



Trolleybus in Bergen, Norway Expand or Die!

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- **Information presented here was a part of a feasibility and strategy project conducted for the County of Hordaland and the PTA (Skyss).**
- **Conclusions and opinions are my own.**
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History - trolleybus operations in Bergen #1

- Trolleybuses first introduced in Norway (Drammen) in 1909.
- First introduced in Bergen in 1950 (line 5).
- Comprehensive plan to replace existing tram lines with trolleybus operation.
- Line 2 converted to trolleybus in 1957.



History - trolleybus operations in Bergen #2

- Line 1 converted to diesel bus in 1966.
- Line 2 extend several times between 1957 and 1982.
- Other expansion plans discussed but not funded.
- Line 5 converted to diesel bus in 1998.
- City operator (Bergen Sporvei) privatized in 1998.
- Trolleybuses and infrastructure transferred to private company:
Gaia Trafikk → now, Tide Buss



History - trolleybus operations in Bergen #3

- Need for new trolleybuses around year 2000
- Basis for special subsidy from the City of Bergen to maintain trolleybus operations
- Line not subject to competitive tender - yet.
- 6 new articulated trolleybuses were bought in 2003.



Status today in Bergen

- Operation of line 2: 7 km long.
- Existing schedule requires 10 - 12 buses - therefore many trips using diesel og gas buses.
- Parallel operations - several lines operate partially under trolleybus infrastructure
- Uncertainty has led to deferred maintenance of buses and infrastructure
- Expertise in bus company is disappearing
- Line 2 will be put out to tender in 2017 - 2019.



Status in Bergen - Conclusions #1

- Infrastructure is not used effectively.
- Therefore operating costs appear to be quite high for trolleybus operations. Cost of infrastructure is only allocated to trolleybuses, not diesel/gas buses operating on same route.
- Efficiency of electric operations not well understood by decision makers.
- 100% of electricity in Norway is renewable sources (hydropower).
- New light rail system - Bybanen - offers the possibility for synergy.
- Politicians fascinated by new technology.



Bybanen is owned by county government



Status in Bergen - Conclusions #2

- Politically not possible to shutdown trolleybus operations.
- Re-purchase infrastructure.
- Assign responsibility for infrastructure.
- Buy new buses.
- Expand to improve efficiency.
- Tender operations.
- Advancement in battery technology adds noise to the decision-making process.

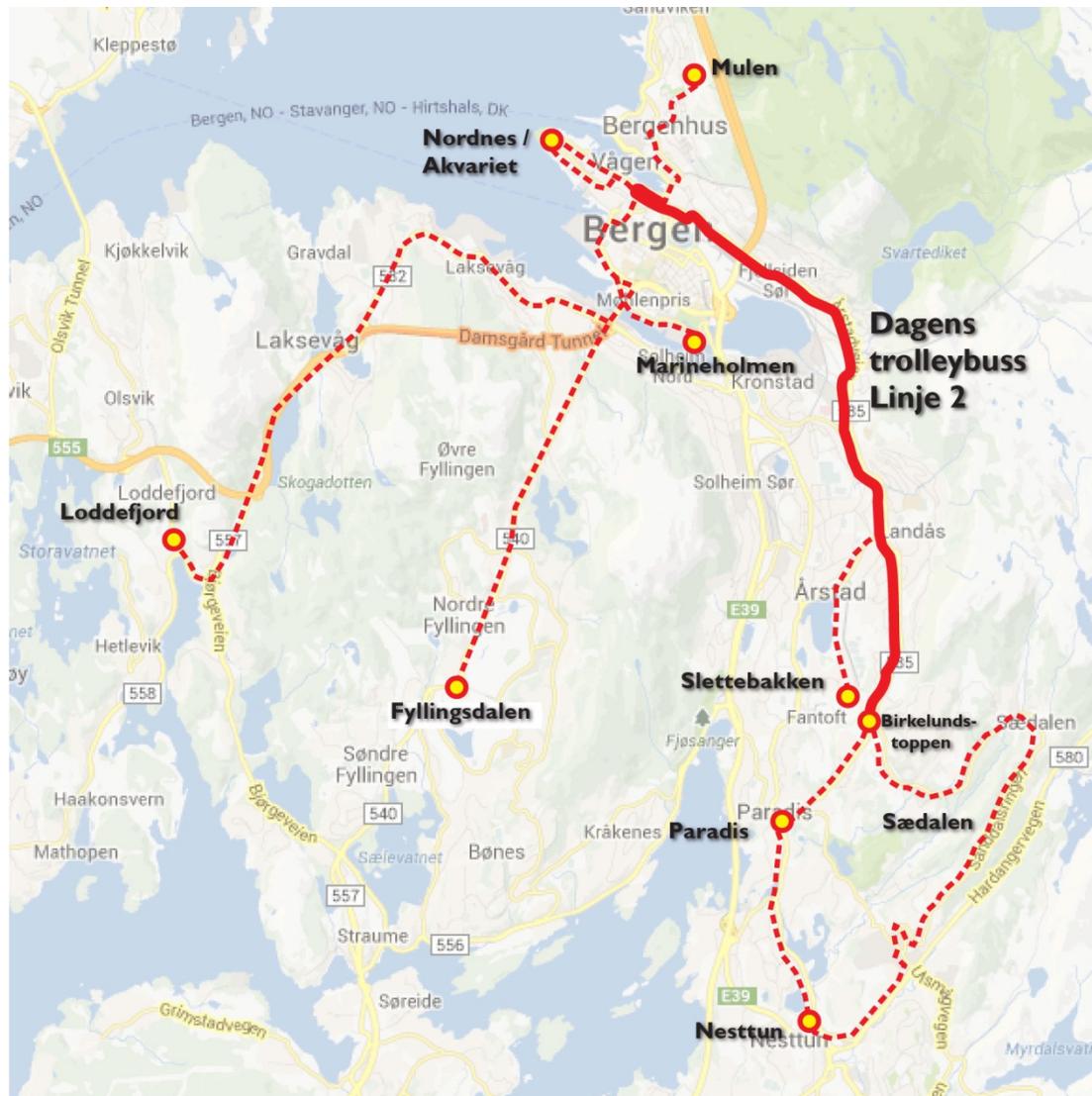
Summary of findings during project

- Advice from other trolleybus cities. If you have a trolleybus system, do not close it - not the right time.
- Trolleybus characteristics are in demand by the public and politicians:
 - Quiet, no local emissions, good acceleration especially in hilly areas
 - Described in "Public Transport Strategy" and "Environmental Program" for PTA
- The bus world is moving in the direction of electric operations
 - Stavanger is considering the use of trolleybus for the BRT project.
- Battery technology is not good enough for 100% battery operations in Bergen, especially in the winter and with articulated buses
- Many investigation and trial projects
 - Better batteries and alternative charging methods under study
- Electricity for lighting, warming/cooling and technical systems is significant and can be up to 50% av total energy requirements
- Trolleybus can be cheaper in operation than diesel or gas, but the infrastructure must be used effectively.
- Traditional trolleybus operation with overhead contact wires is still the best with regard to energy efficiency and reliability.

Maintain trolleybus operation on line 2

- Continue operations until tendering in 2017 - 2019
- Prepare for take-over of infrastructure
 - Due diligence
 - Technical evaluation of infrastructure and buses
- Negotiate and purchase infrastructure
- Integrate responsibility within Bybanen AS
- Upgrade technical systems if needed
- Procure enough buses for 100% trolleybus operations on line 2
- Plan extensions of trolleybus system

Possible extensions of trolleybus network

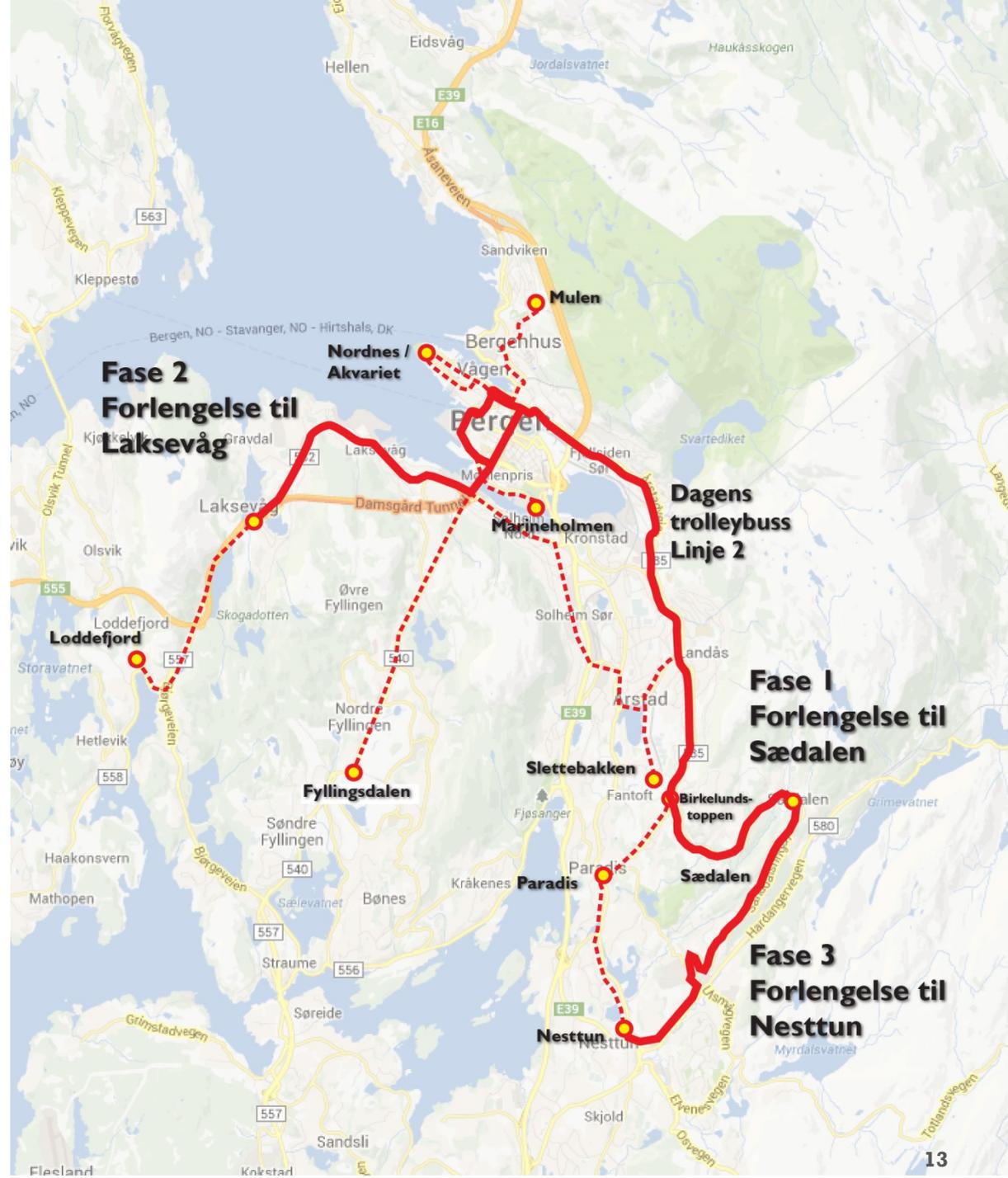


Existing trolleybus line 2

Phase 1:
To Sædalen

Phase 2:
To Laksevåg

Phase 3:
To Nesttun



Infrastructure - establishing an efficient network

- An investment € 60 million will establish a network of two lines with a total length of 35 km operating with 36 buses
- Additional bus lines near the city centre should be evaluated
 - Line 10: Mulen - Sentrum - Søre Skogsvei - Wergeland - Sletten
 - Sandviken: Two line serving areas on the mountainside

Operating costs

- **Operating costs for the trolleybus system in Bergen are high today**
 - A very small system (7 km, 6 buses)
 - Inefficient use of infrastructure and resources
- **Operating costs can be the same or lower than diesel bus operations**
 - Integration with Bybanen AS
 - More effective use of infrastructure
 - Expansion of trolleybus services - new or longer lines
- **Trolleybus qualities are in demand etterspurte egenskaper**
 - Quiet, fast, no local pollution
 - Based on 100% renewable energy in Norway (hydropower)
- **Energy use and costs are significantly lower than diesel**
 - One-fifth of the energy costs for trolleybuss (1 NOK / km) vs. diesel (5 kr / km) (€ 0,12/km vs. €0,60/km)

International cooperation

- Close cooperation with international actors involved with e-mobility
- Participate if possible in national and EU projects
- Membership and active participation in technical organizations such as UITP / VDV / TrolleyMotion.
- Cooperation and contact with other operators and cities with trolleybus operations or considering trolleybus introduction.



Thank you for your attention!