

Why is solar energy important in Cameroon?

Renewable energies, particularly solar photovoltaic energy, are critical for expanding the population's access to electricity in a sustainable basis. PV systems produce decarbonized and environmentally friendly electricity, which helps fight global warming. Cameroon has significant solar photovoltaic (PV) potential across its territory.

Is solar energy a panacea for Cameroon?

However, solar energy is not a panacea for Cameroon's lack of access to high-quality energy. Solar panel output is highly dependent on the erratic nature of both solar radiation and ambient temperature, which frequently leads to an imbalance between supply and demand.

What are the effects of power outages in Cameroon?

Power outages, load shedding, and voltage drops are common on the electrical grid, causing significant social and economic consequences for the population. In 2021, Cameroon's power network experienced an average system interruption duration index (SAIDI) of 162.6 h and an average system interruption frequency index (SAIFI) of 41.8 2.

Consequently, researches in the optimization of renewable and hybrid energy systems in Cameroon is very limited. Added to this, the very few research works in this domain were done by the use of HOMER, no researcher has tried to use heuristic algorithms. ... Socio-techno-economic design of hybrid renewable energy system using optimization ...

Figure 1 illustrates the system model for optimizing home energy management systems in smart cities. It shows the interaction between various components, such as smart buildings, renewable energy sources, and the scenarios used for managing energy. Previous studies have extensively investigated multiple strategies for optimizing energy ...

2.1 Series integration. In hybrid energy systems, the integration of solar energy and natural gas is the most common. In addition to the integrated form shown in Figure 1, Solar energy is also used for the synthesis and decarbonization of gaseous fuels (Wei et al., 2011) this system, natural gas reacts with water vapor under the high temperature heating of solar ...

The paper presents the optimal design of a hybrid renewable energy system regarding the technical aspect that is Loss of Power Supply Probability (LPSP), economic aspect that is Cost of ...

DOI: 10.1016/j.ecmx.2024.100829 Corpus ID: 274692758; Optimization and comparative analysis of hybrid renewable energy systems for sustainable and clean energy production in rural Cameroon considering the loss of power supply probability concept

Embracing hybrid energy systems (HES) to ensure access to clean, reliable, and cost-effective energy is necessary for nations that are striving for sustainable development. By leveraging precise meteorological data from forecasts, the HES can be rendered more accurate. Thus, firstly, the research presented here employed four machine learning approaches, such ...

PFA's application in optimizing energy storage systems demonstrates notable improvements in the performance of renewable energy integration, ... (HRES) for rural electrification in Cameroon, investigating optimal sizing, techno-economic comparisons, performance under varied conditions, and meta-heuristic optimization techniques ...

AI-enabled energy management systems can optimize energy distribution and enable decentralized energy generation, empowering communities to generate their own clean energy and reduce dependence on centralized power grids. AI algorithms may inherit biases from the data used to train them, leading to unfair or discriminatory outcomes, such as ...

This research work presents a techno-economic comparisons and optimal design of a photovoltaic/wind hybrid systems with different energy storage technologies for rural electrification of three different locations in Cameroon. The determination of the optimal, cost-effective, and reliable configuration is performed for the locations of Fotokol, Figuil and Idabato ...

This paper explores scenarios for powering rural areas in Gaita Selassie with renewable energy plants, aiming to reduce system costs by optimizing component numbers to meet energy demands. Various scenarios, such as combining solar photovoltaic (PV) with pumped hydro-energy storage (PHES), utilizing ...

Reinforcement learning (RL) techniques have emerged as powerful tools for optimizing energy systems, offering the potential to enhance efficiency, reliability, and sustainability. This review paper provides a ...

This paper presents the results of the optimization of a hybrid solar PV-micro hydro energy system for the electrification of a remote community in Cameroon. The proposed system was ...

Energy optimization contains energy production strategies and system design. The purpose of energy optimization is to provide the most cost-effective energy. Optimizing productivity while reducing operating costs is the common goal shared by nearly every manufacturing plant. Energy optimization can be done without any upfront cost is a form of ...

The recent trend in optimization in the field of hybrid renewable energy system shows that artificial intelligence may provide good optimization of system without extensive long term weather data. ... J., Vandenbergh, M., and Schmid, J., "Simulation of Off-Grid Generation Options for Remote Villages in Cameroon," Renewable Energy, Vol. 33 ...

This versatile, powerful control strategy uses a model to help experts predict future behavior and make decisions based on these predictions. 1 In renewable energy systems, MPC can manage the fluctuations in energy supply by considering forecasts of renewable resources, such as solar irradiance or wind speed, and adjusting the operations ...

In addition to modeling, optimization of energy systems leads to more favorable and efficient performance. In this regard, the current special issue aims to focus on the energy system modeling and optimization; the main interest of the current issue is publication of both original and review studies in the related fields. The most attractive ...

4. Levels of Optimization of Energy Systems Optimization of an energy system can be considered at three levels: (A) Synthesis optimization. The term "synthesis" implies the components appearing in a system and their interconnections. If the synthesis of a system is known, then the flow diagram of the system can be drawn. (B) Design ...

This paper presents the results of the optimization of a hybrid solar PV-micro hydro energy system for the electrification of a remote community in Cameroon. The proposed system was simulated using GA and HOMER Pro with inputs such as the stream flow rate, the solar radiation, and the cost of system components.

In this article, the results of an optimization study for a cement plant in Garoua Province, Cameroon, show that the hybrid wind and solar grid-tied energy systems in Scenario 1 are considered more efficient; on the environmental, economic and technical level than the solar energy systems connected to the electrical grid in scenario 2.

Design and Implementation of a Smart Home Energy Management System Using IoT and Machine Learning (Hosseinian and Damghani, Citation 2019) demonstrates energy management that can optimize the energy use of smart homes. The system uses IoT devices to collect real-time energy usage data and machine learning to predict future energy usage patterns.

systems integrating various types of energy storage to provide electricity to three particular areas in Cameroon: Fotokol, Fighil, and Idabato. The study utilized the cuckoo search algorithm to ...

Keywords Hybrid renewable energy system · Particle swarm optimization · Loss of power supply probability · Cost of ... Cameroon has a renewable energy potential which as follows [15 ...

An essential resource for optimizing energy systems to enhance design capability, performance and sustainability Optimization of Energy Systems comprehensively describes the thermodynamic modelling, analysis and optimization of numerous types of energy systems in various applications. It provides a new understanding of the system and the ...

Optimization in energy systems is used for the purpose of operational decision-making or the purpose of

achieving an economically profitable investment by simulating several possible scenarios of the system and rating how favorable they are (Klemm and Vennemann 2021). Optimization problem consists of three main components: (1) objective ...

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