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MAXIMUM WORK RATE EXTRACTABLE FROM THE SUN

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ABSTRACT

The socio-economic model based on the fossil fuels is unstainable, resulting into various crisis related to the supply and demand, therefore, it is in the process of a conscious transition. It is urgent to shift from the current centralized system based on fossil fuels toward a system that is distributed and based on local renewable energy. Solar energy is an important part of the world's energy mix. Solar energy is clean, environmentally friendly, and freely available over the planet.

Over the last 60 years, several researchers such as Jeter, Spanner, Petela, Press, Badescu, had proposed different models to define the physical limit of solar radiation conversion. These models overestimate the real maximum work rate extractable from solar radiation. The exergy of solar radiation is a useful index in the preliminary assessment of the performance of solar technologies, since the model provides upper limit of the efficiency of the system. A practical engineering model, however, should consider physical constraints associated with this useful index. In the present work, a generalized expression of a work extraction from solar radiation is presented as a function of the high-temperature radiation reservoir and a low-temperature heat sink that take into account a physical limit of the energy conversion.

Keywords: solar radiation, exergy, work extractor, exergy analysis, finite-time thermodynamics