ADVANTAGES OF APPLYING A HYBRID SYSTEM IN VEHICLES

Mukimova Davlatkhan Karimovna
Andijan state technical institute

Abstract. This article describes the advantages of using a hybrid system in cars. The use of renewable sources is also covered.

Keywords. Electricity, energy, transport accumulator, efficiency, energy density.

Introduction. It is said that the problems that still hinder the spread of battery-powered electric vehicles today are those that caused their abandonment in the past. In the future, the situation will be mitigated due to the introduction of new and better batteries, but improvements in this area can only rise to one point. For improvement, the maximum theoretical energy density of some battery systems in the available field is actually compared with the energy density achieved in the cell and at the battery level: the theoretical energy density is precise, taking into account only the mass of the maximum amount of electrochemical reagents that cannot be approached in close proximity. Some areas for improvement are also indicated by comparing the cell energy density with the actual battery energy density; some savings in mass in the battery structure, which combines cells, installation interfaces, and cooling system that are usually necessary, can improve the energy density of all types of batteries.

At the same time, problems with battery-powered electric vehicles are associated with mass production of this type of vehicle in larger quantities than with the design and construction of vehicles capable of meeting the needs of customers. The first point, as already discussed, is the wide availability of materials needed to build batteries, such as lead or lithium.[1]

Even worse problems are related to energy demands. The energy consumption of a battery electric vehicle is not better than that of a conventional vehicle, but it is probably worse. Electrical energy must be generated from a primary source at power plants, then transported along power lines, used to charge the vehicle's battery, and then converted into mechanical energy in an electric motor. Each step has its own efficiency, in particular, battery charging and discharging has efficiency, which depends on many factors, but cannot be very high. The average efficiency at which electricity is generated at the power plant is much higher than the efficiency of automobile internal combustion engines (usually 39% versus and on average 20-25%), but this is usually not enough to compensate for a large number of energy conversions from the main source to the wheels[2].

Battery electric vehicles have the energy advantages of allowing regenerative braking, which increases their energy efficiency, as well as the disadvantages of not

allowing the use of waste heat generated onboard for heating. Especially in cold weather, the heating of the passenger compartment should be carried out by saving energy from batteries or burning a small amount of fuel. Although efficiency in the second case is very good, but very difficult to implement and requires a side tank for heating fuel, efficiency in the first case will be low, since the efficiency of the circuit starting from the power plant and ending in the battery must be taken into account. The alternative to storing thermal energy on board is somewhat better, since at least losses associated with the charging and discharging of batteries are not allowed, but the introduction of an additional thermal energy storage system and improvement of the efficiency of thermal insulation of the passenger compartment in accordance with current standards are necessary. There's little to say about the air conditioner: energy should come from the battery, reduces the range, and increases energy consumption[3].

The same considerations apply to pollution and greenhouse gas emissions. Electric vehicles are considered Zero Emission Vehicles (ZEV), but in reality, as mentioned above, they have the advantages of transferring pollution from the vehicle's area of operation to the area where electricity is generated. This may be a good advantage in preventing pollution in congested urban areas, but it has no global impact, except for better pollution control that can only be achieved at a power plant.

The outcome for energy and environmental problems strictly depends on the mixture of main sources used in any country. If electricity is mainly produced using petroleum-based fuels, the energy benefits are at best negligible and typically affect greenhouse gas production. The advantage is that wheel energy consumption increases with the widespread use of electric vehicles. If there is a large use of coal, greenhouse gas production deteriorates. There is an advantage in the widespread use of electric vehicles only if the main source is nuclear or a small percentage of which they can contribute to renewable sources, and they are probably a nuclear-based solution that is only suitable for an energy-rich society[4].

Keep in mind that all of the above reasoning is incorrect because they do not take into account the balance of the entire life cycle, especially the energy required to build batteries (with a limited lifetime), the power associated with the required increase in energy and production, and the costs associated with increasing the power of power lines, even if the last two can be reduced by charging the batteries.

Other improvements in recent years, which allow for the construction of efficient electric vehicles, are associated with the development of electric motors and electronics technologies. Brushless, permanent magnetic motors, small electric motors used in automobiles can reduce the main part and weight of the power plant, as well as increase their efficiency by 90%, although the average efficiency is often much lower than the indicated indicator.

Here, another limitation can be assumed: the availability of neodymium, which is important in the production of powerful neodymium-iron-boron magnets for electric motors and generators, is limited, and its production is currently less than 20,000 tons per year. A severe neodymium shortage, with production concentrated in one country (China) (approximately 97%) and subsequent sharp price increases are predicted in the near future. Of course, neodymium reserves are insufficient to build a series of electric motors suitable for converting a large portion of vehicles into electricity[5].

In conclusion, battery-powered electric vehicles will improve their performance, and there is no doubt that prototypes with performance similar to traditional vehicles can be built now and even more so in the near future. Building a large number of such vehicles in accordance with what customers expect from the car at present, with its price and ease of use, is an even more difficult task, although in the future it will be manageable. What is currently impossible and even inappropriate is an attempt to replace current internal combustion vehicles with electric vehicles.

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