Photovoltaic Surfaces to Reverse Global Warming

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Climate changes and its many associated impacts are one of the most critical global challenges. Photovoltaics has been instrumental in mitigation of CO2 through the generation of electricity. However, the goal of limiting global warming to 1.5 °C increasingly requires additional approaches. The paper presents how PV surfaces can be designed to reverse the Earth's radiative imbalance from increased greenhouse gasses that lead to higher global temperatures. The new PV surface generate electricity, reflect sub-band gap radiation, minimize their temperature, generate thermal radiation and emit additional IR through the atmospheric, with these processes totaling 650 W/m². This is realized by: (1) PV system efficiency at operating temperature > 20% and sub-band gap reflection of 150 W/m² for a total of 350 W/m²; (2) Thermally emitted radiation (radiative cooling) of 150 W/m²; and (3) Active IR emission through an atmospheric window at 1.5 mm of 150 W/m². With such PV surfaces, we show that 10 TW of installed PV can reverse global warming. Using PV to balance global temperatures introduces additional considerations for PV, focusing on high efficiency, particularly high efficiency at operating temperatures, radiative cooling, and new processes for 1.5 mm emission. We find that depending on their design, PV panels can increase or decrease global temperatures.