INTERNATIONAL JOURNAL OF INFORMATION TECHNOLOGIES, ENGINEERING AND MANAGEMENT SCIENCE

Energy Intensity in Road Transport and the Need to Reduce It

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Abstract

This article is focused on energy intensity in road transport. We wish to point out that today's transport trends have been constantly increasing, mainly in the road transport of passengers - individuals. This will not decrease in the following decades; for this reason, the European Union member states have been trying to cope with energy intensity and the continually increasing rate of emissions by means of taking measures in the form of various conventions, agreements and regulations. By trying to ensure the increase of the environmental friendliness of combustion engines, they hope to contribute to the decrease of pollutants in the air and to a reduction of the carbon debt. At the same time, they are trying to proceed from fossil fuels to less energy-intensive forms of energy obtained from renewable sources. In this day and age, energy equations have been recalculated all over in combination with economic indicators. It is not easy to switch to a more costly and, at the same time, more ecological system. However, if we want to continue existing on this earth as a society for many more generations, we are compelled to start thinking about our future today. An electric car is, indubitably, a step forward for personal transport, but we also need to consider the resources used during its production and subsequent operation.

Keywords: road transport, energy intensity

Introduction

Road transport in the Slovak Republic, but also in the European Union, is the only transport type characterised by ever-increasing energy consumption. Therefore, this transport segment has become the centre of interest from the perspective of energy efficiency. The logistics services, which are mainly focused on transporting goods and the ever-increasing number of vehicles, are the main contributors to the constant increase in energy consumption in the transport sector. Despite the fact that new types of engines are being continually developed, vehicles with reduced content have been made and fuel consumption by personal and freight vehicles is decreasing, the desired effect of energy saving has not yet emerged. This is due to the fact that the number of vehicles has been steadily increasing.

Transport energy consumption has increased by 60 per cent between 2000 and 2010. Road transport energy consumption has increased since 2000 - mainly due to the increase in the number of vehicles. The most significant increase, up to 2.7-fold to one, has occurred with road transport, however, its transport performance in tonne-kilometres has only increased 1.9-fold. The energy consumption of individual car transportation increased by 7 per cent and its performance increased by 12 per cent.

The factor that contributes to growth the most is the increasing living standards of the population. Energy consumption in rail passenger transport decreased by more than one third, and its performance decreased by one fifth. The performance of road public transport was lowered by 40 per cent. The constant gradual transition from public to individual transport and from rail to the road transport constitutes a risk to increasing the energy intensity of transportation. [1]

Global Trends in Energy Consumption Within the EU

Transport energy consumption has increased by 93 per cent in the EU-13 since the beginning of the 1990s. In 2016, only two EU countries, Estonia and Lithuania,

consumed less energy in transportation in comparison to 1990. The consumption in Latvia remained virtually the same. Seven member states nearly doubled their consumption in the same period, namely the Czech Republic, Ireland, Luxembourg, Poland, Romania and Slovenia. Between 1990 and 2007, transportation energy consumption in the EU was growing steadily. In 2016, three member states succeeded in decreasing transportation energy consumption. Those were France, Italy and the Netherlands. Total energy consumption within the EU was 22 per cent higher in 2016 than in 1990.

In European Union countries, total transportation energy consumption increased slightly by 2 per cent between 2015 and 2016. Maritime, rail and air transport did not increase by more than 4 per cent. In EU countries, energy consumption has increased in all sectors, excluding rail transport. The most rapid increase occurred in maritime transport (15 per cent), followed by air transport (10 per cent). Road transport grew by almost 8 per cent, and inland navigation increased by 2 per cent. Rail transport dropped by 1 per cent.

Energy Consumption in Terms of Political Reduction Efforts Within the EU

Current policies that only address the increase in efficiency of the energy consumed by vehicles will not be sufficient for ensuring a long-term reduction of road transportation energy intensity. Further development must be conditioned by optimizing logistics chains and using transport and infrastructure more efficiently through improved traffic management and information systems, advanced logistics and market measures, such as a development of an integrated European rail market, elimination and reduction of road accident removals, and so on.

In May 2014, the member countries of the European Economic Area adopted the Athens Declaration, which increasingly emphasized the role of maritime short-distance transport and strives to remove long-distance traffic from roads and tackle capacity, energy and climate issues. This is based on the White Paper on Transport, which aims to transfer 30 per cent of road freight transport by transferring more than 300 km of road to other types of transportation, such as rail or water transport, by 2030, and more than 50 per cent by 2050. This should be managed using effective and "green" freight transport corridors. In 2015, the implementation of the White Paper on Transport was revised. The support for the objectives and the need for a global strategy for eliminating carbon emissions was accentuated there again.

Figure 1 – Traffic Jams [4]

EU Has Set These Objectives

By 2020, Member States of the European Union should move towards a 30-percent reduction in greenhouse gas emissions in comparison to the level from 1990 in the context of a global agreement and a unilateral reduction by 20 percent.

The EU's plan to switch to a low carbon economy in 2050 calls for greenhouse gas emissions to be cut by 80 per cent by the same year to act as a global climate change prevention measure.

Should the political frame that was proposed in January 2014 be adopted by 2030, these objectives will be gradually met. Further objectives will be set to reduce greenhouse gas emissions by 40 per cent by 2030 and increase the share of renewable energy by at least 27 per cent, even by 2030. Improvements in energy efficiency have been continually supported (from the "20-20-20" objective, which is increasing energy efficiency by 20 per cent towards 2020), but no new objectives were set (EC 2014a).

Two key documents that the European Commission published in 2011 draw possible strategies for the transportation sector, compatible with the 2050 objective. They are a roadmap for the transition to a competitive low-carbon economy in 2050 and the third White Paper on Transport, a roadmap to a Single European Transport Area - towards a competitive and resource efficient transport system.

The assessment of the impact accompanying the White Paper on Transport of 2011 suggested that oil consumption in transportation should be decreased by 70 per cent by 2050, in comparison to the level of consumption in 2008. [2]

The Electric Car Is Not Clearly a Way to Save

A great disadvantage of electric cars is their batteries. The larger the batteries, the greater their carbon footprint. The latest studies suggest that some drivers will emit less CO_2 and other pollutants into the air if they choose the latest diesel engines instead of an electric car.

The problem with new electric cars is that the environmental burden of battery production is greater than that of an electric car functioning without local emissions. An electric car with batteries must be driven many years to balance out the initial burden caused by the production of its batteries. Another ecological issue related to electric cars is the impact of mining when obtaining precious metals which are needed for its battery production. There are many more issues related to electric cars and recycling a dysfunctional battery is far from the last of them.

New electric car batteries are produced in places where fossil fuels such as coal and the like are the most common sources of energy. Typical examples include Thailand, China, but also Germany and Poland. Even though Germany currently has the fastest-growing energy sector using sustainable sources, coal is still the primary source of energy there. The same is true for Thailand and China. Current but also planned lithium-ion battery plants are mostly situated in the countries and regions with globally the worst energy mix.

Many authors state that car factories which have recently been increasing their focus on launching the production of electric cars should take Tesla and its Gigafactory in Nevada as an example. Tesla started to exclusively use solar panels, which it owns, to produce its own batteries. Therefore, the electric cars it produces, together with the batteries from this factory, are more ecological than those of competing producers. A new Northvolt plant, now being built in Sweden, was also inspired by this idea. It plans to cover its self-sufficiency by producing electricity from a hydro-power plant.

At the moment, one of the most effective options of reducing road transportation energy intensity is to produce hybrid vehicles. They also use electricity, but their batteries are much smaller, and their combustion engines are extraordinarily efficient. [5]

Bloomberg New Energy Finance produced research on efficiency. They chose a vehicle with a capacity of 60 kWh. A battery of a similar size may also be found in, for instance, Chevrolet Bolt, Hyundai Kona and Kia Niro EV. Given the normal use of a vehicle, which is about 15,000 km a year, it would take an electric car more than ten years to reach at least the same level as a car with a new effective combustion engine. In other words, for the first ten years (or 150,000 km), an electric car would be a greater CO_2-producer than a car with a diesel combustion engine.

The amount of CO_2 just when producing the batteries for the new SUV electric car, such as an Audi eTron or a Mercedes EQC, was compared with the production of a whole new efficient vehicle. It was found that just the production of batteries for the electric SUV itself leaves a carbon footprint which is 74 per cent greater than the production of a whole new car with a combustion engine. Naturally, the bigger the battery, the worse the carbon result at the final calculation. Therefore, the main question here is, does it really make sense to buy a new electric car, if for the first 150,000 km it will theoretically be a greater polluter than a much cheaper car with a combustion motor? Another question is, will the batteries in the electric car last long enough to eventually become more ecological and how long will it last to drive the necessary number of kilometres with the electric car, if the car can traverse as much as 300 km on a charge?

Figure 2 – Electric Car [6]

Nowadays, the most important task for an electric car is to move on with its development, so that energy consumption with its production, as well as its operation, would decrease. However, today's technology still needs to evolve to bring the desired result called saving - greening.

Conclusion

Energy intensity is going to rise in the following years. With this regard, the prognosis of consumption development is rather clear. Still, it is positive that the EU, including Slovakia, is trying to reduce energy intensity - not only verbally, but also by means of written agreements and key environmental documents, that they also seek to adhere to. It is important that the words written on paper shall turn into real outcomes. The EU has been trying to promote electric cars and get rid of the production of combustion engines. However, first and foremost, it is necessary to intensify building new facilities for the sources of renewable energy. Presently, it just translates into transferring emissions to the places where they may be seen and felt the least - such as to city suburbs and other continents. And this is what has been going on recently. The world of vehicles has been increasingly forced to adopt ever more absurd emission standards. The reason is to produce more electric cars, even though no emissions are going to be reduced on a global scale. An electric car is not worse than current diesel and petrol cars. The main idea is good, but the implementation of its production has not been entirely thought through. Electric cars could be more ecological than cars with a combustion engine.

Acknowledgements

"This publication was realized with support of Operational Program Research and Innovation in frame of the project: ICTproducts for intelligent systems communication, code ITMS2014+ 313011T413, co-financed by the European Regional Development Fund".

References

[1] https://www.energie-portal.sk/Dokument/energeticka-narocnost-priemysel-je-upornejsi-v-doprave-spotreba-vzrastla-101066.aspx

[2] https://www.eea.europa.eu/data-and-maps/indicators/transport-final-energy-consumption-by-mode/assessment-9

[3] https://podkapotou.zoznam.sk/cl/1000841/1747253/Nove-elektromobily-maju-problem--Pri-nich-su-ekologickejsie-aj-naftove-auta-

[4] Figure 1 – Traffic Jams https://www.google.com/search?q=zni%C5%BEovanie+energetickej+n%C3%A1ro%C4%8Dnosti+cestnej+dopravy&client=firefox-b-d&source=lnms&tbm=isch&sa=X&ved=0ahUKEwi5-ueoyZriAhWDalAKHdmoBJwQ_AUIDygC&biw=1536& https://www.google.com/search?q=elektro+bih=790#imgdii=L3JqcUiGk96fWM:&imgrc=sKzYKH6KGWkOZM:

[5] https://podkapotou.zoznam.sk/cl/1000841/1747253/Nove-elektromobily-maju-problem--Pri-nich-su-ekologickejsie-aj-naftove-auta

[6] Figure 2 –mobil&client=firefox-b-d&sxsrf=ACYBGNTijevdYkHV2ap8S5QO1yU65Nys3A:1573470845963&source=lnms&tbm=isch&sa=X&ved=0ahUKEwip8NnWg-LlAhVLRxUIHXBxCxMQ_AUIESgB&biw=1536&bih=790