



Simulate the CSP Dish Sterling and Generic Model by Using SAM

Software

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ABSTRACT

In this paper, we have simulate two models of capacity 50 KW, one is CSP dish Sterling model and other is generic model using SAM software. With the help of SAM software we have made a business report that involves optimization and management of development, purchase, maintenance, utilization and disposal of both capacity models of 50 KW. For comparison both system are designed with same capacity 50 KW. In this paper we have analyzed both system using several performance indicators, like capacity factor, NPV, energy output, levelized electricity cost and electric efficiency. We concluded that the generic model have 7% less CF and 46% less energy as compared to dish Stirling. The LEC of dish Stirling is much better as compared to generic model.

1. Introduction

Parabolic dishes are usually acknowledged as the most effective concentrating solar power (CSP) innovation for the transformation of solar energy into electric or compound energy. Thus, the guarantee of dish concentrators has for quite some time been perceived. John Ericsson is frequently recognized as the main individual two or three a parabolic dish with an energy change framework (the Stirling motor) [1-2], and he created and tried a few models during the 1880s. Nonetheless, in spite of his eagerness for the "sun-engine", he noted that: "the truth of the matter is ... that albeit the warmth is acquired in vain, so broad, exorbitant, and complex is the concentration device that solar steam is ordinarily more expensive than steam delivered by consuming coal" [3-4]. Ericsson anticipated that "the sun-engine is closer flawlessness than the steam-motor-until the coal mineshafts are depleted its worth won't be completely recognized". It was concern not about coal but rather about oil that started reestablished interest in dish authorities to create energy following the oil emergency in 1973. The concentrating solar power (CSP) dish Stirling framework brags a number specialized benefits when contrasted with other solar power advances, for example it accomplishes the most noteworthy solar to power change pace of all solar advances [6]. Before, notwithstanding these benefits, huge scope business organization of Stirling motors for solar applications has not been accomplished, basically because of the significant expense of the innovation. The subsequent expense of power isn't yet cutthroat with different methods for power age, including other sustainable power innovations, for example, solar photovoltaic (PV) and wind. So an examination is done in this answer to feature the investigation between dish Stirling and generic model. In this study, we compared two systems designed with the same 50 KW capacity. We analyzed both systems using various performance indicators such as capacity factor, NPV, energy output, levelized electricity cost, and electric efficiency. Our findings showed that the generic model has a 7% lower capacity factor and 46% less energy output compared to the dish Stirling system. Additionally, the levelized electricity cost of the dish Stirling system is much better compared to the generic model.

2. Research Methodology

In the USA, government labs got associated with CSP research [7], and privately owned businesses started to contribute, both enormous (for example General Electric, Ford) and little (for example Omnium-G), upheld by liberal examination and commercialization subsidizing. Equal dish improvement programs started in Australia, France, Germany and parts of the Middle East. In the mid-1980s the US spending plan for solar examination was cut definitely under the Reagan organization as energy concerns scattered, and after 1985-1986, dish commercialization endeavors essentially ended for a time of around 10 years [2], however the improvement exertion actually proceeded. The research method involved in this study is to compare the different components of CSP using generic and dish Stirling models. These components are capacity factor, NPV, energy output, leveled electricity cost and electric efficiency. First for finding CF, we will calculate the actual generated power and installed power of the system to find the capacity factor. Next this factor will help us in finding efficiency of dish Stirling and overall efficiency of dish Stirling. Required surface area of the collector is very important to find on each dish Stirling system.

3. Result and discussion

In this investigation, The System Advisor Model (SAM) has been utilized to model conventional and Stirling power systems for similar examination. SAM is programming created by National Renewable Energy Laboratories (NREL) in collaboration with Sandia National Laboratories and utilized for execution modeling and furthermore monetary investigation of renewable energy systems. SAM's exhibition models make hour-by-hour estimations of a force system's electric yield, creating a bunch of 8,760 hourly qualities that address the system's power creation over a solitary year. The system's exhibition attributes can be investigated in detail by review tables and diagrams of the hourly and month to month execution information, or by utilizing execution measurements, for example, the system's complete yearly yield and limit factor for more broad execution assessments. [5-6]. During this analysis, a generic model and dish Stirling models are modeled on SAM. Details and execution boundaries of these two models are addressed in Table.1-2 & Fig.1-2

Table.1. comparison of Dish sterling and generic

Concentrator	Dish Sterling	Generic
Glass area	91m ²	42m ²
Reflectivity	0.91	0.94
Track Control	Open/Closed loop	Open loop
Intercept factor	0.7	0.99
Working Fluid	Hydrogen	Hydrogen
Peak efficiency	44%	29%
Annual Energy	55619 KWh	26111KWh

Let take some assumptions, that we have 10 dishes, availability is 98%. Capacity factor is 26% and average direct beam solar insolation in the region I 450 Wm⁻². The system have a field efficiency of 96% and reflectivity 91%. Then

Table.2. Efficiency percentage of stirling, generic, and combined

Capacity	Stirling efficiency (%)	Generic model efficiency (%)	Combined efficiency (%)
50 KW	44	29	12.7
100 KW	59	37	21.8
150 KW	65	43	27.9
200 KW	69	51	35.1

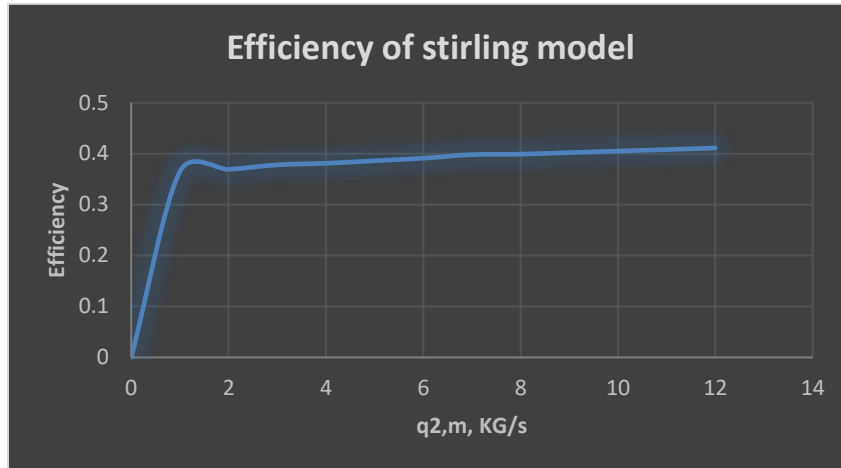


Figure.1. Shown efficiency of stirling model

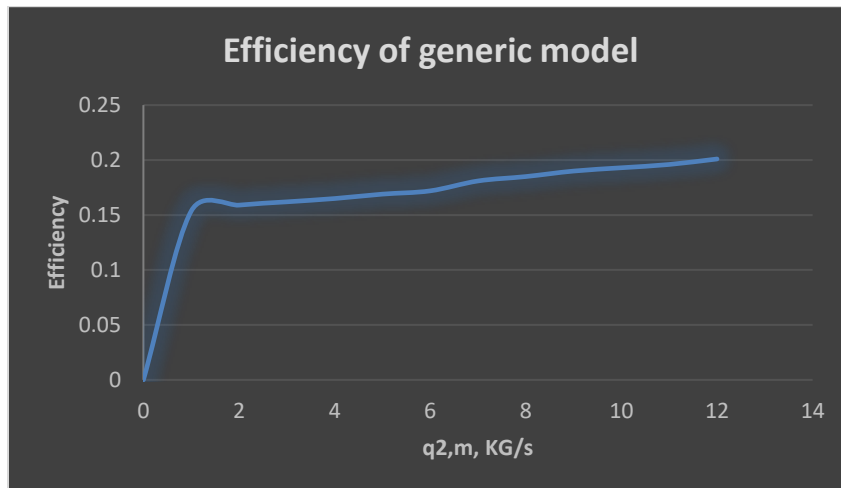


Figure.2. Shown efficiency of generic model

4. Conclusion

This paper reviews CSP dish Stirling model and generic model by using SAM software; we can conclude that the results product by CSP dish Stirling are more efficient and better as compared to generic model. No doubt generic model is more inclined to base level, but it has its own use. But if we compare the analysis dish Stirling is better. We found that the generic model has 7% less carbon footprint and 46% less energy consumption compared to the dish Stirling. The levelized cost of energy (LEC) of the dish Stirling is much better than that of the generic model.

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