Sudan wind-solar hybrid power generation system

Does Sudan have wind energy?
As for wind energy,Sudan is one of eight African countries with significant onshore wind capacity. Wind energy has the potential to meet an estimated 90% of the country's annual energy demands . compares the country's estimated onshore wind capacity with that of other African countries . Figure 10.

Why does Sudan have solar energy?
This due to the availability of renewable energy of resources (i.e. wind and solar) over the year. Fig. 8 shows Sudan's solar atlas and wind atlases obtained from the World Bank Group.

How will hydroelectricity affect Sudan's energy sector?
Combining hydroelectricity with solar,wind,and geothermal energy will substantially increase power productionin Sudan and should eliminate many of the problems Sudan's energy sector is currently experiencing.

Does Sudan have a wind farm project?
As discussed earlier,Sudan's past experience with wind energy has been quite limited however not far away,in Kenya,more specifically in Lake Turkana Wind Farm project-the largest wind farm project in the African continent,many good practices and examples can be learnt from and referred to for any of Sudan's future projects.

What is a good start for a wind power project in Sudan?
One good start where both Sudan decision makers and any respective stakeholders may want to begin with and adopt for any potential Wind Power project,would be the Planning Policy Statement 18"Renewable Energy" (PPS 18). The objectives of the policy include:

Can Sudan maximize its energy resources?
The analysis reveals promising indicators of Sudan's ability to maximize its solar, wind, and geothermal energy resources. It also presents conclusions and recommendations concerning the future of RE policies and production in Sudan.

Earlier only two sources are used of hybrid power generation (solar-wind). In this we are adding one more source of energy power generation (solar-wind-hydro). 2. HYBRID ENERGY SYSTEM The combination two or more energy sources which generates the electricity is known as hybrid power generation system.

Sudan has a very high potential for solar and wind energy, as can be seen from Figure 1 [8] and Figure 2 [9]. The wind and solar generation capacity rise from the south to the

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Renewable resources like the sun, wind, biomass, hydropower, geothermal energy, and ocean resources can all be technologically used to produce clean energy. Despite producing significantly less energy than fossil fuels, solar and wind power have grown rapidly in recent years thanks to the use of PV cells and wind turbines. The solar-wind hybrid power system, which uses both ...

This paper aims to explore the techno-economic feasibility of a wind-solar hybrid energy system for small-scale irrigation applications in Sudan. Considering the aim, 12 different sites were selected across Sudan. The ...

Wind and solar energy exhibit a natural complementarity in their temporal distribution. By optimally configuring wind and solar power generation equipment, the hybrid system can leverage this complementarity across different periods and weather conditions, enhancing overall power supply stability [10].Recent case studies have shown that the ...

The general structure of the proposed hybrid energy system consists of a solar PV array, wind turbine, two diesel generators, battery storage system, and power converter. Fig. 5 show the overall schematic of the proposed HRES. Following the proposed framework discussed above, these components were selected as preliminary feasible technologies ...

The world"s energy landscape is shifting significantly, with a growing demand for clean and sustainable solutions. Combining the strengths of both renewable energy sources--solar and wind--hybrid, clean assets are emerging as a robust and reliable resource to traditional power generation solutions.

A hybrid renewable energy source (HRES) consists of two or more renewable energy sources, suchas wind turbines and photovoltaic systems, utilized together to provide increased system efficiency and improved stability in energy supply to a certain degree. The objective of this study is to present a comprehensive review of wind-solar HRES from the perspectives of power ...

System power reliability under varying weather conditions and the corresponding system cost are the two main concerns for designing hybrid solar-wind power generation systems.

Khan et al (2021) concluded that a small-scale hybrid system (wind-solar) is not feasible in most regions of Sudan. Kassem and Abdalla (2022) concluded that harnessing wind and solar energy ...

The application of renewable sources of energy in the field of power generation is increasing. 9 But due to some drawbacks, renewable energy systems are unable to reach guarantee reliability. 10 Energy generations from RES like solar, wind, and hydro are clean 11 but these energy sources are variable in nature due to the seasonal variation. Because of their ...

Renewable energy integration has attracted widespread attention due to its zero fuel cost, cleanliness,

availability, and ease of installation. Among various renewable energy sources, photovoltaic (PV) and wind turbines (WT) have become very attractive due to the abundant local availability in nature, technological progress, and economic benefits. The hybrid combination ...

Hybrid Power Generation System using Solar and Wind Energy Digbijay Mahanta, Kumar Ashutosh, D Krushna Chandra Sethy Ranjit Pati, Namrata Mishra Department of Electrical and Electronics Engineering,, Gandhi Institute For Technology (GIFT), Bhubaneswar Abstract: This paper proposes a hybrid power generation system using Solar and Wind energy ...

A Solar-wind hybrid power system requires initial investment only. Total power production by hybrid system can be calculated from power generation of solar panels and wind turbine. Mathematical representation of power generated by solar-hybrid system is as follows: P T = N W * P W + N S * P S

Sudan is a sunbelt country that has abundant solar resources and large wasteland areas, especially in the northern and western portions. Concentrating solar power (CSP) technologies are proven renewable energy (RE) systems to generate electricity in neighboring countries from solar radiation and have the potential to become cost-effective in the future.

However, those hybrid systems are mainly based on multiple renewable power generation systems, including wind energy, solar energy, wave energy, and battery backup systems [9][10][11][12] [13] [14 ...

Different hybridization cases of a solar photovoltaic, wind turbine, diesel generator, battery storage, and converter technologies, together with a diesel generator-based energy ...

The importance of renewable power generation is taking a major role in present research work. The consumption of energy has spiked and significant changes in technology have taken place in the last half a century. Perhaps some of the most futuristic and important developments to have happened over this period are in the energy sector, where number of energy resources have ...

The article highlights energy policies in other African countries that Sudan could adopt to expand RE generation. The analysis reveals promising indicators of Sudan''s ability to maximize its solar, wind, and geothermal ...

Different hybridization cases of solar photovoltaic, wind turbine and battery storage at 12 different sites in Sudan are simulated, evaluated, and compared, considering the crop water ...

Solar and wind energy are available in large amount and can be considered as reliable source of power generation. Hybrid solar and wind energy systems can be used for rural electrification and ...

Abstract-- This paper proposes a hybrid power generation system using Solar and Wind energy. It is fact that

energy is an important resource for any country in the world to ...

A hybrid renewable energy source (HRES) consists of two or more renewable energy sources, suchas wind turbines and photovoltaic systems, utilized together to provide increased system efficiency ...

The performance of solar-wind hybrid power system with high penetration of renewable energy sources was investigated under dominant weather condition. Zhao [84] ... Dynamic behavior of a stand-alone hybrid power generation system of wind turbine, microturbine, solar array and battery storage. Appl Energy, 87 (2010), pp. 3051-3064.

strength of the other one. The integration of hybrid solar and wind power systems into the grid can further help in improving the overall economy and reliability of renewable power generation to supply its load. Similarly, the integration of hybrid solar and wind power in a stand-alone system can reduce the size of energy storage needed to

This study describes a grid-connected PV-wind hybrid system"s comprehensive design, control strategy, and performance assessment in Dongola city located in Sudan"s northern region. ...

The study demonstrated that the ideal system with the least cost and the best performance was that which consists of thirteen solar PV systems (70.98 kW), four biomass systems (160 kW), one wind turbine (20 kW) and 15 NI-Fe battery banks (288 kW h), with a total system present cost of $581,218 and a 0.254 $/kWh cost of energy.

Given the abundance of solar radiation and wind resources, Sudan has a lot of promise for clean energy solutions. This study describes a grid-connected PV-wind hybrid ...

What Is a Wind-Solar Hybrid System? A wind-solar hybrid system is an alternative power generation system that pairs two great forces in green energy: photovoltaic (solar) panels and wind turbines. By harnessing the ...

Energy storage solutions, such as batteries and pumped hydro storage, can help mitigate the impact of fluctuations in solar energy generation by storing excess power for use during periods of low sunlight [9, 10]. ... a hybrid solar-wind power system was designed and simulated to address power quality issues in a domestic grid application. The ...

Renewable energy integrated into electric power systems, such as hydropower, solar, and wind power, has been the primary choice for many countries [2].However, both wind power generation (WPG) and photovoltaic power generation (PVPG) have strong randomness, volatility and intermittency [3].Large-scale of them connected to grid proved both a threat and ...

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