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## MARCH 2024

### SOLAR ENERGY



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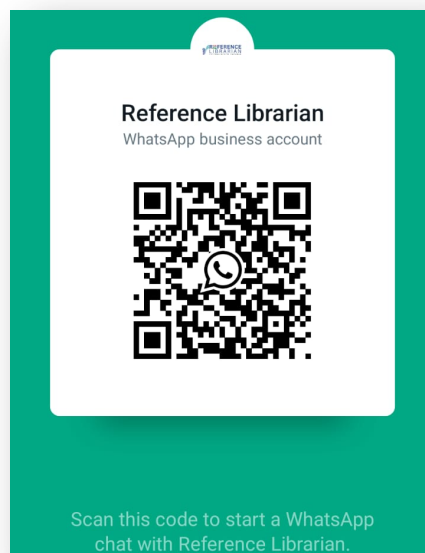
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TOPIC OF CURRENT AWARENESS SERVICES@PUSTAKA FOR FEBRUARY:  
**SOLAR ENERGY**

According to World Book, **Solar energy** is the direct use of sunlight to produce heat or electric power. The sun's energy is plentiful. But it is thinly distributed over a large area. The energy must be collected and concentrated to produce usable power. As a result, solar energy is a more expensive power source than fossil fuels for most applications. Solar technology is improving rapidly, though. Someday, it may provide a clean and abundant source of power.

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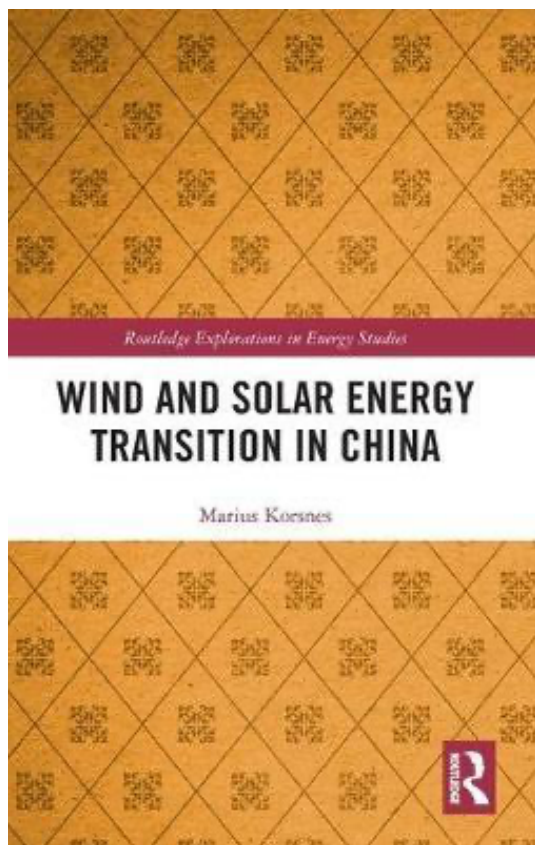
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## LIST OF RESOURCES ON SOLAR ENERGY IN PUSTAKA'S COLLECTION

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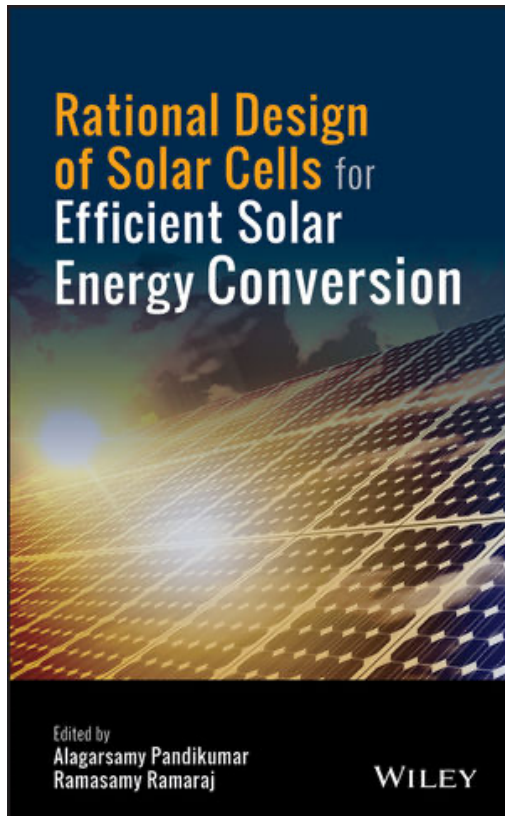


Title : Wind and Solar Energy Transition in China  
Author : Marius Korsnes  
Publisher : Taylor & Francis Group  
Call Number : 333.792/30951  
ISBN : 9780367194185  
Location : Pustaka Negeri Sarawak, Sibu  
Format : Book material



#### Description:

Unlike other publications that focus mainly on the formal policy landscape and statistics of industry development, this book delves deeper into the ways in which the wind and solar industries have evolved through negotiations made by the involved stakeholders, and how these industries play into larger Chinese development and policymaking interests. Overall, it sheds new light on the strategic development of China's renewable energy industry, the flexible governance methods employed and the internal struggles which Chinese local, regional and central policymakers, and state-owned and private enterprises have faced.

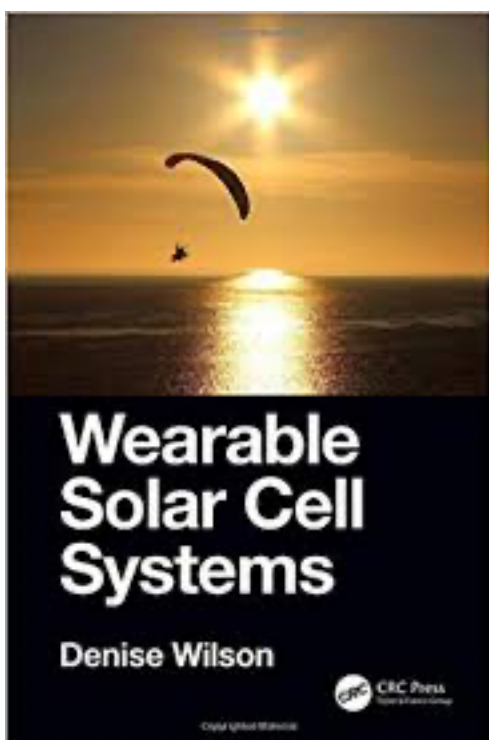


Title : Rational Design of Solar Cells for Efficient Solar Energy Conversion  
Editor : Alagarsamy Pandikumar, Ramasamy Ramaraj.  
Publisher : John Wiley & Sons  
Call : 621.31/244  
Number  
ISBN : 9781119437406  
Location : Pustaka Negeri Sarawak (Kuching)  
Format : Book  
material



Description:

Rational Design of Solar Cells for Efficient Solar Energy Conversion explores the development of the most recent solar technology and materials used to manufacture solar cells in order to achieve higher solar energy conversion efficiency. The text offers an interdisciplinary approach and combines information on dye-sensitized solar cells, organic solar cells, polymer solar cells, perovskite solar cells, and quantum dot solar cells..



Title : Wearable Solar Cell Systems  
Author : Denise Wilson  
Publisher : Taylor & Francis Group  
Call : 621.31244  
Number  
ISBN : 9780367023478  
Location : Pustaka Negeri Sarawak (Kuching)  
Format : Book material



**Description:**

Wearable Solar Cell Systems looks at the possibilities for supporting the energy demand of these devices without the need to return to the dreaded wall outlet for recharging. While crystalline silicon dominates world markets, second- or third-generation solar cell technologies may be more suitable to wearable systems. Array size, architecture, and management must also be chosen to best serve portable and wearable devices and harvest light energy from different light sources under a broad range of input conditions.

This book is intended to serve a wide audience from students who desire a basic introduction to solar (photovoltaic) cell technology to professionals seeking a holistic picture of wearable solar cells and systems.

## LIST OF ARTICLES

**Note:** Kindly scan the QR Code for full text online.

Title : **AI-based forecasting for optimised solar energy management and smart grid efficiency**  
Authors : Pierre Bouqueta, Ilya Jackson, Mostafa Nick & Amin Kaboli  
Online Database : Taylor & Francis Online  
Format : e-Article

INTERNATIONAL JOURNAL OF PRODUCTION RESEARCH  
<https://doi.org/10.1080/00207543.2023.2269565>



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### AI-based forecasting for optimised solar energy management and smart grid efficiency

Pierre Bouquet<sup>a,b</sup>, Ilya Jackson<sup>a</sup>, Mostafa Nick<sup>c</sup> and Amin Kaboli<sup>b</sup>

<sup>a</sup>Massachusetts Institute of Technology (MIT), Center for Transportation & Logistics, Cambridge, MA, USA; <sup>b</sup>School of Engineering, Institute of Mechanical Engineering, Swiss Federal Institute of Technology in Lausanne (EPFL), Lausanne, Switzerland; <sup>c</sup>Warwick Technology Park, National Grid ESO, Warwick, UK

#### ABSTRACT

This paper considers two pertinent research inquiries: ‘Can an AI-based predictive framework be utilised for the optimisation of solar energy management?’ and ‘What are the ways in which the AI-based predictive framework can be integrated within the Smart Grid infrastructure to improve grid reliability and efficiency?’ The study deploys a Deep Learning model based on Long Short-Term Memory techniques, leading to refined accuracy in solar electricity generation forecasts. Such an AI-supported methodology aids power grid operators in comprehensive planning, thereby ensuring a robust electricity supply. The effectiveness of this framework is tested using performance metrics such as MAE, RMSE, nMAE, nRMSE, and  $R^2$ . A persistent model is utilised as a reference for comparison. Despite a slight decrease in predictive precision with the expansion of the forecast horizon, the proposed AI-based framework consistently surpasses the persistent model, particularly for horizons beyond two hours. Therefore, this research underscores the potential of AI-based prediction in fostering efficient solar energy management and enhancing Smart Grid reliability and efficiency.

#### ARTICLE HISTORY

Received 15 June 2023  
Accepted 27 September 2023

#### KEYWORDS

Artificial intelligence;  
shortage economy; energy  
operations; deep learning;  
smart grids; renewable  
energy

## 1. Introduction

A year following the onset of the War in Ukraine, the worldwide energy context has undergone significant alterations, with soaring energy prices impacting consumers globally amidst a geopolitical scenario where energy security is paramount. The immediate surge in energy prices and heightened energy security issues have further spotlighted the necessity for a transition towards more sustainable and geopolitically stable energy sources (IEA 2022). The economic upheaval sparked by the conflict has heightened calls for an expedited transition to sustainable energy. Such a transition would entail a shift from highly polluting fuels, which are typically supplied by a few large-scale producers, towards low-carbon and more decentralised energy alternatives, including renewables (Lorente et al. 2023; Umar, Riaz, and Yousaf 2022). This transition is particularly pertinent in Europe, which has acutely experienced the reverberations of the conflict and where gas has traditionally been a mainstay of imports. Although a mild winter of 2022–2023, there was a serious threat that the European Union could encounter a deficit of nearly 30 billion cubic meters of natural gas (IEA 2023). Amidst these security concerns,

the transition to clean energy has gained momentum. The Commission’s strategy intends to diversify supplies of 101.5 billion cubic meters of gas. The plan implies that nearly 60% of this reduction could be achieved by boosting imports to Europe from other nations. However, an additional 33% could be realised through new renewable energy generation and conservation initiatives (Tollefson 2022).

Even before the war, the occurrence of energy shortages was surprisingly frequent, underscoring the inherent fragility of the global energy infrastructure (Ivanov and Dolgui 2022; Ivanov et al. 2023; Ivanov and Keskin 2023). This vulnerability was demonstrated dramatically in the power outage incidents of February 2021 in Texas (Sugg et al. 2023) and later in the year in the provinces of Heilongjiang, Jilin, and Liaoning in China (Jingyi and Yin 2021). These energy disruptions had significant repercussions on societal functionality and supply chain robustness. For instance, the Texas blackout alone resulted in an estimated economic loss of \$130 billion, reflecting the costs of lost output and collateral damages (Busby et al. 2021). Moreover, these energy deficits, coupled with an accelerated price surge, triggered a pivotal

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Title : **Reliability-based evaluation of hybrid wind-solar energy system**  
Online Database : Sage Journal  
Authors : Yilser Devrim and Serkan Eryilmaz  
Format : e-Article



Original Article



## Reliability-based evaluation of hybrid wind-solar energy system

Proc IMechE Part O:  
*J Risk and Reliability*  
2021, Vol. 235(1) 136–143  
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DOI: 10.1177/1748006X20929975  
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Yilser Devrim<sup>1</sup> and Serkan Eryilmaz<sup>2</sup>

### Abstract

In this article, a hybrid system that consists of a specified number of wind turbines and solar modules is considered. In particular, the system is modeled using weighted  $k$ -out-of- $n$  system which is also known as a threshold system in reliability literature. The system under concern consists of  $n_1$  identical wind turbines and  $n_2$  identical solar modules, and each turbine and module can be in one of two states as working or failed. The probability that the entire hybrid system with  $n = n_1 + n_2$  components produces power at minimum level  $k$  is computed and evaluated. The importance of single-wind turbine and solar module is also calculated to measure which renewable energy component is more critical and important. Extensive numerical results that are based on real data set are presented to illustrate the model.

### Keywords

Renewable energy, wind speed, solar radiation, reliability

Date received: 22 December 2019; accepted: 2 May 2020

### Introduction

With increasing energy consumption, both environmental and economic problems are gradually increasing in fossil fuel-based energy production.<sup>1,2</sup> Therefore, alternative energy sources gain an increasing importance. Solar and wind energy systems are among the most important renewable energy sources. The use of solar and wind power systems has become increasingly popular as these systems are modular, environmental friendly and more accessible than other renewable energy sources.<sup>3</sup> Solar and wind power systems usually operate off-grid or connected to the grid. However, the efficiency of these resources decreases in some cases due to the stochastic structure of solar and wind resources. For example, on cloudy days and at night, the photovoltaic (PV) system does not generate any power. Similarly, although wind energy is sustainable and will never end, wind may not always blow. Therefore, they must be combined with another renewable energy source and used as a hybrid system for reliability and uninterrupted power generation. A hybrid energy system has a powerful energy production that is more likely to meet the energy demand using multiple energy forms.<sup>4–6</sup>

In a renewable energy-based hybrid system, two or more renewable energy sources are interconnected and all provide energy flow to the energy grid.<sup>7,8</sup> The efficiency and power reliability of a hybrid system using

both solar and wind energy sources are more advantageous than a single energy system.<sup>9</sup>

Because of the stochastic nature of solar and wind resources, the power generated by wind turbine or PV system is a quantity which should be modeled as a random variable. Thus, the power produced by the hybrid system consisting of wind turbines and solar modules is also a random variable. In this article, we evaluate the performance of a hybrid energy system that consists of a specified number of wind turbines and solar modules using one of the well-known reliability models called weighted- $k$ -out-of- $n$  system. A weighted- $k$ -out-of- $n$  system consists of  $n$  components such that each component has its own positive weight, and works if the total weight of all working components is at least a given threshold  $k$ . This system is also known as a threshold system in the literature Rusdhi.<sup>10</sup> The concept of “weight” is generic, and it is frequently used to represent the utility or contribution of the individual component to the performance of the whole system. Recently,

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Title : **Decentralised Renewable Energy and Rural Development: Lessons from Odisha's First Solar Village**  
Authors : Chinmayee Mishra  
Online Database : Sage Journal  
Format : e-Article



Article

## **Decentralised Renewable Energy and Rural Development: Lessons from Odisha's First Solar Village**

Journal of Land and Rural Studies  
9(1) 178–192, 2021  
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DOI: 10.1177/2321024920967842  
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**Chinmayee Mishra<sup>1</sup>**

### **Abstract**

Energy plays an indispensable role in providing basic services for our daily lives. The perils of climate change and its impact on our environment have made accessibility of energy difficult. The burden of energy poverty falls particularly on the poor households in rural areas. Decentralised renewable energy options can be used to meet the energy requirement especially for the rural and tribal communities, which are scatteredly located. The study aims to find out the effectiveness of a renewable energy project at village level by studying the experiences of the Ho tribal community residing in Barapita village of Odisha, India. Barapita village is the first 100 per cent solar powered village of Odisha. Participatory rural appraisal method comprising tools such as transect walking, interview schedule, focus group discussion and key informant interviews has been used to find out the energy use pattern and challenges faced by the community. Although the solar project was initially a success, later on technical issues and maintenance problems led to the decline of solar energy use. This article suggests how the Gandhian model coupled with Nai Talim approach can be deployed to train the villagers as solar engineers, which will enable them to resolve issues related to the use of renewable energy.

### **Keywords**

Decentralised renewable energy, rural development, solar village, Ho tribe, Nai Talim

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## LIST OF CASE STUDY

**Note:** Kindly scan the QR Code for full text online.

Title : **Forecasting the Electricity Capacity and Electricity Generation Values of Wind & Solar Energy with Artificial Neural Networks Approach: The Case of Germany**

Authors : Faruk KILIÇ

Online Database : Taylor & Francis Online

APPLIED ARTIFICIAL INTELLIGENCE  
2022, VOL. 36, NO. 1, e2033911 (2273 pages)  
<https://doi.org/10.1080/08839514.2022.2033911>



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### Forecasting the Electricity Capacity and Electricity Generation Values of Wind & Solar Energy with Artificial Neural Networks Approach: The Case of Germany

Faruk Kiliç

Gazi University, Ankara, Turkey

#### ABSTRACT

Recently, studies on energy estimation have been developing rapidly to increase the efficiency of Wind & Solar energy production-consumption. Artificial Neural Networks, an algorithm based on the human brain and its nervous system inspired by the data transfer and storage mechanism, can work very well as a prediction model. In this study, total Wind & Solar Electricity Capacity (WSEC) and total Wind & Solar Electricity Generation (WSEG) values of Germany, a G8 member and a European country, have been estimated by using Artificial Neural Networks (ANN) method. Population, unemployment, GDP growth and total renewable energy capacity (excluding wind and solar energy total) parameters have been used as input variables in ANN calculations. The use of geographic, socio-economic and technological parameters has strengthened the estimation model. WSEC training and test regressions calculated by ANN have been 1 and 0.99988, respectively. WSEC Mean Absolute Deviation (MAD), Mean Squared Error (MSE), Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE) parameters have been calculated as 94.783, 62496.807, 249.994 and 0.364, respectively. WSEG training and test regressions values have been 1 and 0.99983, respectively. The WSEG MAD, MSE, RMSE and MAPE parameters have been calculated as 114.406, 59252.128, 243.418 and 0.526, respectively.

#### ARTICLE HISTORY

Received 15 March 2021  
Revised 29 December 2021  
Accepted 18 January 2022

#### Introduction

Due to technological developments all over the world, improvements in welfare and life expectancy have caused population growth. The energy requirements have also increased with the developing population. Fossil fuel derivatives are natural resources formed after many years and world fossil fuel reserves have come close to their limits because of their consumption for centuries. In addition to the decrease in natural fossil fuel resources, energy requirements have been increasing day by day as the population increases. Increasing energy consumption also brings about some negative factors. Unemployment can be given as the first example of these negative effects. Employees working in fossil fuel resources bring along an increase in

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## LIST OF NEWSPAPER ARTICLE

**Note:** Kindly scan the QR Code for full text online.

Article Name : **Hybrid Diesel-Solar Plants Launched in Tawi-Tawi**  
Newspaper : Sun.Star Davao  
Date of Published : 7 March 2024  
Online Database : PressReader

# HYBRID DIESEL-SOLAR PLANTS LAUNCHED IN TAWI-TAWI

TO IMPROVE residents' access to reliable renewable energy sources and boost the island-province's economy, top national, provincial and donor agency officials launched on Thursday, February 28, two solar PV diesel hybrid power plant projects in Tawi-Tawi, Department of Energy, and the Office of the Presidential Adviser on Peace, Reconciliation and Unity (OPAPRU). The two hybrid power plants are under the Renewable Energy Technology for seaweeds value-added in Tawi-Tawi (RETSA) project and health centers in the municipalities of Sibutu and Sitangkai, as well as neighboring island-communities.

**Socio Economic impact**  
During the launching ceremony Tawi-Tawi Governor Yshermal Sali emphasized the signif-



Article Name : **Reduce reliance on fossil fuels**  
Author : **Anaseini Dimate**  
Newspaper : The Fiji Times  
Date of Published : 9 March 2024  
Online Database : PressReader



Article Name : **Zero carbon requires 'huge solar boost'**  
Authors : Victoria Bela  
Newspaper : South China Morning Post  
Date of Published : 4 March 2024  
Online Database : PressReader



**Zero carbon requires 'huge solar boost'**

**Generating capacity of sun and wind power would have to double, study says**

**Victoria Bela**  
Victoria Bela is a senior reporter at the South China Morning Post.

China will need nearly five terawatts of solar and wind power to achieve its goal of becoming carbon neutral by 2060, according to a new simulation.

That would be double total energy generation capacity now, and more than five times the capacity in the United States.

The study was a collaboration between scientists at the University of California San Diego and Tsinghua University in Beijing.

Their simulation found that if China was to meet its lofty carbon neutrality goal, it would need to have 21 TW of wind power capacity and 3.8 TW of solar installed – or around 10 times more than the country had in 2022.

Michael Davidson, senior author of the study and a professor at the University of California San Diego, said the study found that 40 percent of suitable land in eastern provinces like Anhui and Zhejiang, where electricity demand is highest.

"We know China has a very ambitious pathway to achieve carbon neutrality. We wanted to find out exactly what that entails," Davidson told a campus news site.

The team ran a "highly spatially resolved model" that took into account China's current grid integration, land use, energy storage and government policies. They said it could be adapted to assess other countries.

The model simulated the power grid in 2060 with "unprecedented" resolution, the report said. Individual land plots in the model were as small as 20 sq km.

China's energy sector transformation is "at the heart" of worldwide efforts to achieve net-zero emissions by the middle of the century to limit global warming, according to the scientists.

Electricity is central to the green transition since decarbonisation in other sectors such as transport also relies on it, and it can be used to offset other hard-to-abate sectors, according to the paper.

It said new solar installations would be needed in regions where electricity demand is high, and they would take up most of the land suitable for this purpose.

energy and low demand in those areas meant less capacity should be installed there, it added.

Beyond the expansion of solar and wind power, an "unprecedented" 1,000 gigawatts of energy storage would also be needed to provide reserve energy during peak demand, mostly for solar.

According to the model, inter-provincial ultra-high-voltage energy-transmission lines will need to double the current size.

That will involve expanding the existing lines as well as building new ones.

The researchers said the model was created with the expectation that China would continue to exploit its hydro-power resources, and that 200 GW of nuclear power would be added.

Coal is also not completely off the table, for the simulation. It retained a role in the north of the country for district heating networks, many of which are new.

The scientists concluded that retiring them would be unnecessary. They said all coal plants

**Planning and policy formulation are necessary to achieve China's climate goals**

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