

ADVANTAGES OF USING RENEWABLE ENERGY SOURCES IN TRANSPORT NETWORKS

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Abstract: Renewable energy sources (solar, wind, hydropower, geothermal energy and biofuels) are playing an important role in the global energy system. The use of these sources in transportation networks allows for environmentally friendly and efficient vehicles such as cars, buses, trains and even ships.

Keywords: renewable energy sources, transport, solar, wind, hydropower, geothermal energy, biofuels.

Renewable energy sources offer the following key benefits in transport: Environmental friendliness and reduced emissions. The exhaust gases (CO₂, NO_x, soot) emitted by conventional fuels (petrol, diesel) vehicles pollute the environment. Renewable energy, such as the use of solar or wind energy in electric vehicles (EVs), can reduce emissions by 75-95%. For example, the Toyota Mirai hydrogen car emits only water and reduces CO₂ emissions to zero. Globally, transport emissions account for 24% of global warming, and renewable energy can reduce this figure by 50%.

Energy savings and cost reduction. Renewable energy increases the efficiency of vehicles. Electric engines have an efficiency of 80-90%, much higher than gasoline engines (20-30%). For example, the Tesla Model 3 can travel 500 km on a single charge, and the cost of charging is 50% cheaper than gasoline. Charging via solar panels or wind turbines will further reduce costs. The solar energy potential in Uzbekistan (3,000 hours of sunshine per year) is ideal for electric transport.

Noise and pollution reduction. Electric and hydrogen vehicles operate almost noiselessly, which creates comfort for city dwellers. For example, electric buses reduce city noise by 20-30%. In addition, due to their low emissions, urban air quality improves and health costs are reduced.

New jobs and economic growth. Renewable energy creates new sectors in transport networks. For example, the production of electric batteries and the construction of charging stations can create more than 100 thousand jobs. Solar panel production in Uzbekistan (for example, projects in Navoi region) can become the basis for electric transport.

Energy security and sustainability. Reduces dependence on oil and gas. Solar and wind energy are renewable, preventing price volatility. In Uzbekistan, wind energy (Bukhara and Karakalpakstan) and solar energy potential are sufficient to provide electric transport.

Renewable energy sources are essential to power these vehicles. For example, homes equipped with solar panels or city infrastructure can provide cars with clean energy. Electric vehicles are one of the most advanced ways to effectively use renewable energy. EVs are charged with clean energy from solar and wind power plants, which reduces greenhouse gas emissions and significantly reduces dependence on imported oil.

Public health benefits. Transport emissions cause respiratory diseases and allergies. Renewable energy can reduce emissions and reduce health costs by 15-20%. For example, in Europe, the introduction of electric transport has reduced health problems by 10%.

Renewable energy in transport networks in Uzbekistan is still in its early stages. As for electric transport, 50 charging stations are planned for Tashkent in 2024, but the number of electric cars is less than 5,000. Solar power plants are being built in Navoi and Kashkadarya regions, which can be used to power the charging stations. Wind turbine projects are being

developed in Karakalpakstan and Bukhara regions, which will help generate electricity for transport. Cotton and other agricultural products have the potential to produce bioethanol and biodiesel, but the production infrastructure is limited. As for hydrogen transport, there are currently no pilot projects, but hydrogen production through solar energy is planned by 2030.

While the benefits of renewable energy in transport are great, there are the following problems:

Lack of infrastructure: The number of electric charging stations is limited, and solar and wind energy networks are underdeveloped. Costs are high, electric batteries are expensive (\$100-150 per kWh). Technological limitations, hydrogen storage and battery charging time (30 minutes-1 hour) reduce competitiveness compared to traditional fuels. There is a shortage of renewable energy specialists in the transport sector, 60% of the population is unaware of the benefits of electric transport. Environmental problems, battery production and disposal processes can harm the environment if renewable energy sources are not used.

In addition, transport systems based on smart technologies are contributing to the expansion of the use of renewable energy sources (RES) within the framework of the “smart cities” concept.

Uzbekistan is taking important steps to transition road transport to environmentally friendly energy: electric buses are being introduced as a test in Tashkent and tourist areas. Customs privileges are being provided for the purchase of electric vehicles through the “Green Transport” program. The network of charging stations is gradually developing.

Uzbekistan is making significant progress in the use of RES. The country’s natural and geographical opportunities, reforms carried out by the state, and international cooperation are creating the basis for the rapid development of the “green energy” sector.

Conclusion: Renewable energy sources offer significant benefits in transport networks, such as environmental friendliness, energy efficiency, noise reduction, economic growth and improved health. The potential of solar and wind energy in Uzbekistan, the Digital Uzbekistan 2030 strategy and international experience create the basis for the introduction of these technologies. However, infrastructure, cost and skill constraints need to be overcome. Achieving these goals will make Uzbekistan’s transport system sustainable and efficient, protect the environment and improve the standard of living of the population.

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