

Analytic modeling of parabolic trough solar thermal power plants

Can a parabolic trough solar thermal power plant predict energy production?

In this paper, both types of models have been investigated in the particular context of a parabolic trough solar thermal power plant. The models aim to predict the electric energy production at the output of the electric generator and, more especially, the hourly energy production of the power plant.

Is PTSTPP a parabolic trough solar power plant?

In this work, three models were conducted in order to estimate the hourly electric production of a parabolic trough solar thermal power plant (PTSTPP) located at Ain Beni-Mathar in Eastern Morocco. First, two analytical models are considered.

How are parabolic trough power plants optimized?

A recent literature review shows that most studies on the optimization of parabolic trough power plants are based on physical or analytical models, including steady-state and dynamic models, while machine learning models such as artificial neural networks (ANN) models are rarely used.

What are the analytical models of a parabolic trough collector?

The first analytical model (AM I) is based on calculating the heat losses of parabolic trough collectors (PTCs), while the second analytical model (AM II) is based on the thermal efficiency of PTCs. The third model is an artificial neural networks (ANN) model derived from artificial intelligence techniques.

What is a parabolic trough solar collector?

A parabolic trough solar collector (PTSC) has proved itself in solar to thermal conversion and also in serving various applications as desalination, heat-intensive industrial processes, etc. Installing a PTSC to serve a particular application requires a large setup and capital, so, it is expected that they work at their maximum efficiency.

Can ANN model be used to estimate PTSTPP energy production in Morocco?

Since Morocco is planning to implement further solar power plants with parabolic trough technology. The suggested ANN model could be used to estimate energy production of similar PTSTPP design as in ABM for other locations in Morocco. The analytical models proposed in this paper lead to similar but lower accuracy levels than the ANN model.

The primary novel contributions of the paper are the following: (i) a methodology, based on models with short computational time, for the evaluation of stresses in steam ...

2 parabolic trough solar power plants 3 P.A. González-Gómez^{*1}, J. González-Hernández¹, D. Ferruzza², F. Haglind, D. Santana^{1 4 1} Department of Thermal and Fluid ...

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Medium temperature solar power plants use the line focusing parabolic solar collector at a temperature about 400°C. Significant advances have been made in parabolic ...

Several concentrated solar power technologies have been developed including the solar tower, the parabolic trough technology, solar dish and linear Fresnel systems. Among ...

By serving as a dependable and flexible energy source, large-scale parabolic trough solar power plants play a crucial role in transitioning towards sustainable and resilient energy ...

Modeling of PTSC serves as a good option to analyze and suggest viable improvements for it. To support the aforementioned, the current study focuses on providing ...

An analytical dynamic model can deepen our understanding of system characteristics. However, no system-scale dynamic model of integrated parabolic trough ...

NREL has developed a parabolic trough simulation model that allows a detailed performance, cost, and economic assessment of design and technology variations. NREL ...

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Analytic modeling of parabolic trough solar thermal power plants. Germán A. Salazar, Naum Fraidenraich, Carlos Antonio Alves de Oliveira, Olga de Castro Vilela, Marcos ...

An analytic model for a solar thermal electric generating system with parabolic trough collectors was developed. The energy conversion of solar radiation into thermal power ...

In this work, three models were conducted in order to estimate the hourly electric production of a parabolic trough solar thermal power plant (PTSTPP) located at Ain Beni ...

From the available CSP technologies, parabolic trough is the most widespread today, with around 29 plants in operation and around 1220 MW e of installed power in the ...

As a mature and low-cost large-scale solar thermal power generation technology, parabolic trough solar thermal power generation technology is becoming increasingly ...

Parabolic trough solar thermal power plant (PTSTPP) is one of the attractive technologies to produce electricity from thermal solar energy that use mirrors to focus sunlight ...

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The accurate estimation of a concentrated solar power plant production is an important issue because of the fluctuations in meteorological parameters like solar radiation, ...

Solar thermal systems are advantageous since it is easier to store heat than electricity on a large scale. As such, concentrated solar power is receiv...

Parabolic troughs with evacuated tubular receivers are the mainstay of most solar thermal power plants. Typically, they have geometric concentration ratios $C \approx 23\text{--}26$...

We derive, evaluate and validate comprehensive analytic modeling of the energy flows in parabolic trough solar thermal power plants. The analytic formulae are straightforward ...

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