Creation of Marketable Cost Efficient Transparent Solar Cells with Design and Testing via Virtual Computer Simulations and Engineered Model Prototypes for the Product's Development through the Fabrication of Nanotechnology

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Earth’s average surface temperature has increased by 1.62? since the late 19th century. Natural gas was the source of about 32% of U.S. electricity generation in 2017 with coal following at 30%, both nonrenewable resources contributing to the greenhouse effect, causing the global warming crisis. Solar panels are crucial in harvesting renewable energy. However, they occupy vast amounts of space and in highly urbanized areas, cannot be used as skyscrapers exteriors, being generally transparent, since current solar panels are opaque. By replacing skyscrapers' surface area with transparent solar cells, photon energy would be harvested by generating electron flow. Photovoltaic transparency was achieved through integrating nanotechnology in the engineering design tested through FDTD software computer simulations, incorporating the finite-difference time-domain method to evaluate Maxwell’s equations to produce output data. Parameter sweep and optimization simulations tested individual components of the transparent solar cell, composed of two layers of series circuits to form a grid-like structure. The tested parameters included the x, y, and z spans of each photovoltaic component’s geometry in the design, and the data was analyzed to determine the dimensions resulting in the most efficiency without compromising transparency. The final design’s photovoltaic components had a generation rate of 3.2e+02, the number of electrons generated due to the absorption of photons. The maximum power output with respect to voltage was 8.5 milliwatts per square centimeter at 5.4 volts. Due to the grid-like structure, the cost of the transparent solar cell may decrease, further improving affordability.

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