

**Recommendation for ideal  
Funding Instruments for Urban  
Electric Buses**

<b>Deliverable n°</b>	<b>D51.7</b>
<b>Version Date</b>	<b>05.09.2018</b>
<b>Nature of Deliverable</b>	<b>External</b>
<b>Dissemination Level</b>	<b>Public</b>
<b>Status</b>	<b>Issued</b>

<b>Issued by</b>	<b>Project Director</b>
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**PROJECT ACRONYM: ZeEUS**

**PROJECT FULL TITLE: ZERO EMISSION URBAN BUS SYSTEM**

**GRANT AGREEMENT NUMBER: 605485**

**SUMMARY SHEET**

Programme	Seventh Framework Programme
Contract N.	605485
Project Title	Zero Emission Urban Bus System
Acronym	ZeEUS
Coordinator	UITP – International Association of Public Transport
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Website	<a href="http://www.zeeus.eu">www.zeeus.eu</a>
Starting date	1 November 2013
Number of months	42 months

Deliverable n°	D51.7
Deliverable Title	Recommendation for ideal Funding Instruments for Urban Electric Buses
Project Title	Zero Emission Urban Bus System
Version	1
Date of issue	05.09.2018
Distribution	External
Dissemination level	Public
Book captain	
Abstract	Deliverable 51.6 has analyzed the different framework requirements to finance public transport and especially shown the different funding schemes in the European Member States. It's important to promote the exchange of information of the electric bus operators. Within the framework of the ZeEUS project more than a dozen different organizations and transport companies were contacted and surveyed about their operating experience in funding electric busses and their valuation about the further development of the funding and financing schemes.
Key words	Funding schemes, electric buses, expert interviews

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**DOCUMENT CHANGE LOG**

Version number	Date	Main area of changes	Organisation name	Comments
1	11/07/2018	Elaboration	VDV	
	05/09/2018	Consolidation and Finalisation	VDV	

**CONTRIBUTING PARTNERS**

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## 1. EXECUTIVE SUMMARY

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The previous report D51.6 has analyzed the different framework requirements to finance public transport and especially shown the different funding schemes in the European Member States. It's important to promote the exchange of information of the electric bus operators. Within the framework of the ZeEUS project more than a dozen different organizations and transport companies were contacted and surveyed about their operating experience in funding electric busses and their valuation about the further development of the funding and financing schemes.

The interviews with twelve questions were hold with a questionnaire and by telephone. The results are presented in this report.

## 2. ENCOURAGE AN EXCHANGE EXPERIENCE ON NATIONAL AND EU FUNDING WITHIN THE SECTOR

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Deliverable 51.6 has analyzed the different framework requirements to finance public transport and especially shown the different funding schemes in the European Member States. It's important to promote the exchange of information of the electric bus operators. Within the framework of the ZeEUS project more than a dozen different organizations and transport companies were contacted and surveyed about their operating experience in funding electric busses and their valuation about the further development of the funding and financing schemes.

The interviews with twelve questions were hold with a questionnaire and by telephone. The interview gave the following results.

### ***1) The costs of procurement and operation are much higher with the use of electro mobility concepts. Do you think the costs can be covered by (increased) ticket prices?***

The respondents agree with the thesis about higher costs with the use of electric mobility concepts. The increased investments and operating costs for electric busses cannot be covered by the current tariffs. Ticket prices are fixed by the local transportation authorities and not by the public transport operators. In some Member States the ticket prices must be authorized by the local authorities. Increased ticket prices are generally contra productive to promote the use of public transport. Increased ticket prices would decrease the popularity of public transport and negating the efforts for the electrification of the public bus system. One respondent gave the information that costumers will pay about 15 % more to ride on full electric vehicles.

### ***2) Is there a funding for the introduction of electric buses by public authorities necessary (state, federal government, European Union)?***

Yes, for all respondents any funding is welcome at any political level. Current funding isn't strong and continuous enough. Currently there is no funding program at the European Level for electric busses. Most national states have no funding program too. The higher costs with electric mobility concepts were completely covered and financed by the local transportation authorities. The local authorities and transport companies need mid-term funding programs that are currently not available.

### ***3) Should there be a financing from state or federal government side next to the financing by the local authority districts?***

Yes, the respondents fully agree. State government should incentivize funding for the local public transportation authorities. A common financial effort at all governmental levels is necessary.

### ***4) Do local authority districts meet the financial challenges for the electrification of the public transportation?***

The local authorities meet the financial challenges partially. As well at the local level there is no funding for electric busses. The regions aren't able to meet the financial challenges of the electrification without a significant change in the way the budget is designed. Financially strong regions (e.g. Bozen) are able to achieve a financial contribution to support electric



busses. The regions can't launch independently financing programs. There's a very limited availability of European funds or funds of national level.

***5) Should there be a European framework of financing programs to be part of the implementation of electric buses?***

The respondents answered clearly with Yes. This kind of funding is very relevant for the local authorities and transportation companies. European projects like in Horizon 2020 are funding only new innovations but not the run-up of upcoming technologies like electric busses. For the run-up of electric busses high scale of investments are required. European Union should launch an investment plan for ecological and sustainable mobility. Some respondents propose a common European legislation or framework for sustainable mobility. This would give a standard framework that is generally known in all Member States and could be used. The respondents estimate that the standard framework would be a better system that shows quicker results and allow a adequately broad time schedule.

***6) Should there just be one funding / financing organization or should there be a combination of different financing programs (state, federal government, European Union)?***

The most respondents don't think that a single funding is feasible and prefer a combination of concordant funding programs. Some respondents argue that different political levels have different visions and ambitions. Technically a single funding programmed would be easier to handle by the local authorities and transportation companies. There should be a strong commitment from EU and the Member States. The European or the national or state level should cover the additional costs for the electric part of the bus, involving the local. The local authorities continue funding the conventional part of the bus.

***7) The financial participation of state, federal government, European Union can be a subsidy / grant (typical funding) or a public subsidized low-interest loan = credit financing. Which model is preferable?***

The majority of the respondents prefer typical funding or a fund for sustainable mobility. For the respondents credit financing and debt are not an option. The regions cannot go into debt and debt should be generally avoided. EU should allow regions to increase their debts for sustainable projects. For some respondents political subsidized low-interest loan is more coherent with an economical management of the transportation companies. Maybe both programs – subsidy / grant and low-interest loan – should be offered.

***8) A change to an electro mobility system is not only a change of the powertrain. All parts of the systems are affected. What should be funded?***

The respondents agree that the main cost expensive investments of the electro mobility system should be covered by public funding, especially vehicles and charging infrastructure. Some respondents answered, that the main infrastructure investments and the re-construction of the depot and workshop, construction work for the energy network should be founded.

***9) Due the Commission Regulation (EU) No 651/2014 the funding quote for vehicles is bounded to 40 % in regards to the increased costs for electric buses compared to the diesel buses. An increased funding quote has to be notified in advance at the European Commission.***

***How high should be the funding quote to meet the financial requirements and should it be all the same quote for all affected parts of the system?***

Some respondents differ the funding quote between vehicle and charging infrastructure. The quote for vehicle investment should be “minimum 50 %”, “more than 50 %”, “not less than 70 %” or “around 75 %”. The quote for charging infrastructure investment should be “more than 50 %”, “more than 70 %” or “around 75 %”. All required funding rates are above the present European level. Some respondents see reduced rates when the prices will decrease in the future. To respondents gave no information’s about the funding quote. One respondent answered that the current sold electric buses are strongly subjected to “technical obsolescence” and there’s a rapid evolution of the technical solutions e.g. for batteries. Therefore 100 % of the purchasing costs of electric busses should be covered by funding.

***10) Is a subsidy per electric bus km more applicable than the typical funding described above?***

The respondents answered similarly with Yes and No. This solution is preferable and gives more value to the service to the costumers. It seems to be a good solution but is often not favored at the regional level. The real operating costs of electric public transport aren’t currently well-known so that’s difficult to calculate the amount of the subsidy.

***11) What other financing models can you think of to enable the switch to electric buses?***

Some respondents think about batteries leasing or long term rent. Many respondents made comments about the costs and taxation of energy. They wish lower and subsidized costs of energy, e.g. reduced energy tax for the electric drive.

***12) How is the general experience with fundings?***

The experience of the respondents with funding depends on the political drive. The funding is not continuous and strong enough.

The answers of the respondents differ by nations and regions. They all have different schemes in financing and funding public transport. Lots of combined tendencies can be found in the answers but some contentious issues as well.

### **3. ANALYSE THE FUNDING SYSTEMS IN DIFFERENT MEMBER STATES IN CONJUNCTION WITH THE EU LEVEL IN ORDER TO IDENTIFY A COMPREHENSIVE ARRANGEMENT**

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The funding systems had been already analyzed by the document 51.6.

The outcome of the questionnaire and the findings of 51.6 show clearly big differences in all Member States if it comes to funding and financing public transportation, especially the introduction of electric buses.

- The range of funding quotes in different country's spreads from 40 % - 80 % and also the fundable items are different.
- Combination of European, federal government and state funding systems is unclear.
- Higher operation costs for the whole system are mostly not addressed in funding schemes, yet it can be one off the most effect full tools to fund the alternative engine.
- Funding programs mostly demand a technical innovation to be applicable, which will be not the case by just converting diesel buses into available battery electric bus systems.
- Funding programs have a certain run time, which is mostly quite short for such big projects.
- Additionally the buildup of the energy network is not funded.

Also looking at the technical state of the art, there are still issues to solve.

The main technical conclusion from the European E-Bus Projects is that the achievable range of full battery electric buses is still not acceptable, especially with "overnight charging" systems. Projects with opportunity charging systems are running nearly the same routes as diesel buses, but need more time for charging at the end stop and the infrastructure for these systems are much more expensive and complex, since it is build up on public space. The increase of the energy capacity of batteries is not expected within the next five to ten years to fulfil the general requirements of the operator at the moment. Also battery electric buses are technically dependable, but not as diesel vehicles.

In order to solve these technical issues the operators have to adapt their lines, increase their bus stock and the number of drivers, which producing additional operational costs.

Regarding these subjects operators have to adapt to a complicated funding concept and new technology, which is available and stable, but just at the start of its development.

Therefore it is required to optimize the funding systems to overcome the technical issues and motivate operators to a fast switch from diesel to battery electric bus systems.

## 4. COLLECT A LIST OF REQUIREMENTS TOWARDS THE “IDEAL” FUNDING INSTRUMENT FOR ZERO-EMISSION BUSES

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The evaluation of the funding systems and the questionnaire of the European Member States has identified a list of requirements to have the ideal funding instrument for zero emission buses.

### 4.1 100% percent funding of all increased investments and running costs

The technology of zero emission buses is on a high level, but there are still developments to be expected. In general it is the achievable range and durability of battery electric buses, which are influencing the whole system approach and can change the investment towards the system drastically. The state of the art battery can guarantee a range of about 200 km with all climatic influences on its best, but the operators are requiring 300 km to cover the range of all diesel bus lines. To cover the lines the operator has to split the lines or introduce more buses and also drivers to reach the same performance as a diesel bus.

Another approach is the introduction of opportunity charging on the road, mostly on the end stop of the line to manage a high range. This requires additional infrastructure on the route, which can lead to uncalculatable costs due to the many uncertain conditions and the electric connections at these spots. Additionally the break times of most lines at the end of the stations are mostly not sufficient today to charge the batteries to target the daily range. This results in changing the time table of the bus or operate an additional bus to ensure a sufficient charging process. Since an improvement of the battery is expected, there will be the question what to do with this infrastructure if it is not needed anymore.

Focusing on the battery there are also uncertainties to the real lifetime at the moment. Also the future changeability with improved batteries with more energy capacity is in question. The maximum reachable range is also effecting fleet management on the depot since a calculation on a daily base is required to send a specific bus to a specific route, depending on their state of charge, climate conditions to ensure the operation. Also the required energy on the depot or the route has to be build up and usually not available in the grid.

All these factors are showing that in addition to the increased investment costs for:

- The vehicle
- And charging infrastructure

There should be a funding for the increased costs of:

- Build-up of electricity network
- Fleet Management system with Charging Management system

And also the increased running costs for:

- Additional drivers
- Additional buses

To these so far not identified funding areas the funding should be raised to 100 % for all increased costs, since there are future uncertainties, which aren't calculable at the moment.

## **4.2 Continuous mid-term funding programs**

The majority of the current funding directives in the Member States are short-time oriented with a period of two or three years. The bus operators require a longer time up to ten years to change the whole fleet. Transport companies and local authorities need continuous mid-term or even long-term funding programs. These programs should just focus on the switch from diesel to zero emission drives, without containing technical research goals.

## **4.3 Update of the standard European framework (EU) No 651/2014 for higher funding rates for electric buses and main cost expensive investments**

The Commission Regulation (EU) No 651/2014 is the present European framework for funding directives, granted the acquisition of new transport vehicles on road complying with adopted Union standards (Article 36 4 (a)). The current aid intensity shall not exceed 40 % of the eligible costs (Article 36 6). Funding directives with higher aid intensity must be authorized individual by the European Commission and take up to half a year. In the questionnaire all respondents answered that the funding quote should be obvious above 40 %. So Article 36 6 of Commission Regulation (EU) No 651/2014 should be modified for zero emission buses and allow an aid intensity not exceed 75 % of the eligible costs. This rule should be valid for the main investments e.g. charging infrastructure, re-construction of depots and workshops and construction work on the energy network.

With this update of Article 36 6 the Member States get more flexibility to create mid-term funding directives without losing time for the notification by the European Commission. This change on (EU) No 651/2014 is key relevant to support zero emission bus systems and will economize current proceedings. The funding rates can be reduced when the prices for zero emission buses will decrease in the future.

## **4.4 Update of the standard European framework (EU) No 651/2014 for cumulation of European, national, state and local funding possibilities**

Article 8 of the Commission Regulation (EU) No 651/2014 regulate the cumulation of subsidies. In the questionnaire the respondents prefer a combination of concordant funding programs but it's frequently unclear if the cumulation of subsidies to support zero emission buses is allowed and up to which level. It would be a very strong commitment of the EU to permit the cumulation of subsidies for zero emission buses on different federal levels in article 8 of Regulation (EU) No 651/2014. So the European, national or state level are allowed to cover the additional costs for the electric part of the bus and the main cost intensive investments. The state and local authorities continue funding the conventional part of the bus as funded before.

## **4.5 Allow funding in terms of leasing and renting**

Some of the current sold electric buses are strongly subjected to "technical obsolescence" and there's a rapid evolution auf the technical solutions e.g. the batteries. Instead of buying buses and technical infrastructure the leasing or renting of the full or of parts (e.g. the batteries) of the zero emission bus system is another model upcoming of ownership. With that the operator doesn't have to deal with the lifetime durability of the vehicles and get a reliable calculation, even if the technology does not perform over the time. Current funding schemes usually allow the buying model of ownership. The enhancements of the funding



schemes on each federal level should allow upcoming models of ownership, like leasing or renting.

#### 4.6 Reduce of the electricity tax for the electric drive within a standard European framework

The most respondents of the questionnaire gave comments about the high costs and taxation of energy for the electric drive. As described in document 51.6 the level of the electricity tax rate is a key factor for the economic successful operation of electric buses. Article 5 of the Council Directive 2003/96/EC of 27. October 2003 permits the reduction of the energy tax rate to the EU minimum tax rate of 0,50 euros/MWh or the full exemption from the energy tax for public transport. 25 of the 27 EU Member States make use of the reduction options (see figure below). 18 of the EU countries grant the total exemption from the energy tax ore use the minimum tax rate of 0,50 euros/MWh and a further seven EU Member States raise an energy tax of 5,0 euros/MWh or less. Only Germany and Austria have a tax rate above 10,0 euros/MWh and belong to the tail lamp in Europe.

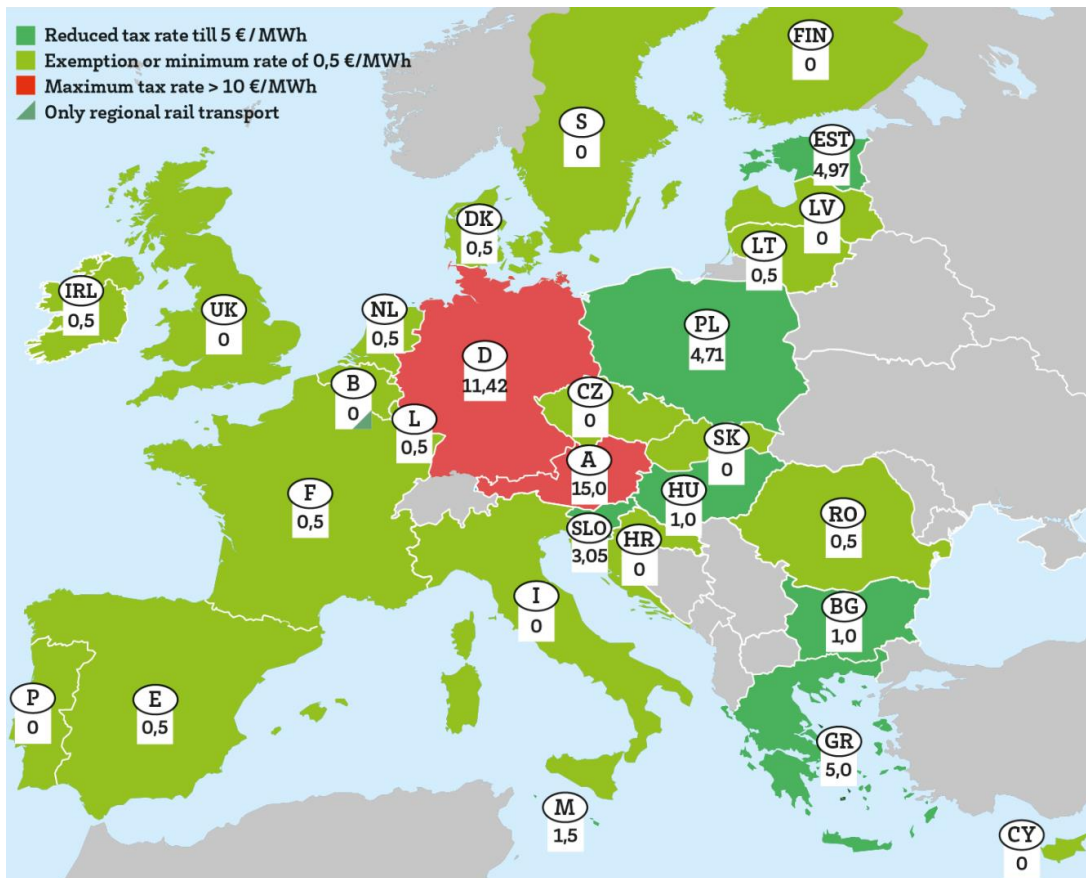


Figure 1. Overview over the level of energy tax on public transport across Europe in 2016/17

EU should use fiscal guidance more consequent to promote electric public transport and especial zero emission electric buses. EU Regulation that permits the reduction of the energy tax rate shouldn't be optional but rather mandatory for the Member States. At the moment there's a rag rug in the EU of energy tax on public transport. The respondents of the questionnaire prefer a standard and mandatory European framework.