



Third-Generation Solar Cells Using Optical Rectenna

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Background

Solar panels are designed as a photovoltaic module. The energy producing aspect of the photovoltaic module has two primary steps. The first is a semiconducting material such as silicon that can absorb the photons from sunlight, knocking electrons from atoms to produce a flow of electricity. The next step is conversion of the electricity into direct current through an array of solar cells.

The first generation of solar cells, used in 90% of today's cells, have a focus of high efficiency. These cells use a single p-n junction to extract energy from photons and are manufactured from silicon semiconductors. This allows for about 30% efficiency, but resulted in a price too high to compete with fossil fuels (Payback time of about 5-7 years). The second generation of solar cells focuses on low production costs using thin film cells, which resulted in much lower efficiency rates. The third generation of solar cells has not yet been created, but focuses on combining the high efficiency of the first generation with the low cost of the second generation.

One possible way to do this would be to use an antenna built with nanotechnology to convert light into wave-like motions of electrons instead of the use of the expensive and less-efficient silicon. This is known as an optical rectifying antenna, or optical rectenna system. This system would have no need for silicon, dramatically reducing the cost of a photovoltaic module by eliminating the high cost of silicon production.

Technology

[Garret Moddel](#) of the University of Colorado at Boulder has developed a possible third-generation solar cell using optical rectenna technology. By developing a geometric diode with an ultra-low capacitance, the cell can match the antenna impedance where the light is absorbed, and direct the flow of electrons. This allows for a highly efficient photovoltaic module at a low cost.

Status

Dr. Moddel is seeking research support and collaboration to further develop this concept.

IP Status:

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