Viability of PV-cladding on building facades in the city of Astana

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Photovoltaic (PV) power systems are the fastest growing green technology. Integration of PV in the urban environment is a promising technology that can lead to a construction of Zero Energy Buildings or nearly Zero Energy Buildings (nZEB). However, PV installation in an urban environment is followed by several difficulties such as lack of space, severe climate exposure and aesthetic implementation. The most recent and relevant solution is Building Integrated PV (BIPV), which is an installation of PV on building façade or roof with an appropriate aesthetics contributing to the urban environmental impression of passers-by. However, building structures are often exposed to strong winds applied on a large lateral area of the façade. In this paper we address the case study of the city of Astana where wind velocity may reach up to 10 m/s during wintertime (December and January) at a level of 50 meters above the ground (UNDP Kazakhstan, 2009). Without a proper design, buildings, especially equipped with a façade-integrated energy absorbing system, exposed to such extreme actions may not survive. Therefore, the given project is dedicated to proposing a new anchoring system for photovoltaic panels used in building façade under extreme wind conditions in the city of Astana. However, before proceeding to the design of anchoring unit, it is vital to analyze the viability of the project and identify the feasible range of financial resourses for production of mounting system.

This paper proposes a techno-economic study of the installation of solar panels in facades of high-rise buildings. As a case study, a dormitory building of Nazarbayev University is considered. Construction of frame for installing PV panels with 30° inclined angle is proposed. In total, an array of 72 PV panels with 17.28 kWp power capacity is included in the model. Profitability of the project is analyzed by using RETScreen 4 decision-support software. Three different scenarios are analyzed: current FIT of 36,410 KZT/MWh with no incentives from the government, current FIT with 30% incentives from the government that covers 1/3 of initial costs, and finally improved FIT of 70,000KZT/MWh. Results demonstrate that among all explored cases, scenario 3 is the only capable to guarantee an attractive outcome, given that it leads to the Benefit-Cost ratio of 2.65 and Equity Payback of 4.7 years.

[1] UNDP Kazakhstan. 2009. UNDP Kazakhstan Wind Power Market Development Initiative, pp. 1-18