



Is it the right time for solar roadways in Almaty, Kazakhstan?

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In light of the world's trending focus on sustainable development and renewable energy concepts, many projects have been implemented or are currently being considered in Kazakhstan. Most of them were introduced under the auspices of EXPO 2017 which has been held in Astana city and they include the technologies related to solar and wind energies. One of the recently developed concepts is the solar roadway. The idea is to use solar panels as surface of the roads instead of the conventional asphalt and concrete. The countryside roads are mostly not crowded by vehicles at all hours and thus, the road can be used in an effective manner to receive the abundant solar irradiation in the region. As a further improvement of the concept, it is possible to include piezoelectric materials in order to gain more energy from the contact between the vehicles and the road, as it has been recently investigated by researchers. The first prototypes of such roads have already been built in US and France. Hence, there are discussions among members in the national engineering community regarding the implementation of such a technology in Kazakhstan. Especially, Almaty region is often mentioned as the target location since the major share of the energy consumption in the country comes from this region. Moreover, the dissolution of the agreement about electric power supply between Kyrgyzstan and Kazakhstan stimulated this idea to a new level and a need of a thorough research of alternative sources of power generation has been raised in recent years. This paper analyzes the implementation of the solar roadways concept in Almaty region based on its financial indicators and overall economic viability, including the impact on greenhouse gas (GHG) emission reduction. The clean energy management software RETScreen has been utilized for the identification, calculation, assessment and optimization purposes.

The target road in the project is a 5-km long road in Kulja tract, in Almaty. The overall power capacity of the proposed PV system 5,542 kWp for which the initial cost is about 4 billion KZT.

The Life Cycle Cost (LCC) assessment led to an NPV of 168 million KZT, but with fair general indicators, such as IRR of 13.7%, simple payback of 18.5 years and a marginally favourable Benefit-Cost ratio of 1.07. Results lead to the conclusion that the project is not feasible at this moment without the implementation of more effective Feed-in-Tariff policy, government subsidies or GHG credits. Therefore, the reduction of the initial cost or the increase of electricity export rate may positively affect the project feasibility and thus, the project should not be refused completely in upcoming national plans. In fact, the future studies in this area might yield to the discovery of new materials and technologies which will allow producing the photovoltaic panels and transparent glasses at relatively low cost, if not policy intervention is foreseen.

