



Transition to zero emission buses

Victor Hug, Movia

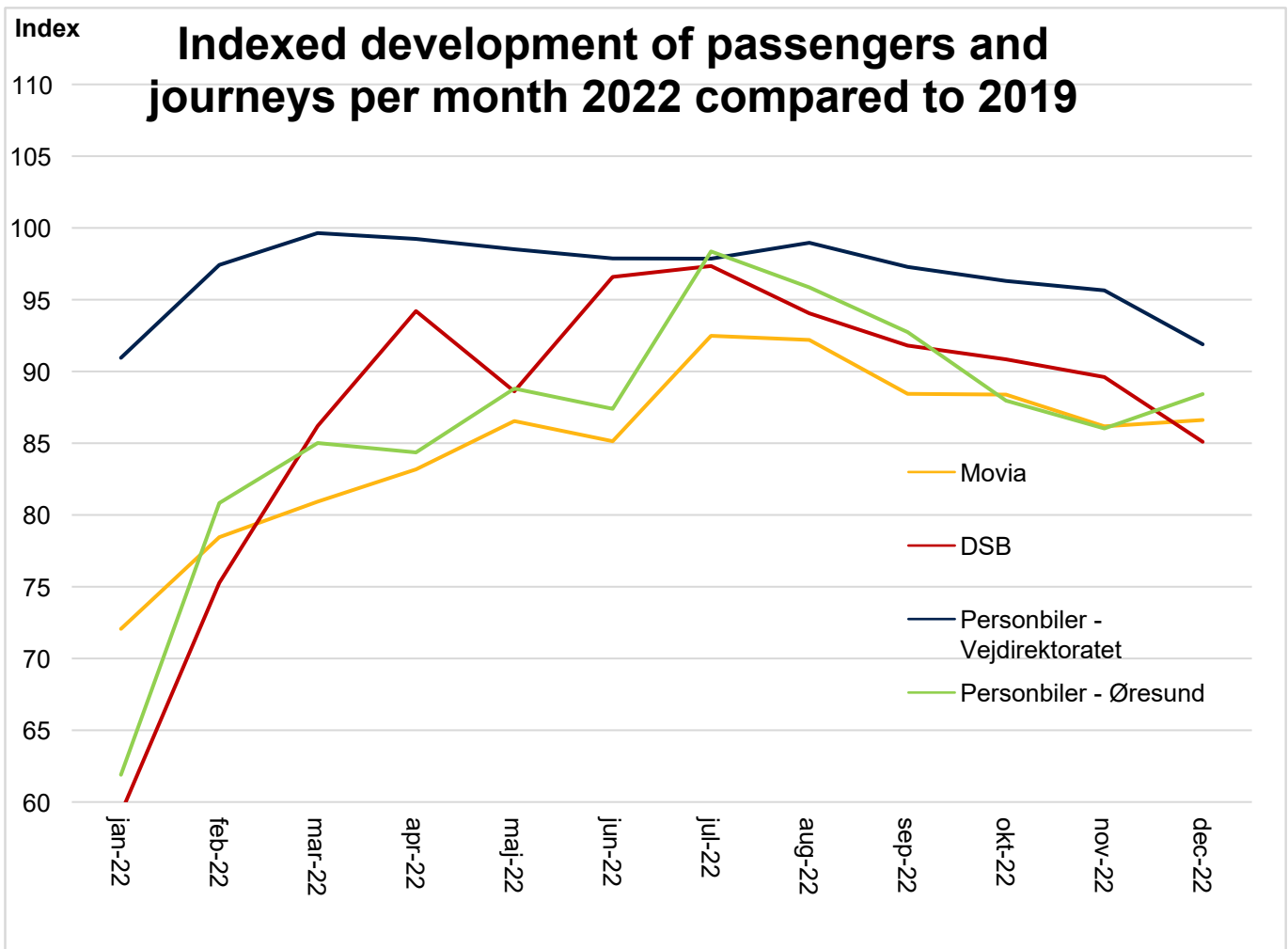
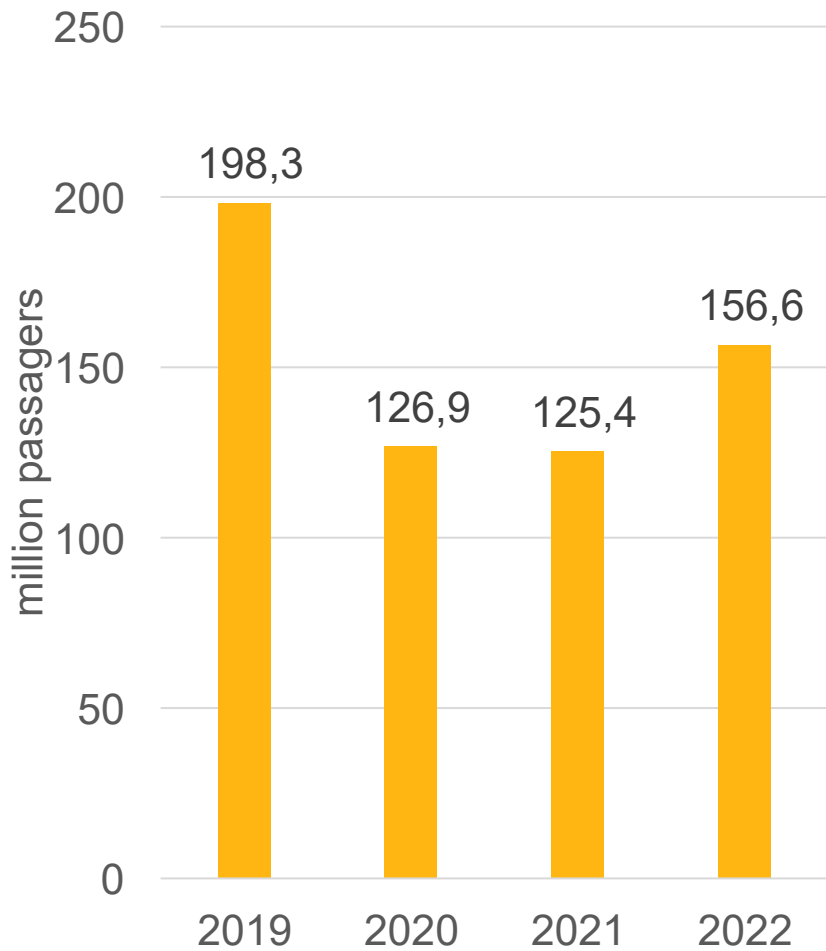


About Movia

- Public Transport Authority for Zealand, Denmark
- Owned by two regions and 45 municipalities
- Owners order bus services and decide environmental performance
- 1,324 buses hereof 339 electric buses
- 2030 target: All bus operation is fossil free and 50% zero emission
- All bus operation is tendered out to private PTOs
- Gross cost contracts



Ridership in Movias buses



Organisation of public transit in Denmark

- Who decides the service level and pays for the services?
- Who is planning the services?
- Who is operating the vehicles?



Securing right technology

- Competing technologies - Fuels Cell, Depot charging and Opportunity charging
- Maturing market through trails of new technologies
- Functional demands – Movia asks for zero emission
- Tenderers choose the preferred technical solution - strong competition and financial attractive offers
- Framework contract with supplier of opportunity charging in public space – solution no longer requested by the tenderers



2009 - 2014
Depot charged midi buses



2014 - 2015
Trial with depot charged 12 m

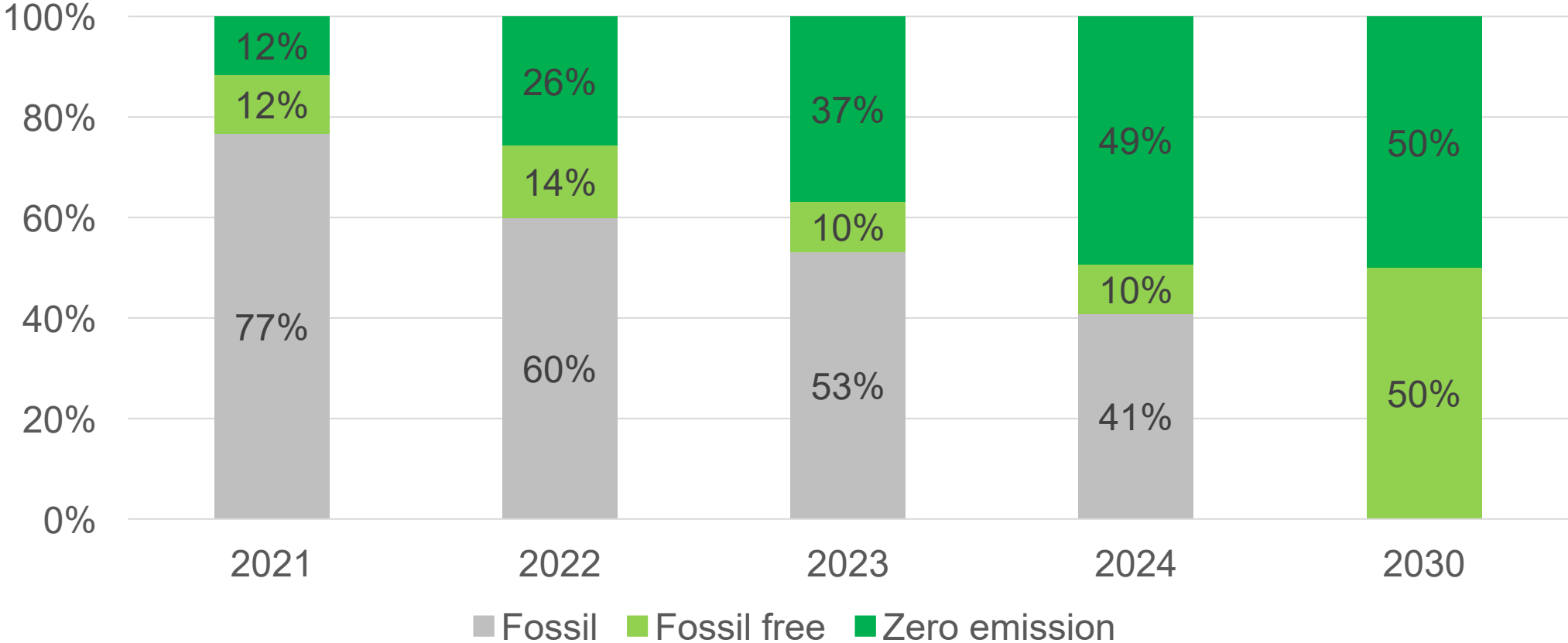


2016 - 2019
Trial with opportunity charging

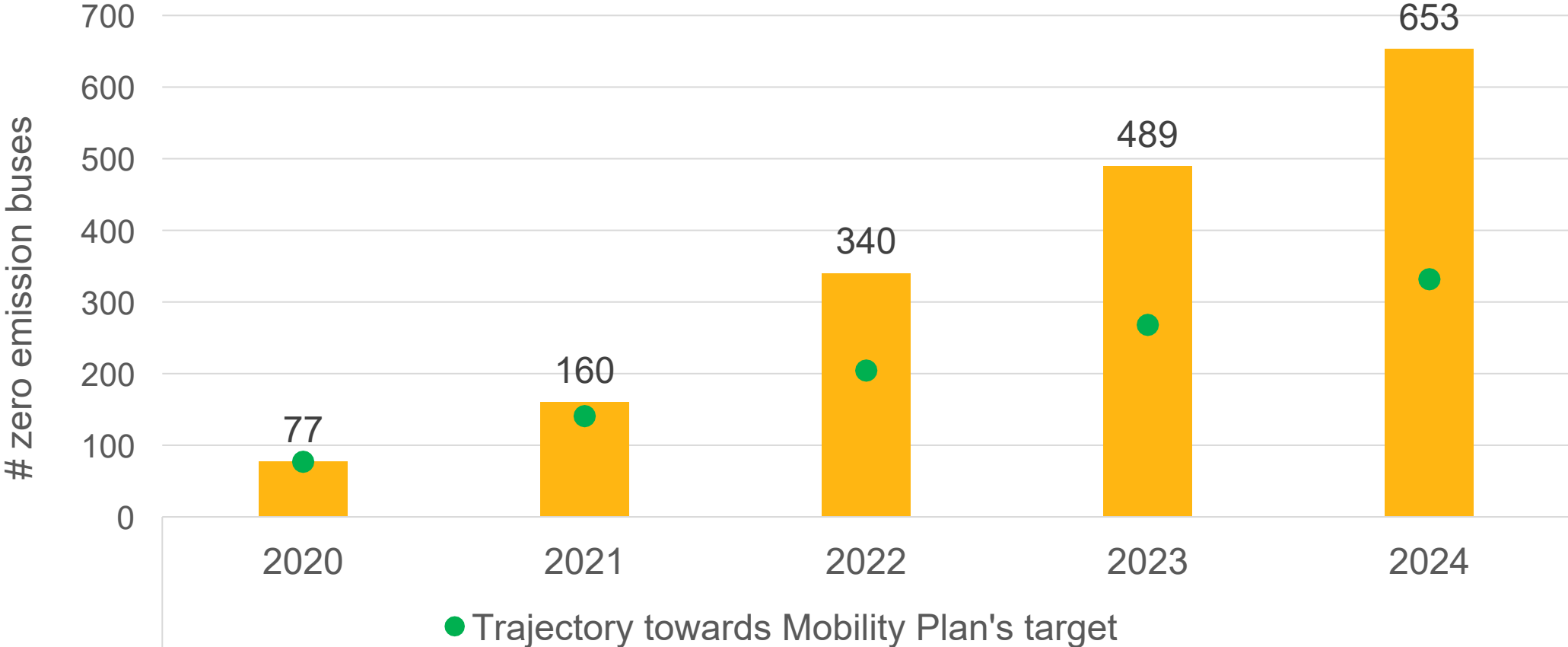


2022 - 2024
Trial with 12 m fuel cell bus

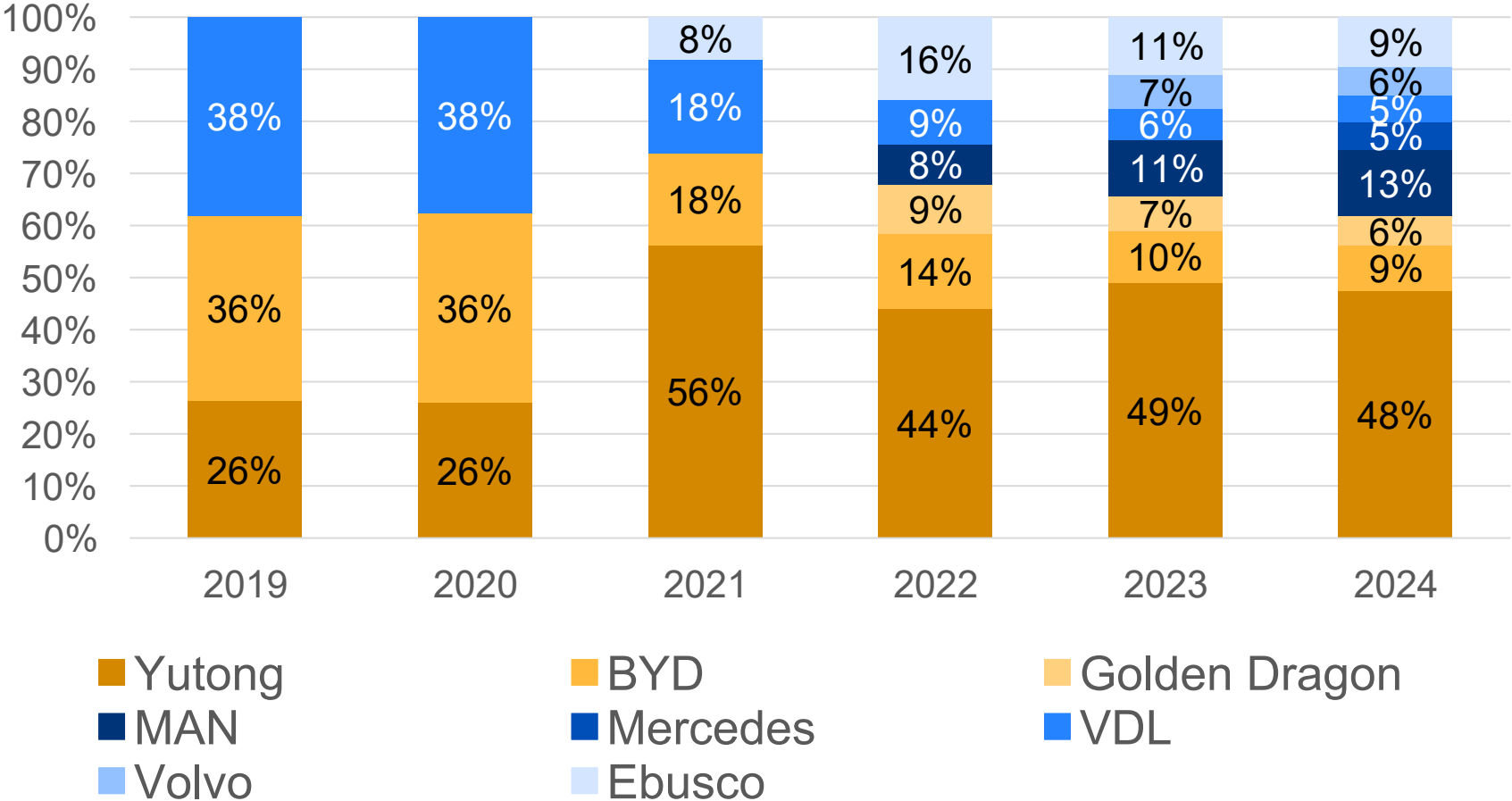
Share of bus fleet



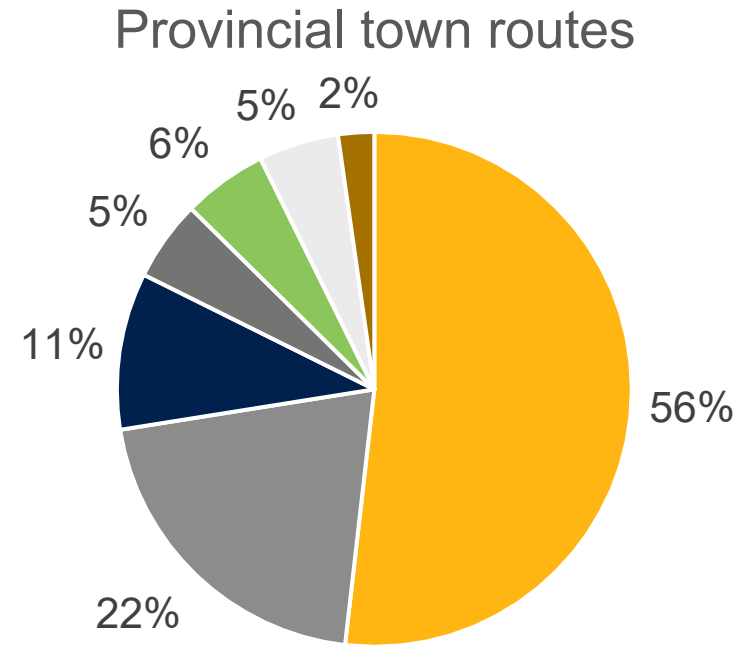
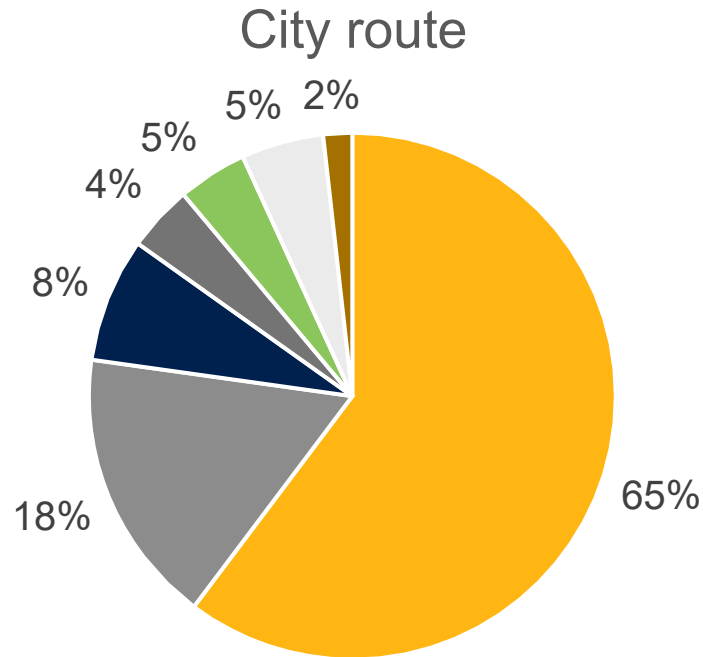
Deployment of zero emission buses



Market shares for bus manufactures



Break down of bus service cost – TCO model



- Driver salary
- Tyre, maintenance, repair
- Electricity
- Depot charger
- Bus
- Bus depot
- Return of investment

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Cost drivers

- Bus utilization (hours/year) – bus costs
- Deadhead – driver salery
- Efficiency in operation – driver utilization
- Special requirements for buses – of the shelf item (e.g. solo buses) vs. special vehicle (e.g. boogie buses)
- Risks of changes to service level
 - Increase in number of buses
 - Reduction in number of buses
 - Increase in hours – if there is a need for additional buses



Risk management

- Risk that the operator can control is well located at the operator
- If the operator cannot control the risk, the risk becomes a problem for the operator
- The operators may add risk premium to their offer if they face risk that they cannot control
- In 2017, Movia tendered out the first routes with requirement for 12 m ebuses
- Close dialogue with bus operators on requirements for zero emission bus services – which changes to the tender documents were needed to avoid risk premium?
- Most important changes:
 - ✓ Longer guaranteed contract period
 - ✓ Compensation when changing number of in-service buses
 - ✓ Limitation in Movia's access to increase routing (km/day)
- Marked dialogue with operators every second year where terms for tender of zero emission bus services are adjusted.

Risks in Movias contracts

Risk item	Management	
	Diesel buses	Ebuses
Pris development	Regulation of payment according to cost index	
Deadhead and efficiency of bus runs	Regulation of deadhead mileage, efficiency regulation	
Scaling production	Payment according to hourly, bus related and fixed costs	
Increase of in-service buses – depreciation	Operator is liable for risk	Compensation
Increase of in-service buses – residual value	Operator is liable for risk	Compensation
Power supply at bus depot	Not relevant	Min. 14 month from contract awarding to start of operation
Procurement of buses	In 2016: 9 months	Min. 14 month from contract awarding to start of operation
Toothing problems – electric driveline	Not relevant	≤ 10% diesel operation the first year
Contrakt length - depreciation/residual value	Used to be 6+2+2+2 years Now much shorter	8+2+2(+2) years

Different risk profile

Perception on risk and willingness to take risks depend on:

- The operators ownership including need for approval of offer by board/foreign owners
- Assessment of possibilities to move buses to other contracts
- Assessments of residual value of buses
- Assessment of risks due to Movia's requirements for operational flexibility
- Assessment of risks by procuring buses/installing electricity supply at the depot
- Assessment of risks in obtaining contract extension

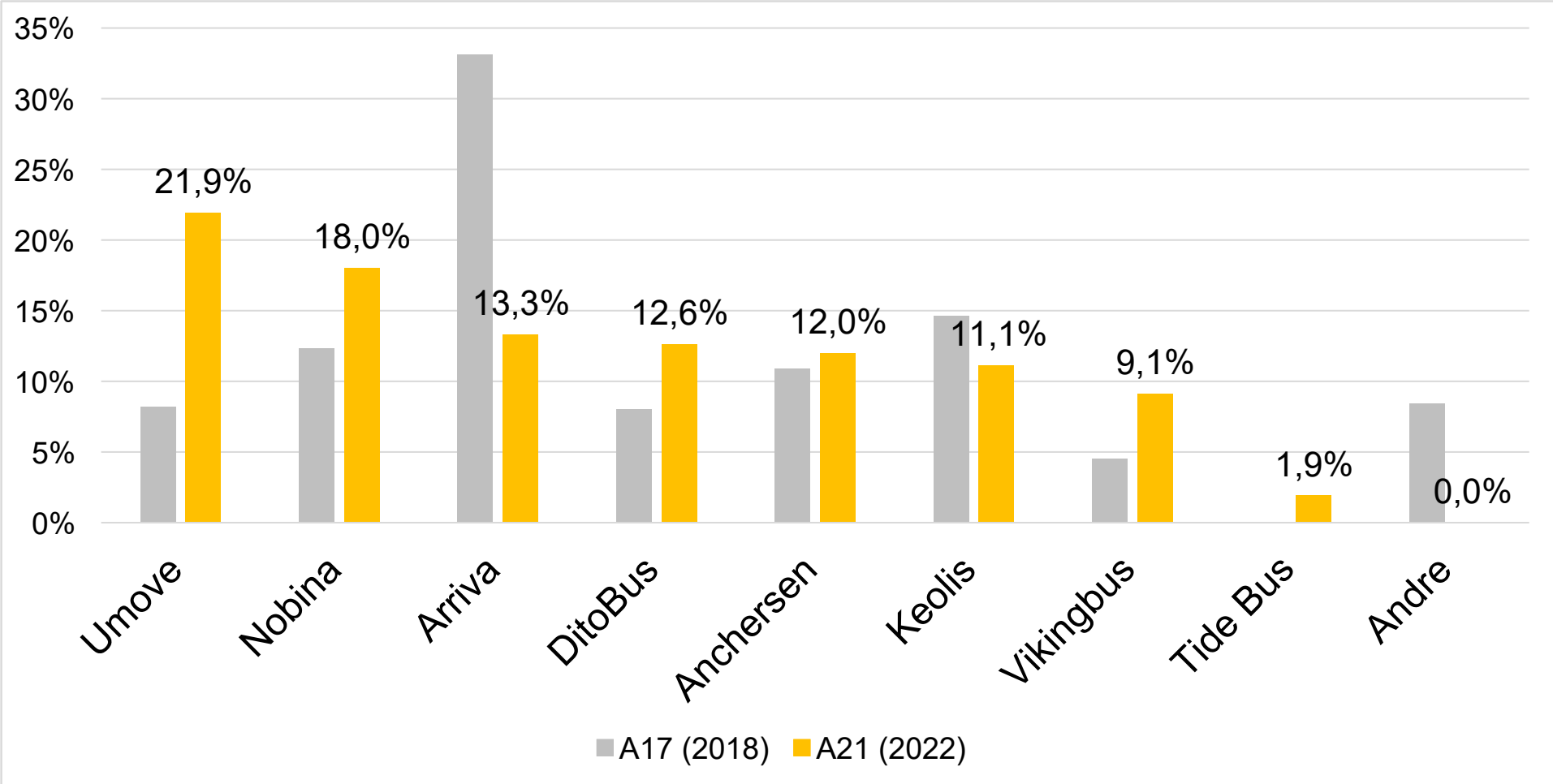


Good competition is essential

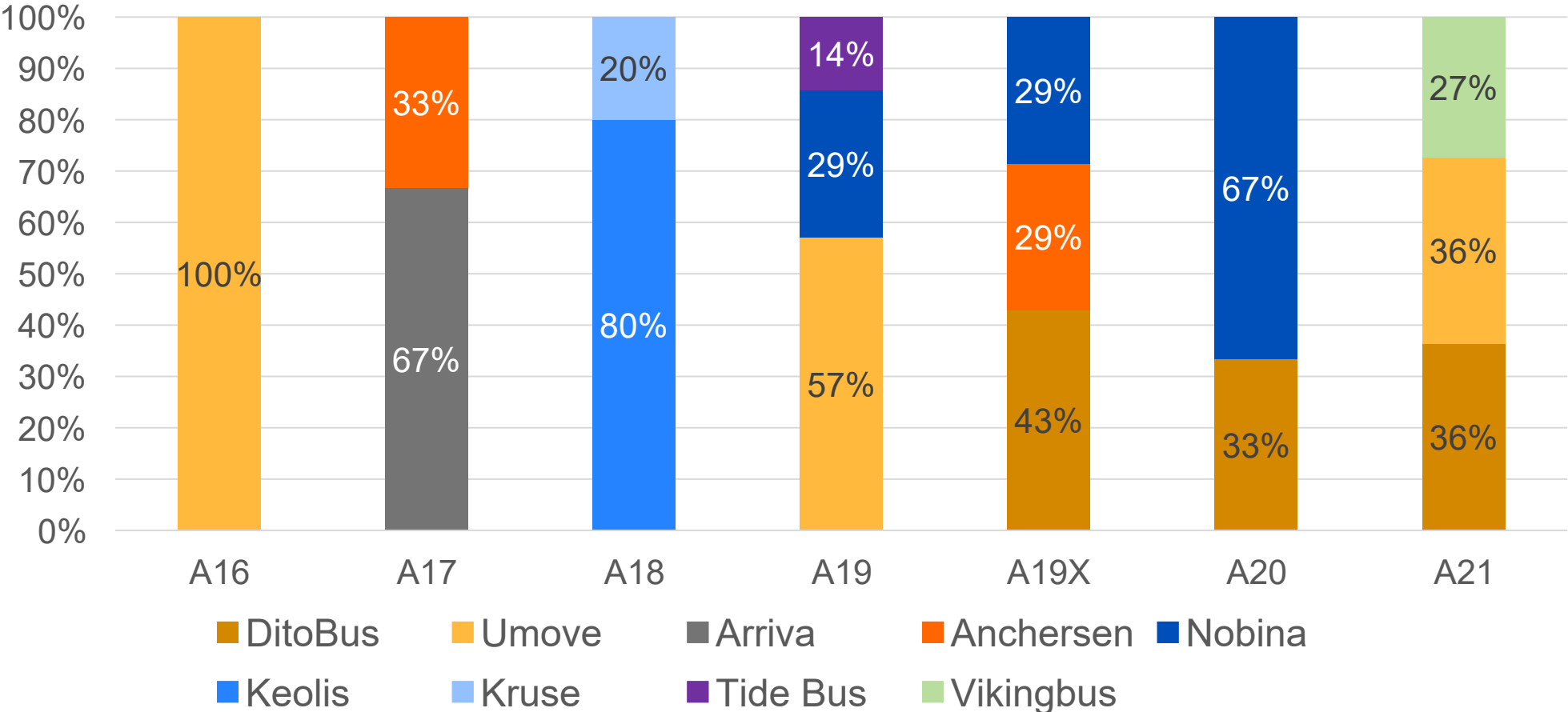
- Important to listen to all PTOs and settle on a level that most can accept
- Not appropriate to transfer too much risks to the operators
- PTOs do not always add risk premium to offer – fierce price competition
- Preferable to distribute market shares between the operators



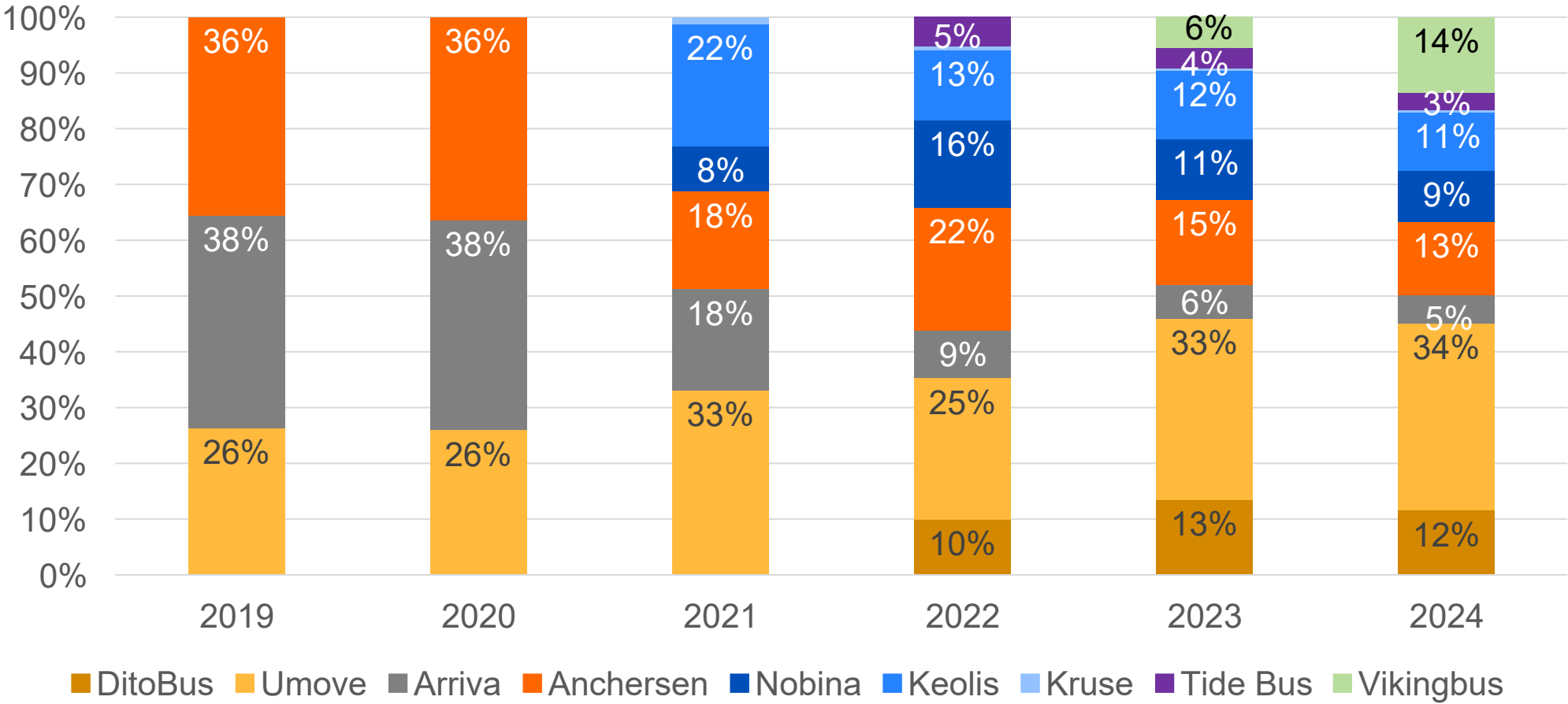
PTOs market shares



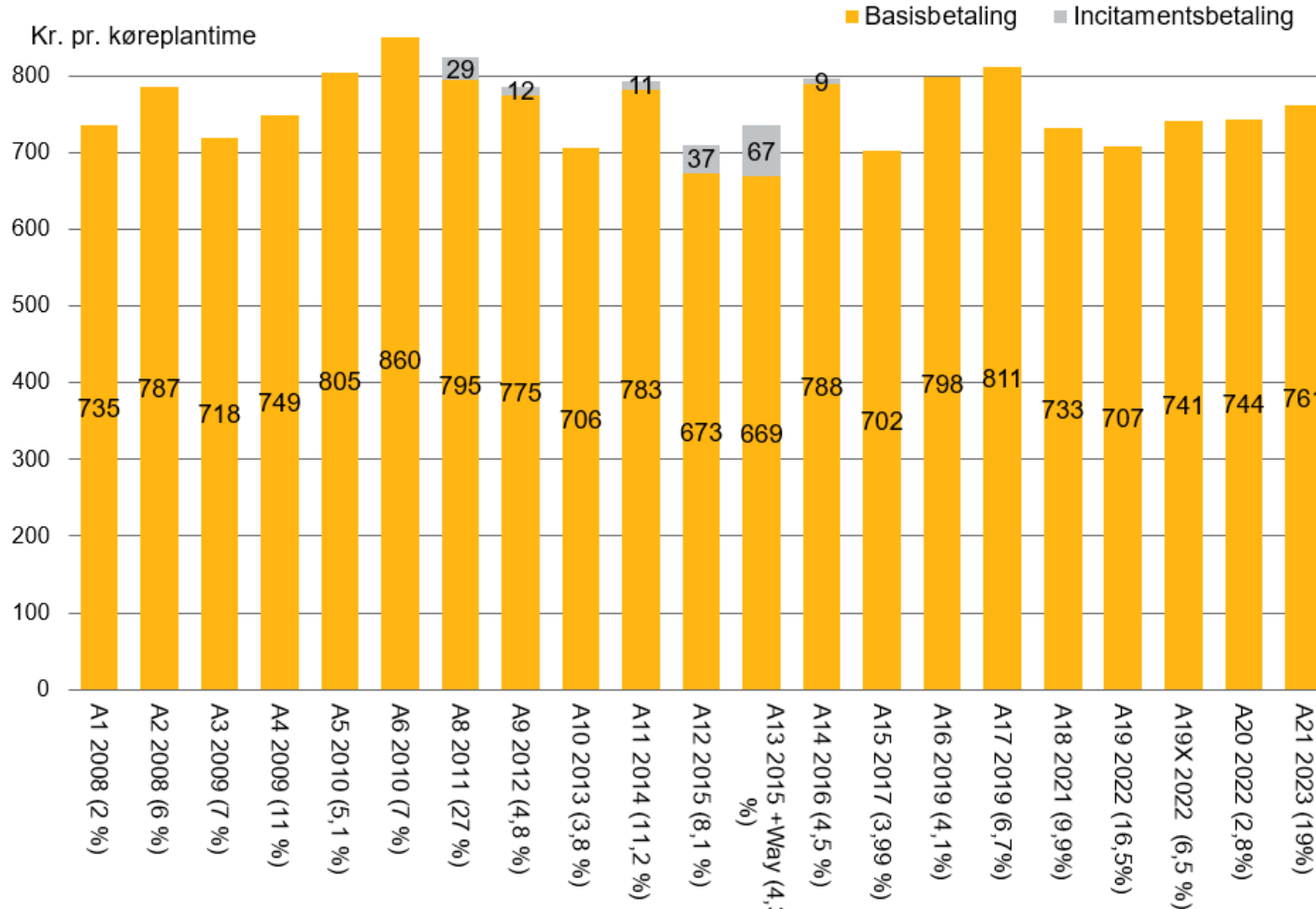
Share of awarded zero emission tender units



Share of zero emission buses



Development in hourly costs

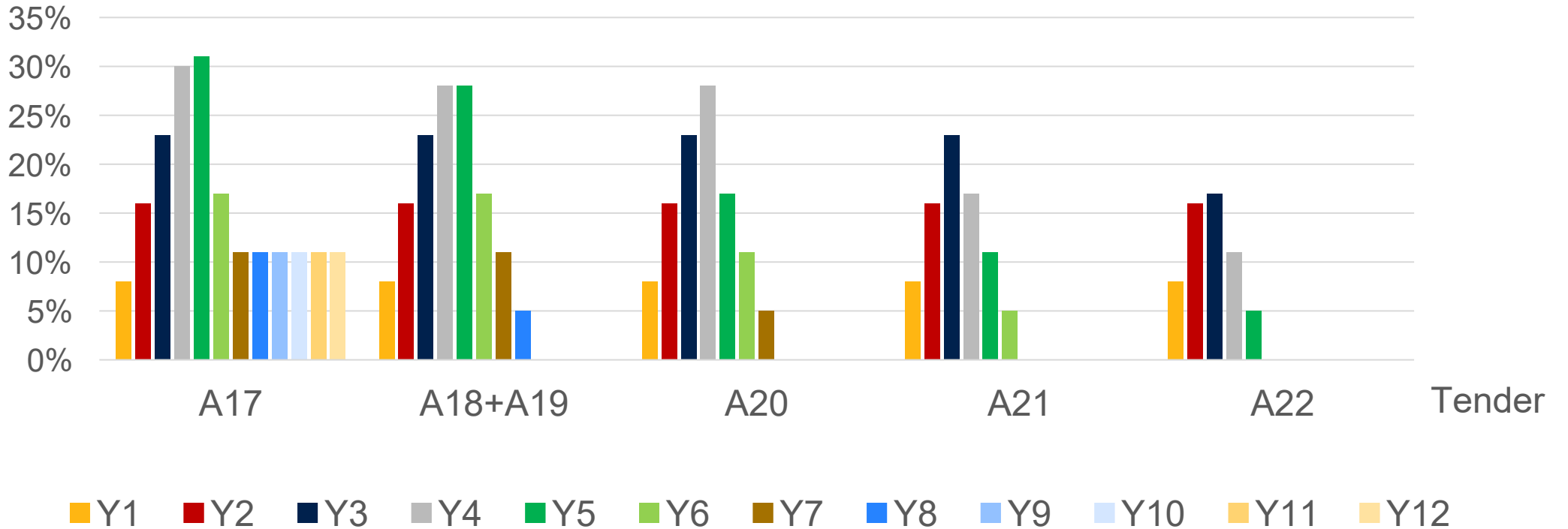


Prisudvikling siden 2008. Alle priser Marts 2022 prisniveau. A1 til A5 er med Cross Border Leasing

Compensation for change of in-service buses

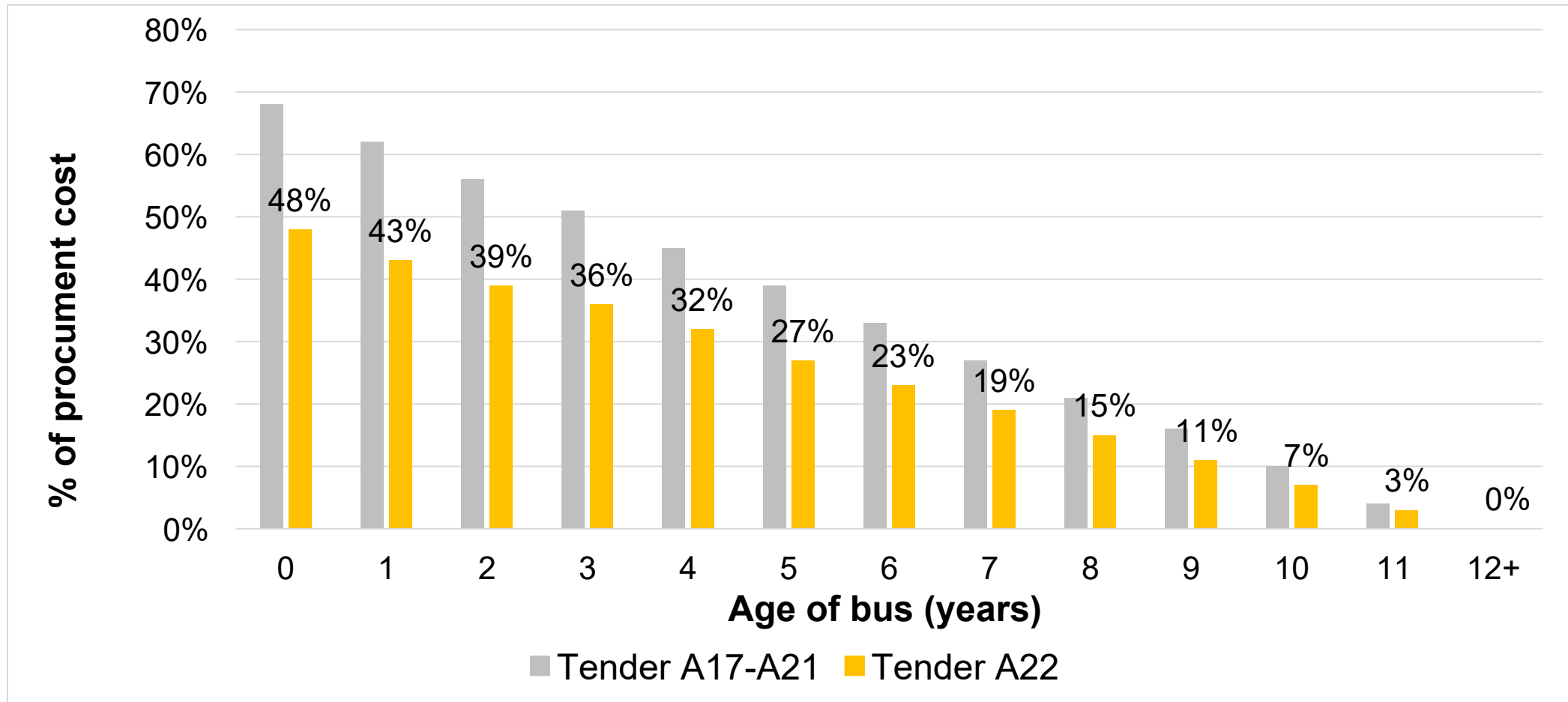
- Double cost of e-buses compared to diesel buses
- Fast technological development and old ebus models are quickly becoming obsolete
- Uncertainty regarding resale value and the possibility of re-employment of e-buses
- Without compensation for reducing and expanding the number of operating buses, the operators will add risk premium to their offer
- The amount of compensation is determined in dialogue with the operators

Increase of in-service zero emission buses



Compensation per in-service zero emission bus

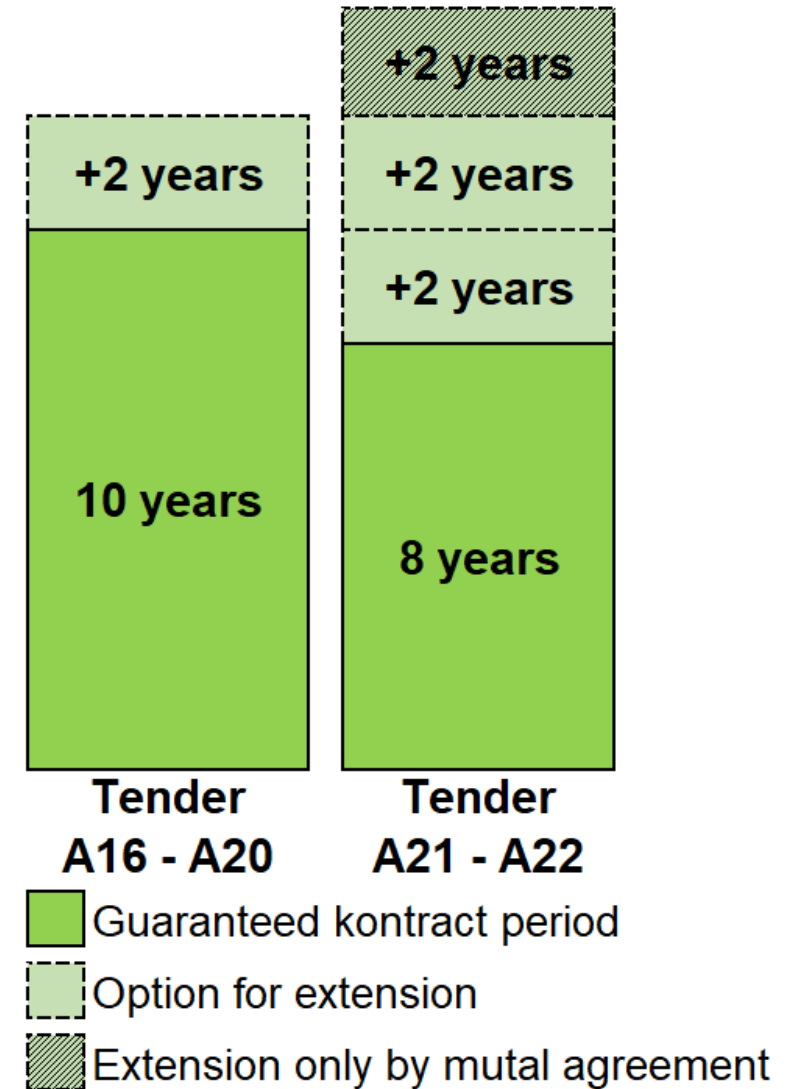
Reduction of in-service zero emission buses



Compensation per in-service zero emission bus

Guaranteed contract periode

- Longer guaranteed contract ensures the operators a longer period to depreciate buses
- And thus reduces the operator's risks
- ovia is working towards a shorter guaranteed contract period

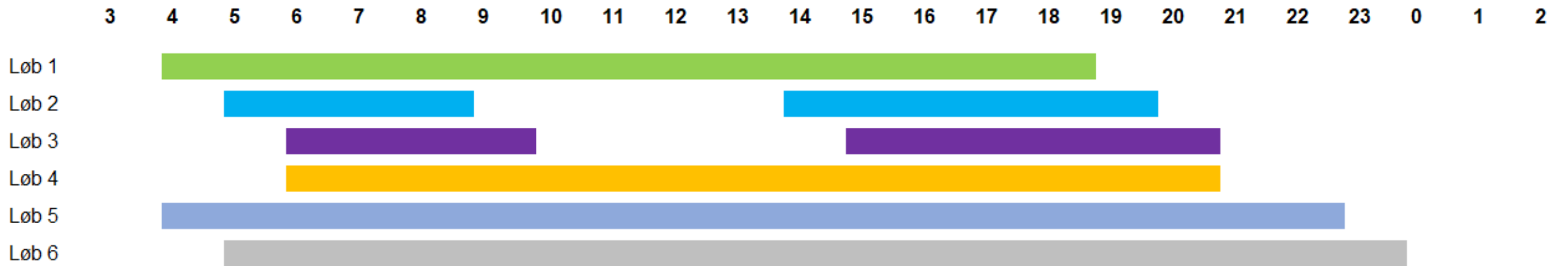


How to keep flexibility?

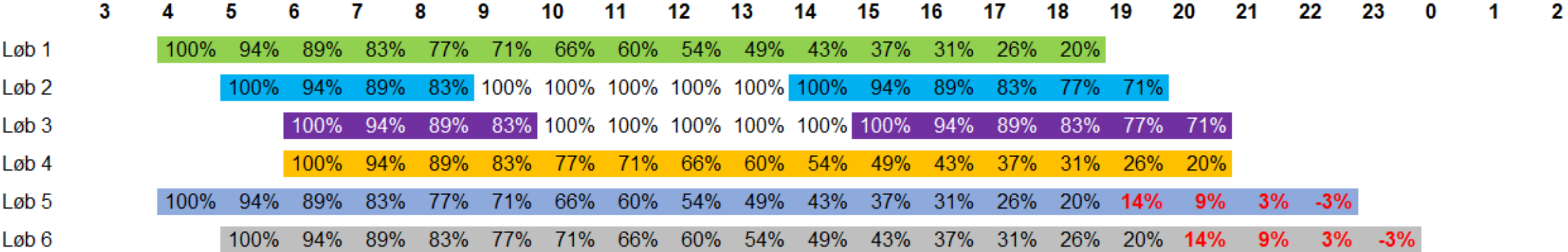
- Tender A16: operator offered range of buses
- Tender A17-A20: possibility for Movia to extend the routing with 10-30% - routing is calculated as sum of distance of all trips
- Award criteria
- Tender A21-A22: Movia may extend the amount of bus services with 25% without compensating the operator



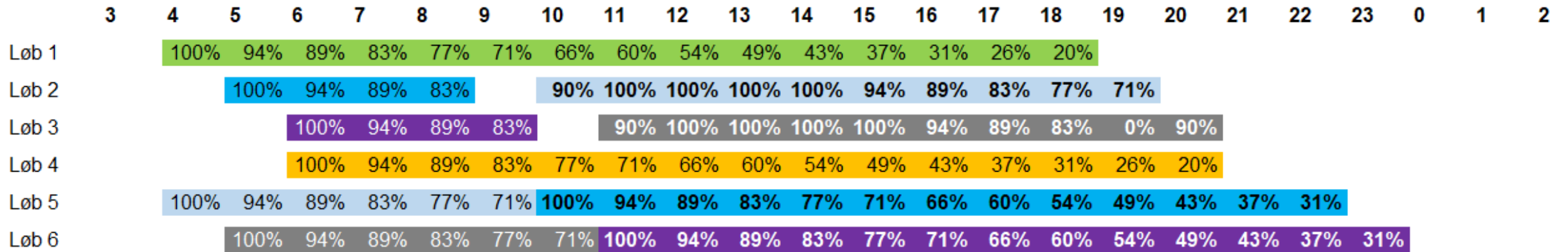
Managing ebuses – tendered operation



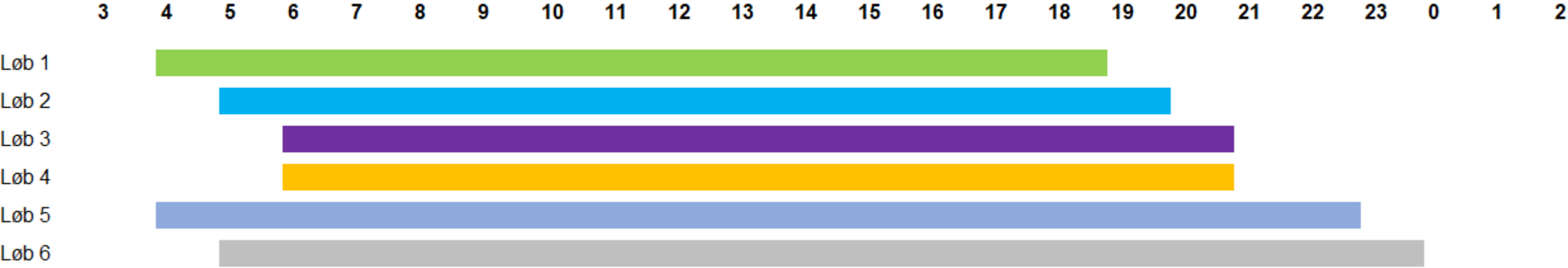
Managing e buses – tendered operation



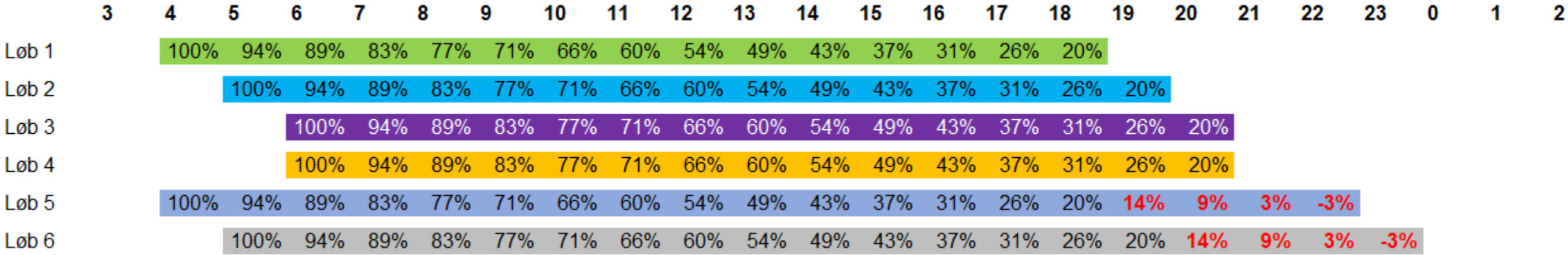
Managing e buses – tendered operation



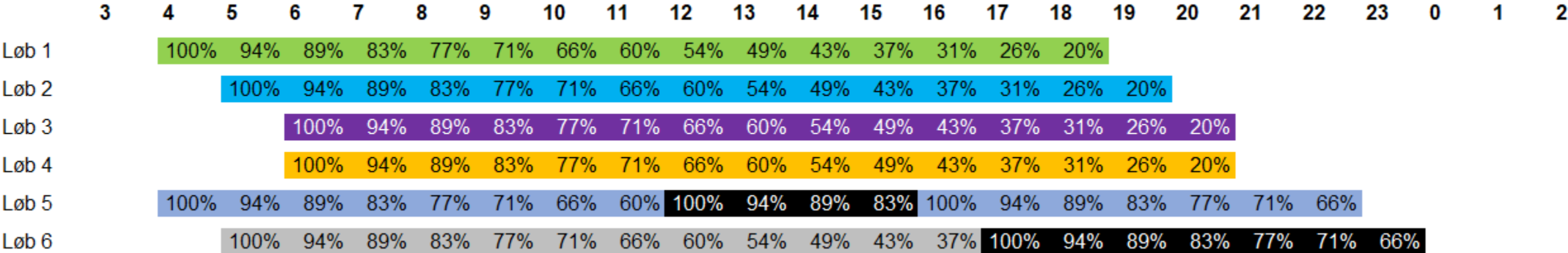
Managing ebuses – increased operation



Managing ebuses – increased operation



Managing ebuses – increased operation



Important learnings

Focus on costs by:

- Close and ongoing consultations with the market
- Reduction of PTO risk through lower levels of flexibility for the PTA

Choice of technology by:

- Functional demands – give freedom to the market





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movia

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Thank you for your attention
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