Experimenting with the Radiative Cooling Effect to Generate Electricity from the Night Sky

Warnock, Julia (School: PSD Global Academy)

In the process of thermal radiation, many materials release heat as light. A transmission window in the atmosphere allows infrared light to pass through. Because of this, the heat that is released in the form of infrared light escapes to space. The material and its surroundings become cooler as it loses heat faster than it gains heat. This process is called radiative cooling, and only works at night because the sun's heat cancels the cooling effect. The radiative cooling effect can be used to generate electricity from the night sky. Thermoelectric generators, or TEGs, can produce electricity from a temperature difference. Radiative cooling is a natural way to cool one side of a TEG. The TEG can be placed in an insulated box with the cold side towards the night sky. A black aluminum plate is attached to the top. An aluminum block is attached to the hot side of the TEG, and another aluminum plate is attached to the bottom of this block outside the box. When this device is tested on a clear night, electricity is produced. Four night sky panels were built to attempt to increase the efficiency of these devices. Three had plates of increasing sizes. Another panel was built with four TEGs, one in each quadrant of a single plate. Increasing the number of TEGs in a single plate does not improve power production but increasing the size of the plates increases the power significantly. Sufficient power was produced to light a bright LED.

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