



UNIWERSYTET GDAŃSKI
Katedra Rynku Transportowego



Trolley

Economic analysis of diesel buses conversion into trolleybuses in Gdynia

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The Organisation of the Local Public Transport in Gdynia

- In the city of Gdynia, the local public transport services are organized by the Board of Municipal Transportation (BMT) in the form of a budgetary unit.
- The BMT employs seven bus operators and one trolleybus operator. The latter, servicing links within Gdynia and Sopot, constitutes 26% of the exploitation work organized by the BMT within 7 administrative areas (gminas).
- The trolleybus operator is organized in the form of a Limited Liability Company, which was founded on January 1st 1998 after being excluded from the joint bus and trolleybus company.

The Fleet of Trolleybus Transportation Company at the Beginning of its Functioning in 1998

The Trolleybus Transportation Company in Gdynia (TTC) in 1998 owned a fleet consisting of vehicles manufactured by the Jelcz company. The vehicle which dominated the make-up of the fleet was a Jelcz PR110 E model manufactured between the years of 1987 and 1992. All vehicles, both old and new, were high-floor models, what had a negative influence on the image of trolleybuses in comparison to buses, which, starting in 1996, were increasingly becoming a low-floor fleet. However, all but one of the newly manufactured trolleybuses bought by the TTC in the first three years of the company's existence were still high-floor models.

The Beginning of the Structural Changes of the Trolleybus Fleet



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- BMT and TTC commenced action directed at the structural change of the trolleybus fleet. Consequently, the Solaris Bus&Coach company, together with the local company Trobus Gdynia, manufactured the first low-floor vehicle Trollino 12.
- The most restricting factor in the exchange of the old fleet by the TTC was the price of a modern trolleybus vehicle which was approximately 75% higher than the cost of an identical bus model.
- As a result, in 2001-2003 only 5 vehicles were purchased by the Company itself. Owing to this, a decision was made by the TTC to undergo the conversion of low-floor Mercedes O 405 N buses into trolleybuses.

The Main Aim and the Stages of Diesel Buses Conversion into Trolleybuses

- The main aim of the conversion was to increase the number of low-floor buses which would be of both a modern and durable construction.
- The equipment installed on the vehicles converted at the first stage of conversion (2004-2008) was taken from old vehicles and was based on a direct current engine.
- At the second stage of conversion (2009-2010) the vehicles were equipped with new alternating current engines and a power electronic traffic control system.

The Range of Diesel Buses Conversion into Trolleybuses

- In 2004-2010, 22 out of 28 converted vehicles were fitted with an engine and steering system taken from the old vehicles. One vehicle converted in 2008 was equipped with a transitory solution, whilst 5 more recently converted vehicles were equipped with a fully innovative engine.
- Considering the different reasons for the conversion of the old buses into trolleybuses at the first and second stages, its economic efficiency should be determined for each stage with the exception of one vehicle which incorporated a transitory solution and as such should be treated as a separate element of the assessed group.

Duration of the Conversion of the Vehicles

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- The time devoted to the conversion of particular vehicles lasted between 3 to 8 months. In the case of 24 vehicles the smallest time frame was required.
- The longest conversion (8 months) was the conversion of the first vehicle at the second stage. It was a conversion which included the implementation of a new system. The long duration of its conversion resulted in its higher price.



The Relation and Differences between the Initial Value of the Converted Vehicles and the Brand New Trolleybuses at the First Stage of the Conversion (2004-2009)

The scale of the analysis	Initial Value of the Converted Vehicles [PLN]	Initial Value of the Brand New Vehicles [PLN]	Relation between the Values of the Converted and Brand New Vehicles [%]	Difference between the Values of the Brand New and Converted Vehicles [PLN]
Total	6 720 836	25 680 071	26,17	18 959 234
Average	305 492	1 167 275	26,17	861 783

The average relation for 22 vehicles amounted to 26%, which means that at this stage, on average 4 converted vehicles were introduced for every brand new trolleybus. The functional effect of the more rapid introduction of low floor trolleybuses was achieved.

The Relation and Differences between the Initial Value of the Converted Vehicles and the Brand New Trolleybuses at the Second Stage of the Conversion (2009-2010)

The scale of the analysis	Initial Value of the Converted Vehicles [PLN]	Initial Value of the Brand New Vehicles [PLN]	Relation between the Values of the Converted and Brand New Vehicles [%]	Difference between the Values of the Brand New and Converted Vehicles [PLN]
Total	2 867 963	7 756 200	36,98	4 888 236
Average	573 592	1 551 240	36,98	977 647

An average relation for 5 converted vehicles at the time amounted to 37%, which means that on average 3 converted vehicles were introduced for every one brand new trolleybus at this stage. The functional effect of a quicker introduction of low floor buses together with an additional exploitation and economic effect of a smoother drive and a lower power consumption were achieved.

The Third Stage of Conversion in the Years 2011-2012

- The positive perception of the conversion of used vehicles, in both technical and economic aspects, resulted in the decision of TTC to continue the process.
- In the third stage of conversion, two modern Mercedes 0 530 Citaro were converted into trolleybuses. These vehicles are equipped with AC which distinguishes them from the other converted vehicles.
- They also have a stronger backup drive, which allows them to travel more kilometres without the power tracks. As a part of the third stage of the conversion a new project involving two Solaris Urbino 12 buses was taken on. The conversion of the first one will be ready at the end of this year.

Summing up the Economic Analysis of Diesel Buses Conversion into Trolleybuses

- the procedure of conversion of used buses into trolleybuses in TTC can be perceived as being economically efficient.
- Due to the conversion the process of exchange of the old fleet for new low floor vehicles was substantially quickened.
- Particular exploitation and economic effects were also achieved.

The Structure of TTC Fleet in the year 2012

- In 2012 the make-up of the fleet of TTC is dominated by low-floor trolleybuses, which constitute 95% of the entire fleet of this operator.
- 35% of these vehicles were obtained by conversion, which means that about one out of 3 vehicles was previously a low floor bus.
- The vast majority of the brand new vehicles within the TTC fleet are a result of the company's participation in two EU projects. As part of the project 38 vehicles were purchased and partially financed by the EU.
- This, in turn, means that only 13 low-floor vehicles were obtained in other way than as a conversion or part of an EU project.