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Entitled

*DETERMINE OF CLEANING FREQUENCY AND POWER ENHANCEMENT OF PHOTOVOLTAIC
PANELS USING NOVEL CLEANING APPROACH*

by

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Abstract

Dust accumulation on Photovoltaic (PV) surface decreases the solar radiation penetration to the PV cell and eventually the system efficiency. The PVs are periodically cleaned traditionally by water sprinkling employing external mobile equipment that at the best involves robotics. Water transportation and consumption required for PV cleaning incur tremendous overheads on the plant operations thus increasing the electricity production cost. Most of the utility scale PV plants are installed in desert environment that poses a two folds challenge of increased dust accumulation coupled with lack of water supply infrastructure to keep the plant cleaned. The current research attempts to overcome this constraint through an alternative mechanism of water production applying a customized atmospheric water generation system. The research will involve determining the frequency of cleaning required as it varies substantially depending on geographic location. The findings will enable optimize the capacity of the atmospheric water generation system. The embodiment of atmospheric water generation system will exploit the diurnal dew point drop, adiabatic air expansion in porous media, radiative cooling over a sky exposed surface and Peltier cooling in sequential order to optimize the self-reliant PV cleaning system. Determining the optimal frequency of cleaning indicating a minimum of 13 % power loss in UAE. The radiation loss reached up to 27 % within three months that represents yet the best-case scenario. The findings enabled designing the optimal capacity of the AWG system. The proposed AWG was constructed and tested with an average water production of 110 ml per night having average night-time humidity of 66 % with an average electricity consumption of 1.17 kWh/day. The water produced over seven night reached an average value of almost 1 liter that was sprinkled over the panel and wiped of that achieved completely cleaned PV surface.

Keywords: Radiation, Efficiency, Water Sprinkling, Transportation, Environment, Infrastructure, Radiative, Expansion, Atmospheric, Peltier, Cleaning.