

# City electric transport preferences and motives of the Russian students

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**Abstract.** The share of electric transport in Russia is very small. Many cities refuse operation of urban electric passenger transportation. Basic reasons of it are high cost value and expensive operation. In Moscow the emphasis is placed on development of rail electric transport. It provides fast movement and pollutes the city environment less. The Moscow students understand that for an urban transportation ecological compatibility and safety are important but they choose buses and individual cars with the internal combustion engine for daily use. The main criteria of the choice are the speed and comfort. Ecological compatibility of the individual transport costs on one of the last places.

## 1. Introduction

During its existence history electric city passenger transport has endured a set of reforms. After several unsuccessful management decisions, that were made in the nineties XX centuries, the number of the cities in the Russian Federation where electric transport was earlier successfully operated, decreased with 121 to 110. Today in "a risk zone" there are 19 Russian cities. Movement of trolleybuses and trams of Vladivostok, Kaliningrad, Chelyabinsk, Lipetsk and Rostov-on-Don is under the threat of closing. Low tariffs for passengers` transportation are one of objective problems of city electric transport. [1, 2] At the same time low level of living in many cities doesn't allow to raise the freight charge since it will significantly lower passenger traffic [3]. This reason of decrease in number of the electric transport in Russia is not singular. Significant factor is high cost in case of the following route expansion (laying of tunnels, stacking of rails, the structure of contact network, parks of servicing and repair, etc.). The bus fleet in this aspect is much cheaper.

But recently in the world the concern on the environment and the economic risk connected with oil production are growing. It forces all countries to look for more eco-friendly technologies in development of transport. Electric transport can play a crucial role in the fight against climate change, improvement of air quality, decrease in noise pollution and decrease in energetic dependence. The transport industry offers various versions of engines which allow reducing fuel consumption and CO<sub>2</sub> emissions [4].

However the engines using alternative energy sources still haven't gained mass recognition around the world. For clarification the reasons in the different countries the researches "population relation to the sustainable transport, including to the electric transport" are conducted. The positive relation to electric motors is connected with their operation profitability and environmental friendliness. Negative responses are caused by generally high price and technical shortcomings. It forces carmakers and scientific laboratories to conduct new and new researches and developments [5-8, etc.].

Researches among youth are of special interest [9]. It is not only the potential consumer, but the



important ecological information distributor [10]. Young people are those who will make decisions in transport sector and in urban policy in the near future.

The purpose of the real research is to study the relation of Moscow students to electric city transport at the moment and their plans of using eco-friendly transport in the future.

The target group is chosen not incidentally. First, students at the age of 20 years are the most active part of the population. Secondly, the relation of students to city transport will help to plan the direction of his development and modernization. Thirdly, in 2-3 years they will begin to work and will be able to buy cars. It is important to know their opinion for planning of the market of electric vehicles and cars with the hybrid engine.

## 2. Methods

In this research the method of the analysis of the documents which are in open access, and also information placed in media is used. This method allows defining real situation in operation of electric transport in Russia. For assessment of the people relation to city electric transport the scientific method of sociology poll (questioning) is used. In 2016-2017 at the Moscow State University of Civil Engineering the sociological research with use of specially developed tools (questionnaire) has been conducted. Students aged from 17 up to 20 years participated in a research. Total of respondents is 186.

We have defined by the questionnaire:

- permanent residence (Moscow or other cities, including suburb);
- relation to the Moscow city electric transport;
- the fears and fears connected with use of electric public transport;
- valuable priorities at the choice of individual and city public transport;
- existence of the privately owned vehicle with the electric or hybrid motor and desire to get him.

## 3. Results

Primary analysis of poll results has allowed dividing respondents into two groups. The first group (34%) was made by the students who are constantly living in Moscow. The second group (66%) was made by the students who are constantly living in the suburb of Moscow or in other cities of Russia. For brevity a further statement we will call them "The first group" and "The second group" respectively.

From the official reports analysis [11] it is known that in the last decade the ratio of city electric passenger transport changes towards increase in a share of electric trains, including the underground and easy subway. There are new lines of the subway and city electric trains, the number of structures increases. At the same time the number and extent of trolleybus and tram routes decreases. Trolleybuses and trams, generally ply on the old central regions of the city. Here cultural and leisure and business infrastructure is located. Density of inhabitants is rather small. Suburban dormitory areas, on the contrary, have dense population which is twice a day forced to reach the place of work and back. Most quickly it can be done only on the transport having own lane. These are electric trains and the subway. The emphasis in development of city transport infrastructure is placed on them [12]. Such administrative decisions find reflection in perception inhabitants. 77% of the students interviewed by us consider that in recent years the volume of electric transport in Moscow has increased, 20% - consider that has decreased, and 3% - hasn't changed. Significant distinctions between answers of The first and The second group aren't revealed.

The question "What electric city transport is in that area, where do you live?" of 59% of students was answered "electric train", 47% - the trolleybus, 40% - the tram, with 21% - the subway, 8% - any (only participants of the Second group have so answered). To complete the picture we will note that in five to a kilometer zone from university all listed means of transport meet. The electric train is city transport according to 37% of respondents from the First group and 71% from the Second group. For most of students of the Second group the electric train is the only electric transport in the hometown. Preference is given to transport which uses traditional hydro carbonic fuel. These results confirm official data on low electrification of transport in the towns of Russia [13]. The provided answers show that most of Muscovites carry an electric train to suburban transport and doesn't see the prospects of using it as city

transport. Perhaps, over time this relation will change after commissioning of the Moscow central ring [14].

Students' preferences at choosing of city transport for short (to 5 km) trips are given in Figure 1. Respondents could choose several possible answers.

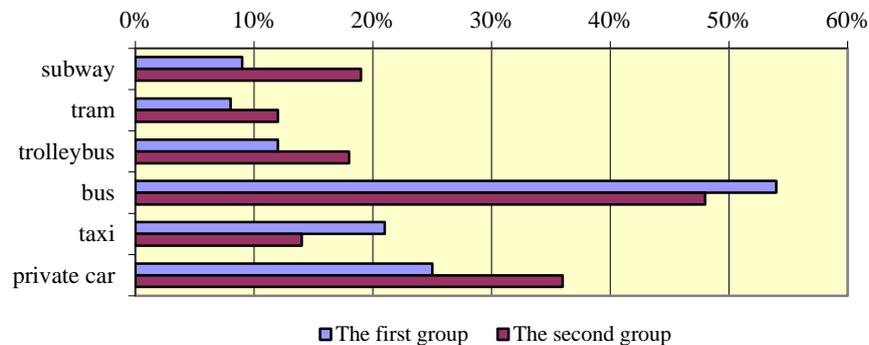


Figure 1. The transport choice for short city trips.

Students explained the reason of the choice in comments. Most often they specified the movement speed, comfort (irrespective of a transport type). The decisive reasons of the public transport choice were low price in comparison with the individual transport, the special allocated lane without traffic jams, personal preferences ("is pleasant").

The given results show that ecological motives of the vehicle choice at students are almost not shown. At the daily choice environmental transport friendliness isn't considered. Preference is given to the buses using traditional hydro carbonic fuel. Though it is known that one Euro-3 standard bus in 14 hours of operation gives exhausts so much, how many 343 cars together. The main reason for the electric transport choice (the subway and the tram) is an opportunity to move quickly around the city to rush hours. Points out 96% of respondents at the choice of transport for distant city trips this quality.

Muscovites and guests of the capital consider electric transport more dangerous to residents, than traditional buses. On a direct question 56% of respondents have answered that electric transport is more dangerous. The comparative ideas analysis of electric vehicles safety is provided on Figure 2.

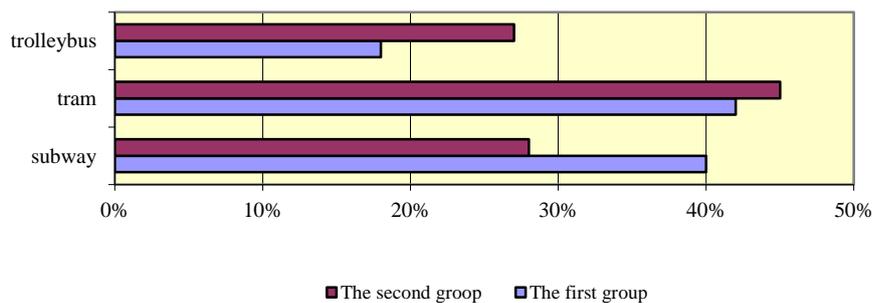


Figure 2. Idea of city transport safety.

In the drawing it is visible that ideas of electric city transport safety in two groups were divided. Residents of Moscow consider the least safe transport for citizens the trolleybus. Reasons: the old worn-out cars, frequent breakages, low manoeuvrability on streets, accident with other participants of the movement, sparking in contacts and wandering currents. Residents of other cities consider the trolleybus and the subway equally dangerous.

Dangers of the subway: terrorist attacks, falling on rails, very large number of people, the closed space. On set of answers the safest city transport can be considered the tram. But for some respondents and it constitutes danger since has unenclosed ways, has accidents, has the high noise level and vibrations and at stops pedestrians come to the carriageway. Dangers of city transport on hydro carbonic fuel, which were called by students, are accidents and pollution of the atmosphere.

Thus, students realize the environmental problems connected with use of hydro carbonic engines on transport. The following results show, their ecological consciousness is how deep.

Ecological consciousness reflects real practice of the relations between the person and the environment of his lives between society and the nature [15]. The ecological consciousness structure distinguishes three enough independent a component: ecological knowledge, an ecological situation assessment and ecological behaviour [16]. For our research the most considerable component is ecological behaviour. It shows assimilation depth and ecological knowledge adoption by the person and sincerity of an ecological situation assessment.

The ecological values place was defined by the question "Range the transport characteristics importance for you personally and for the city environment" (1 – the high importance, 7 – the low importance). Results are given in tables 1 and 2.

As you see, valuable orientations at the transport choosing "for me" and "for the city environment" significantly differ in both groups. Ecological knowledge is brightly shown at transport assessment for safe operation in the city. On the first places students have put it such qualities as environmental friendliness, safety and profitability of operation / the taken place on city streets. These qualities provide the maximum comfort for all citizens, even for pedestrians. Economic characteristics hold the fourth and fifth places of rating, and comfort of passengers – the last. Speed of movement was around the city put on the first place totally by 16% of respondents. This result significantly concedes to transport environmental friendliness. In the given above results speed was one of the vehicle choice decisive factors (watch the comment to figure 1).

Absolutely other significant factors` picture is drawn at the choice of transport "for me". The first positions were taken by speed, comfort and low cost. Environmental friendliness and manoeuvrability on streets were on the last lines of rating. These results show that in students` ecological consciousness there is ecological knowledge, and ecological motives of behavior are still insufficiently created.

Table 1. Transport characteristics ranging. The first group.

Characteristics	Rank place						
	1	2	3	4	5	6	7
	Important for me						
comfort	25%	36%	25%	9%	1%	4%	0%
safety	9%	9%	29%	29%	17%	6%	1%
low cost	1%	12%	32%	19%	16%	9%	12%
environmental friendliness	4%	3%	1%	4%	19%	46%	22%
profitability of operation	3%	6%	0%	38%	14%	19%	20%
the taken place and manoeuvrability on streets	0%	6%	7%	1%	25%	16%	45%
speed	58%	29%	6%	0%	7%	0%	0%
	Important for city environment						
comfort	0%	13%	4%	4%	7%	41%	30%
safety	9%	30%	28%	16%	9%	6%	3%
low cost	10%	19%	14%	25%	9%	10%	13%
environmental friendliness	42%	10%	4%	13%	9%	13%	9%
profitability of operation	12%	16%	6%	19%	35%	3%	10%
the taken place and manoeuvrability on streets	4%	7%	36%	7%	13%	14%	17%
speed	23%	4%	7%	16%	19%	13%	17%

Table 2. Transport characteristics ranging. The second group.

Characteristics	Rank place						
	1	2	3	4	5	6	7
	Important for me						
comfort	26%	32%	15%	13%	10%	3%	0%
safety	17%	14%	26%	25%	10%	4%	3%
low cost	19%	12%	8%	16%	17%	5%	23%
environmental friendliness	0%	0%	15%	19%	20%	12%	35%
profitability of operation	3%	5%	7%	8%	16%	34%	27%
the taken place and manoeuvrability on streets	5%	3%	9%	17%	24%	36%	7%
speed	30%	34%	21%	3%	3%	6%	4%
	Important for city environment						
comfort	2%	1%	10%	23%	7%	21%	36%
safety	5%	28%	18%	13%	22%	11%	3%
low cost	13%	21%	9%	4%	8%	15%	31%
environmental friendliness	49%	13%	12%	9%	5%	3%	10%
profitability of operation	11%	12%	30%	11%	16%	20%	0%
the taken place and manoeuvrability on streets	9%	21%	14%	25%	13%	10%	8%
speed	11%	4%	8%	15%	29%	20%	13%

One more result confirms this conclusion. The question "Will you plan to buy in the future car with the electric or hybrid engine?" was positively answered by 48% of students. They called the most significant qualities of such car – profitability, innovation and environmental friendliness. Significant distinctions of answers on groups aren't revealed. 49% of respondents have answered negatively. The insufficient gas stations number, high cost, unsatisfactory operation of the engine, limited speed are the main reasons for negative attitude. These answers well correlate with results of the Flemish research [17]. The remained 3% don't plan to buy the privately owned car at all.

Now only family of one student has the privately owned hybrid vehicle. 9% have answered that their friends and acquaintances have such cars. This fact demonstrates that ecologically safe cars don't make the sufficient competition to transport with the engines using hydro carbonic fuel yet.

#### 4. Discussions

Insufficient distribution and reduction of electric transport number in the Russian cities has, first of all, the economic reasons: high prime cost and bad payback. Other group of the reasons has social character. Residents of Moscow consider it a good alternative only at trips on long distances and in rush hours. From all types of city electric transport the subway most of all is suitable for these purposes. However, its use exerts negative impact on people mentality [18].

The city electric train can remove a number of the subway negative factors and keep at the same time all his advantages. The Moscow government has included it in uniform the city transport system. But residents of Moscow don't consider it city transport yet.

The electric train analogue on city streets can be considered the tram. But outdated cars, high noise level, frequent crossing with traffic flows and routes` limitation have led to loss of this oldest environmentally friendly city transport popularity.

The least demanded on the Moscow streets is the trolleybus. If its route coincides with a bus route, preference of young passengers is more often given the last. For the city budget the maintenance of a bus fleet costs cheaper, than trolleybus. Therefore on city streets there are a lot of old trolleybuses with inconvenient seats, bad heating and air conditioning, low speed. All this only reduces citizens` loyalty to this type of transport.

Comparative assessment of the city and individual transport shows the low level of ecological consciousness development at the Moscow students. (Research results of ecological motivation at students of the same university are described in [19].) Ecological motives are present into them at the level of knowledge, but at real behavior recede into the background and give way to the motives connected with basic requirements.

Results of a research show that in the next 10-15 years in Russia cars with the electric or hybrid engine won't be able to make the full competition to cars to internal combustion engines. The same tendency is observed also in other countries. Generally, people recognize positive ecological, economic and social advantages of electric vehicles. But residents of Hong Kong do not prefer to buy electric vehicles because of their high cost [20]. Belgians need the car with higher maximum speed and more productive battery [21]. Only the Indian consumers are ready to pay a worthy award for acquisition the car which is friendly relating to the environment. [22].

## 5. Conclusions

As well as in many new technologies, widespread introduction of electric transport on city streets demands not only overcoming technical, but also social problems, changes of mentality of residents of Russia.

Making decision on acquisition and introduction of expensive electric transport is demanded by more time, than, for example, purchase of bread which people make almost automatically. For this purpose the special strategic thinking and high level of ecological consciousness which considers all aspects and consequences of the person and the nature interaction is required. It is possible to create such relation to the environment and the future only on condition of purposeful training and education with the state support.

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