PLATON –

Planning Process and Tool for Step-by-Step Conversion of the Conventional or Mixed Bus Fleet to a 100% Electric Bus Fleet

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Procedure EC-Compare

Calculation of energy consumption by an electric bus using data of similar diesel bus

Description and user's manual

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1 Introduction

The EC-Compare procedure is designed to calculate the energy consumption of an electric bus on a route taking into account fuel consumption of a diesel bus similar in weight [1]. The result is energy consumption by the electric bus under the same conditions as of the diesel bus-analog.

The EC-Compare procedure is implemented in the Excel file: EC-Compare.xlsx.

2 System requirements of the EC-Compare

To realize the procedure EC-Compare, the personal computer with OS Windows and Microsoft Excel application is used.

3 Objective of the EC-Compare

Objective of EC-Compare is to calculate the energy consumption for an electric bus using data on energy consumption of a diesel bus on the same route and take into their different Tank-to-Wheels (TTW) losses and the ability to recover the energy of an electric bus.

4 Input data for the EC-Compare

Input data are presented in Figure 1.

	A	B	C
1	**EC-Compare**		
2			
3	**Input data**		
4	1) Route data		
5	Route length, m	7960	
6	Total driving time, including stops, s	1390	
7			
8	2) Bus data		
9	(Remark. Diesel and electric buses should be about the same weight!)		
10	2.1 Diesel bus		
11	Effective efficiency of the diesel (default is 0,23)	0.23	
12	Transmission efficiency (default is 0,90)	0.92	
13	Coefficient taking into account the diesel power consumption for equipment drive (by default 1.05)	1.05	
14	Calorific value of diesel fuel (default is 43.12 MJ/l)	43.12	
15	Diesel bus fuel consumption (default is 37.40 l/100 km)	37.40	
16	2.2 Electric bus		
17	Maximum electrical power of auxiliary system or its subsystems with battery energy consumption, kW	6.00	
18	Average efficiency of the invertor (default is 0.98)	0.98	
19	Average efficiency of the motor (default is 0.95)	0.95	
20	Average efficiency of the transmission (default is 0.95)	0.95	
21	The degree of energy recuperation on the route (default is 10%)	0.10	
22			

Figure 1 Input data for EC-Compare

5 The core of the EC-Compare

The Excel file of the EC-Compare provides the intermediate calculations presented in Figure 2.

22		
23	**Intermediate calculations**	
24	TTW1 (diesel)	0.212
25	The energy expenditure of a diesel bus per km of the route, MJ/km	16.127
26	Energy for movement, MJ/km	3.250
27		
28	TTW2 (electric bus)	0.884
29	Energy consumption of the electric bus for movement	
30	MJ/km	3.307
31	kWh/km	0.919
32	Energy consumption for the entire auxiliary system of the electric bus	
33	kWh/km	0.291
34		

Figure 2 Intermediate calculation

6 The outputs of the EC-Compare

The final result of the EC-Compare is the total energy consumption of the electric bus (for movement and entire auxiliary system), kWh/km (see Figure 3).

34		
35	**Final result**	
36	Total energy consumption of the E-bus (for movement and entire auxiliary system), kWh/km	**1.210**

Figure 3 Final result of the EC-Compare

References

1. Algin V. (2019) *Calculated Modes for Assessing Operation Properties and Dependability of Vehicles*. In: Uhl T. (eds) Advances in Mechanism and Machine Science. IFToMM WC 2019. Mechanisms and Machine Science, vol 73. Springer, Cham, pp. 3749-3758, doi: 10.1007/978-3-030-20131-9_370