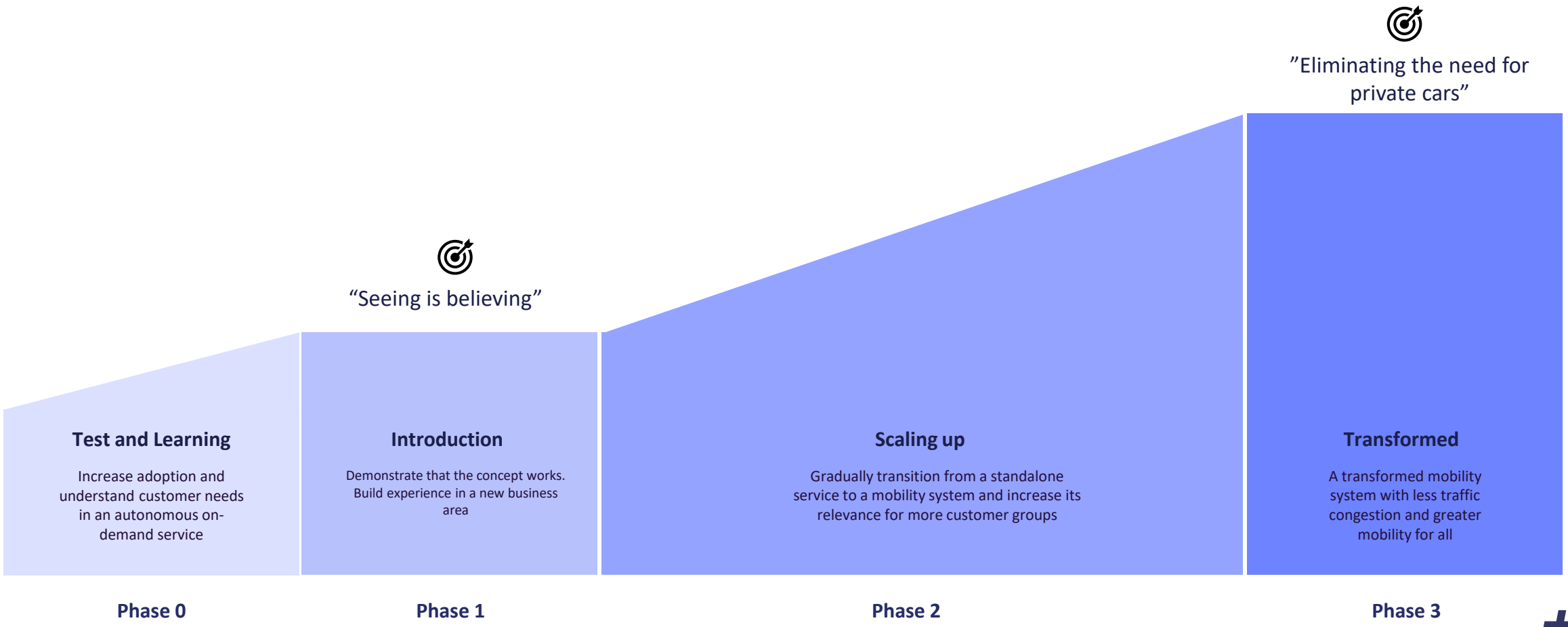
We have to safeguard our sustainable future and our **security and emergency preparedness**

Shared autonomous on-demand service



A Transformation Across Multiple Phases

Ruter’s strategy for on-demand transport based on autonomous driving



Key Service Design Criteria and Ambitions going forwards



Ridesharing (pooling)

Fundamental to get reduction in kilometres driven, which drives benefits as well as business case



Operate as one integrated fleet

Competing fleets will not reduce kilometres driven, hence not generate benefits



Integrated with public transit

Key to complement to maintain reduction in kilometres driven



Replacement of private car journeys

If this is just a complementary service, it will not provide key sustainability benefits



Large scale needed

Both to provide reliable private car replacement service and to be attractive investment case

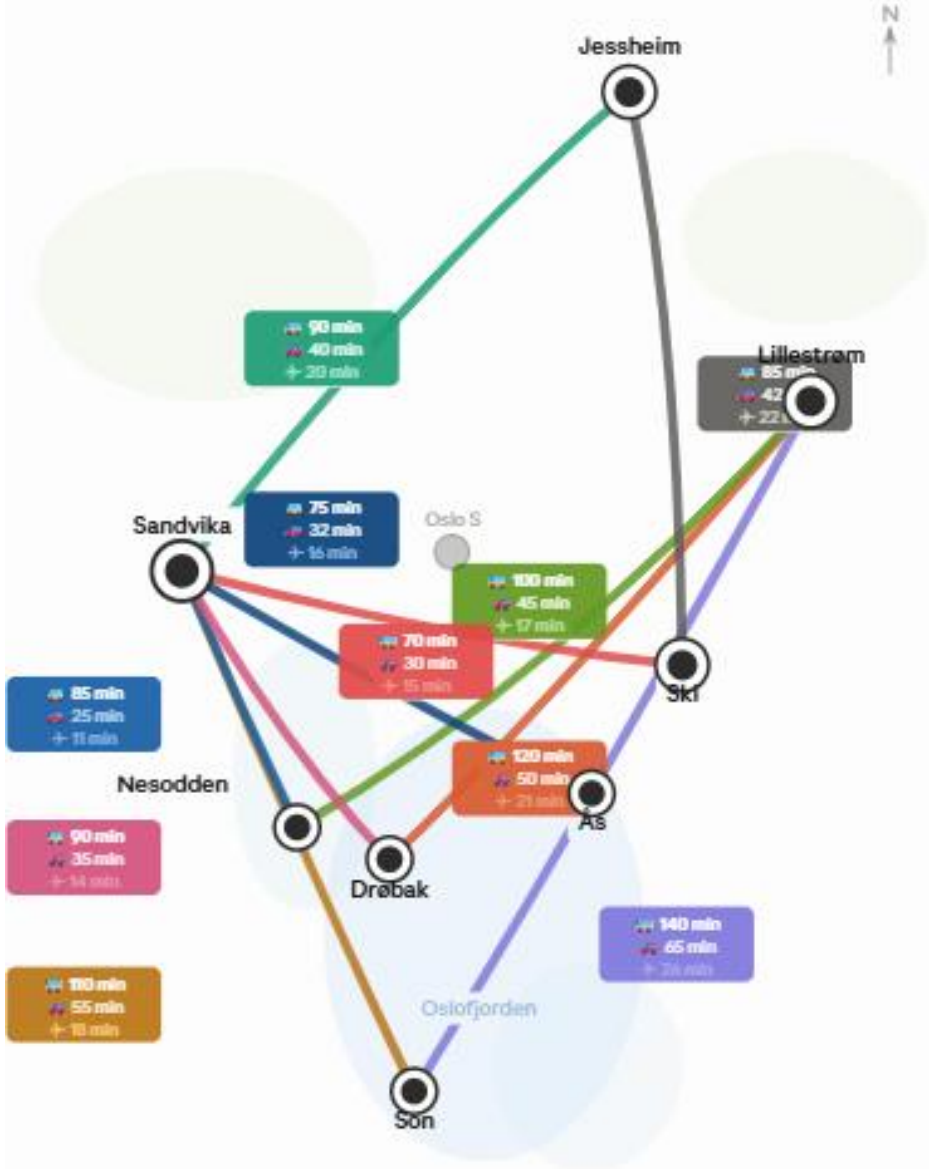


Subsidy free service

Self sustainable service – key to scaling

Passenger drone networks in the Ruter area

- Sample connections targeting travel time reductions
- Other network design strategies will deliver different networks.



Her er et eksempel på reiser mellom ulike regionbyer/steder

Sample simulation

Possible drone network in the Ruter area

Simulated ticket price vs PT and car

Route	Drone dist (km)	Drone ticket (NOK/pax)	PT fare (NOK/pax)	Car (NOK/trip)
Son (Strømbråtenveien) → Dal (Dal stasjon)	85.7	514	162*	575
Spikkestad (Spikkestad stasjon) → Dal (Dal stasjon)	73.7	442	162*	548
Drøbak (Drøbak torg) → Dal (Dal stasjon)	72.6	436	162*	505
Son (Strømbråtenveien) → Gjerdrum (Korsmo)	67.5	405	162*	477
Drøbak (Drøbak torg) → Nannestad (Nannestad torg)	65.5	393	162*	516
Drøbak (Drøbak torg) → Jessheim (Jessheim stasjon)	61.3	368	162*	435
Vestby (Vestby stasjon) → Gjerdrum (Korsmo)	57.8	347	162*	418
Spikkestad (Spikkestad stasjon) → Gjerdrum (Korsmo)	55.9	335	162*	449
Drøbak (Drøbak torg) → Gjerdrum (Korsmo)	54.1	325	162*	407
Ås (Ås stasjon) → Gjerdrum (Korsmo)	50.8	305	162*	382
Bekkestua (Bekkestua) → Son (Strømbråtenveien)	44.5	267	162*	373
Drøbak (Drøbak torg) → Rælingen (Fjerdingby)	38	228	134*	342
Nesodden (Oksval) → Son (Strømbråtenveien)	37.2	223	105*	273
Kolbotn (Kolbotn stasjon) → Gjerdrum (Korsmo)	35.2	211	134*	290
Nesodden (Oksval) → Gjerdrum (Korsmo)	34.6	208	162*	451
Bekkestua (Bekkestua) → Gjerdrum (Korsmo)	32.8	197	134*	290
Spikkestad (Spikkestad stasjon) → Son (Strømbråtenveien)	31.8	191	134*	341
Spikkestad (Spikkestad stasjon) → Nesodden (Oksval)	22	132	134*	292
Drøbak (Drøbak torg) → Nesodden (Oksval)	21.5	129	69	171
Spikkestad (Spikkestad stasjon) → Drøbak (Drøbak torg)	18.4	110	105*	214



Alternate network

- Different drone with shorter range but same designstrategi shows a different network
- Saving 65-80% traveltime vs PT and 40-70% vs car
- Max capacity 1600 passengers per day
- Cost per seat kilometer almost 19 kroner
- Ticket price of 20 NOK pr kilometer leads to trip prices in the range 200-700 NOK

