

Extension of the trolleybus system to the surroundings, Salzburg, Austria



The trolleybus network of Salzburg has a full length of approx. 100 kilometres and 140,000 daily passengers are transported by a modern fleet of 86 trolleybuses. Without the trolleybus system, CO₂-emissions would increase annually by some 60,000 tons in Salzburg.

Background & Objectives

In approximately 60 cities of the European Union, trolleybuses form an integral part of public transport. In Salzburg, the trolleybus network (that consists of 10 lines) and 3 tram lines provide the backbone of public transport. Salzburg's transportation service is complemented by several gas and diesel bus lines. Currently, the trolleybus network of the Salzburg AG has a length of approx. 100 kilometres (61.24 miles). With the planned network extensions and the purchase of new attractive designed trolleybuses in 2012 Salzburg AG expects a further increase of the currently 140,000 daily passengers in the future. Potential for network extensions are extensions of existing trolleybus lines, electrification of existing diesel bus lines and highly frequented diesel bus corridors to the surrounding due to increasing commuter flows.

Comparison between diesel bus and trolleybus

A comparison between the two shows that the running costs (energy, vehicle maintenance and depreciation) for trolleybus operation are lower for average mileages than for comparable diesel bus operation. This is mainly due to the considerably lower energy costs. The maintenance costs for diesel buses and trolleybus, however, are similar. Only the vehicle depreciation costs are slightly higher for trolleybuses. The higher purchase price of trolleybuses can, however, be mostly offset by their longer average life time. On the other hand, trolleybus operation does require investments in power supply. In addition, the impact on the environment is also relevant for a system comparison between diesel bus and trolleybus. Trolleybus operation has the advantage that it is locally emission-free. As the Salzburg AG operates their trolleybuses with water-generated power, no emissions are produced for power generation either.

A study from Eberswalde in Germany also proves the environmental friendliness of trolleybuses, as the study shows that the trolleybus could reduce greenhouse gases up to 95% - from 1,661 g/km (diesel bus) to 80 g/km – based on a green energy mix (mainly wind energy). Anyhow, based on the given energy mix (mainly based on coal) a trolleybus still reduces greenhouse gases by 31% compared to a diesel bus. But, trolleybuses do not only reduce greenhouse gas emissions as mentioned above, as compared to diesel buses, they are able to recharge braking energy and thus save up to 25% of the energy consumption of a trolleybus.

Implementation

In Salzburg concrete use cases were applied to shed light on the effects of network extensions, including the impact on the environment, passenger volumes and economic viability. The results of a passenger survey on the trolleybus service in the recently developed surrounding Hallwang Mayrwies were used to gain information on acceptance of the trolleybus service.

In general, people considered the trolleybus more environmentally friendly as well as more modern and

quiet than the diesel bus. In addition, they believe that trolleybuses contribute to a more positive image of the city of Salzburg.

On a newly electrified route section between Liefering (Austria) and Freilassing (Germany) with a scheduled 20-minute interval for trolleybuses, the existing diesel bus line 24 (with a 30-minute schedule) could be cancelled.

The extension of the existing trolleybus line to Freilassing requires investments in the infrastructure of approx. € 2.7 Mio. In addition, one new vehicle must be purchased. But, bus line 24 can be cancelled and up to 3 diesel buses taken off of the road. The running costs for operation also change. Based on personnel requirements, energy consumption, vehicle maintenance and maintenance of the power generation facilities, an extension of the existing trolleybus line 4 to Freilassing is approx. € 50,000 less expensive per year than the previous operation by diesel buses. This is possible, in spite of the shorter service intervals to Freilassing, as within Salzburg the parallel service of line 24 (diesel bus) and trolleybus line 4 could be cancelled.

Furthermore, with the cancellation of bus line 24, the CO₂ emissions can be reduced by 200 tons per year. In fact, the emission of other pollutants such as particulate matter and NO_x are also reduced.

Conclusions

Trolleybus systems are a proven technology that directly responds to today's challenges concerning new technical and environmental requirements. Trolleybuses reduce energy consumption and greenhouse gas emissions and thereby foster the achievement of EU's climate and energy targets to reduce greenhouse gas emissions by 60 % by 2050. And surveys conducted on the acceptance of trolleybuses in Salzburg show that passengers and citizens evaluate trolleybuses as mostly positive. Trolleybuses are considered environmentally friendly. In the given example for the trolleybus network extension from Salzburg to Freilassing, the diesel buses along the densely populated axis between Freilassing and Salzburg could be cancelled and the greenhouse emissions can be reduced by 200 tons per year. An analysis of the economic viability of the network extension indicates a higher level of service provided by a trolleybus at less operating costs than for the diesel bus line.