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JULY 2024

HYDROPOWER DAM TECHNOLOGIES



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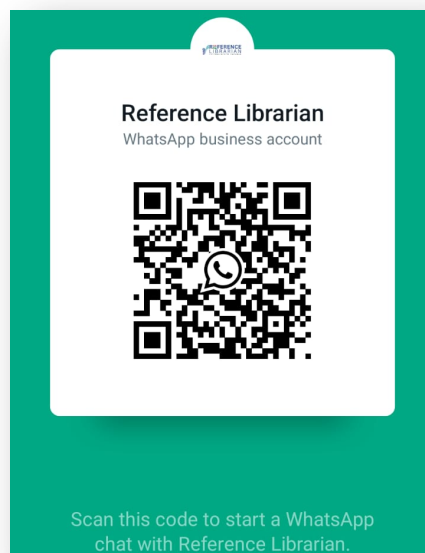
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TOPIC OF CURRENT AWARENESS SERVICES@PUSTAKA FOR JULY:
HYDROPOWER DAM TECHNOLOGIES

Hydropower dam technologies harness the energy of flowing water to generate electricity, offering a renewable and sustainable energy source. These technologies primarily include impoundment dams, which store water in large reservoirs and release it to drive turbines, and diversion (or run-of-river) dams, which redirect a portion of river flow through canals or penstocks to generate power without significant storage. Advances in hydropower technologies have improved efficiency, reduced environmental impacts, and enabled better integration with other renewable energy sources.

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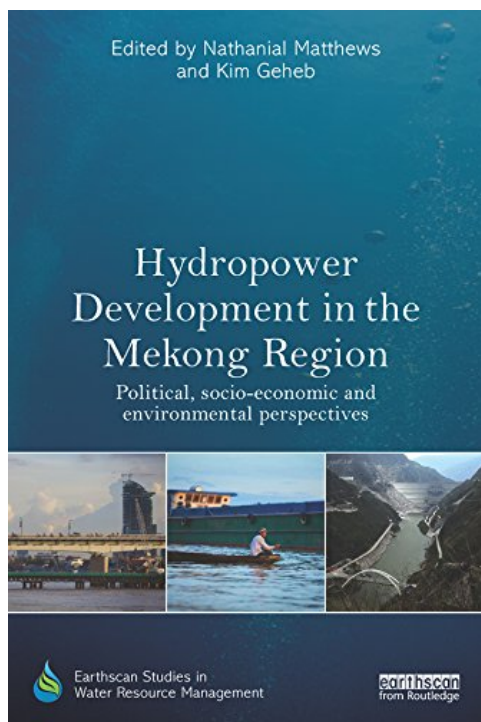
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List of Resources on Hydropower Dam Technologies in Pustaka's Collection

LIST OF BOOKS

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



Title : Hydropower development in the Mekong Region : political, socio-economic, and environmental perspectives

Author : Nathaniel Matthews and Kim Geheb (Editor).

Publisher : Routledge, Taylor & Francis Group, 2015

Call Number : 333.914150959/HYD

ISBN : 9780415719131

Location : Pustaka Negeri Sarawak (Kuching)

Format : Book

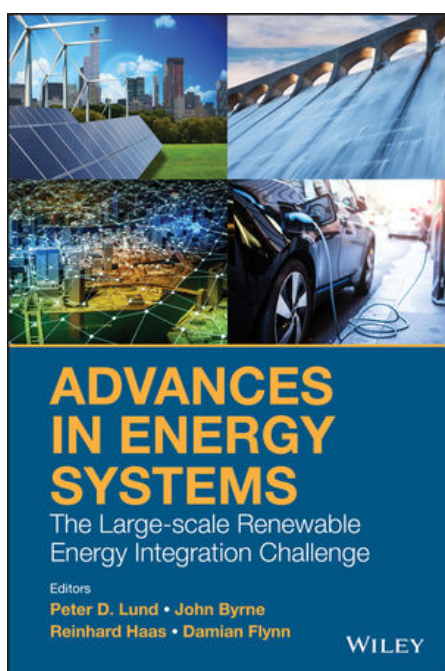
material



Description:

The Mekong Basin is home to some 70 million people, for whom this great river is a source of livelihoods, the basis for their ecosystems and a foundation of their economies. But the Mekong is also currently undergoing enormous social, economic, and ecological change of which hydropower development is a significant driver. This book provides a basin-wide analysis of political, socio-economic and environmental perspectives of hydropower development in the Mekong Basin. It includes chapters from China, Thailand, Laos, Cambodia and Vietnam.

Written by regional experts from some of the region's leading research institutions, the book provides an holistic analysis of the shifting socio-political contexts within which hydropower is framed, legitimised and executed. Drawing heavily on political ecologies and political economics to examine the economic, social, political and ecological drivers of hydropower, the book's basin wide approach illuminates how hydropower development, and its benefits and impacts, are linked multilaterally across the basin.



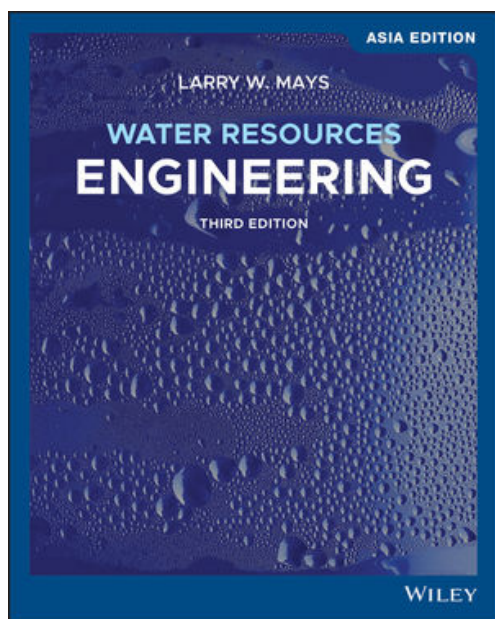
Title : Advances in Energy Systems : the Large-scale Renewable Energy Integration Challenge
 Author : Peter D. Lund, John A. Byrne, Reinhard Haas, Damian Flynn (Editor)
 Publisher : John Wiley & Sons, 2019
 Call : 333.794/ADV
 Number :
 ISBN : 9781119508281
 Location : Pustaka Negeri Sarawak (Kuching)
 Format : Book
 material



Description:

Advances in Energy Systems offers a stellar collection of articles selected from the acclaimed journal *Wiley Interdisciplinary Review: Energy and Environment*. The journal covers all aspects of energy policy, science and technology, environmental and climate change. The book covers a wide range of relevant issues related to the systemic changes for large-scale integration of renewable energy as part of the on-going energy transition.

The book addresses smart energy systems technologies, flexibility measures, recent changes in the marketplace and current policies. With contributions from a list of internationally renowned experts, the book deals with the hot topic of systems integration for future energy systems and energy transition.



Title : Water Resources Engineering, 3rd Edition
Author : Larry W. Mays
Publisher : John Wiley & Sons, 2019.
Call : 627/MAY
Number
ISBN : 9781119590576
Location : Pustaka Negeri Sarawak (Kuching)
Format : Book
material



Description:

Modern water conveyance and storage techniques are the product of thousands of years of human innovation; today we rely on that same innovation to devise solutions to problems surrounding the rational use and conservation of water resources, with the same overarching goal: to supply humankind with adequate, clean, freshwater. *Water Resources Engineering* presents an in-depth introduction to hydrological and hydraulic processes, with rigorous coverage of both core principles and practical applications.

The discussion focuses on the engineering aspects of water supply and water excess management, relating water use and the hydrological cycle to fundamental concepts of fluid mechanics, energy, and other physical concepts, while emphasizing the use of up-to-date analytical tools and methods. Now in its Third Edition, this straightforward text includes new links to additional resources that help students develop a deeper, more intuitive grasp of the material, while the depth and breadth of coverage retains a level of rigor suitable for use as a reference among practicing engineers.

LIST OF ARTICLES

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

Title : Technology transfer in the hydropower industry: An analysis of Chinese dam developers' undertakings in Europe and Latin America
Authors : Julian Kirchherr, and Nathaniel Matthews.
Online Database : Mandeley (Elsevier)
Format : e-Article
DOI : <https://doi.org/10.1016/j.enpol.2017.11.043>



Technology transfer in the hydropower industry: An analysis of Chinese dam developers' undertakings in Europe and Latin America[☆]

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ARTICLE INFO

Keywords:
Technology transfer
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Large dams
Chinese dam developers
Europe
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ABSTRACT

Technology transfer is essential for transitioning to a low carbon economy which can include hydropower. Chinese dam developers allegedly dominate the global hydropower industry. Studies have been carried out on technology transfer in their undertakings in Africa and Asia. However, such work is lacking for Europe and Latin America. The aim of this paper is to identify the extent, drivers and inhibitors of technology transfer of Chinese dam developers' undertakings in Europe and Latin America. We find relatively few Chinese undertakings and thus limited evidence for technology transfer both in Europe and Latin America. Transfers identified are frequently mutual with the Chinese player transferring technology to the host country and vice versa. This transfer is driven by business considerations in Europe (costs, capacities) and Latin America (costs, lacking access to finance), but also geopolitical ones (Europe: creation of a trading area; Latin America: access to (natural) resources). It is impeded by Chinese dam developers' poor reputation regarding safeguards as well as (only in Latin America) protectionist policies and significant capacities of host country players. Our research provides transparency regarding the European and Latin American hydropower industry, while also highlighting that attempts to influence what kind of technology is transferred by Chinese dam developers may be worthwhile.

1. Introduction

The transition towards a low carbon economy is seen as a major challenge by policy-makers around the world (Bridge et al., 2013; Geels, 2012). Hydropower dams are considered by many as a part of the energy mix of a low carbon economy, particularly for developing countries which have not exploited many economically viable hydropower sites yet (Gemaat et al., 2017; Zarfl et al., 2015). Hydropower already provides 16% of the global electricity and about 85% of global renewable electricity (IEA, 2016). Its role as a renewable electricity source is projected to grow in the coming years due to an unprecedented boom in dam construction currently under way with installed global hydropower capacity expected to increase by 73% until 2040 (Zarfl et al., 2015). Despite this boom, hydropower remains extremely contested due to its vast negative environmental and social impacts (Khagram, 2004; Kirchherr et al., 2016a; McCully, 2001; WCD, 2000). Some have even questioned if hydropower is an appropriate

technology to use because of these impacts (Ansar et al., 2014; Kirchherr, 2017a; Warner et al., 2017).

Mitigating hydropower dams' negative environmental and social impacts is a challenge, as is their construction from an engineering standpoint, particularly for many energy-hungry developing countries (Biswas, 2012; Hensengerth, 2015a). Traditionally, the World Bank as the largest international donor linked to hydropower facilitated technology transfer (term defined in Section 3) to enable developing countries to exploit their hydropower resources (Kirchherr et al., 2017; Park, 2010). However, a funding gap opened when World Bank decided to opt out of hydropower dam financing in the early 2000s due to the massive public protests.¹ This funding gap helped to prepare the ground for the rise of Chinese players in the global hydropower industry (Biswas, 2012; International Rivers, 2012; Kirchherr, 2017b; McDonald et al., 2009). It coincided with the Chinese government's 2001 Going Out Strategy which encouraged SOEs to expand abroad to continue their growth and increase Chinese influence (Chen et al., 2017; Motta

[☆] This article is part of a Virtual Special Issue entitled 'South-South Technology Transfer and Cooperation for Low Carbon Energy Technologies'.

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¹ The World Bank has engaged again in hydropower financing again around 2010 (Kirchherr et al., 2017; Park, 2010).

Title : A review of previous studies on dam leakage based on distributed optical fiber thermal monitoring technology.

Authors : Xiao Fang, Yajie Zeng, Feng Xiong, Jiang Chen and Fei Cheng

Online Database : Emerald

Format : e-Article

DOI : DOI [10.1108/SR-02-2021-0068](https://doi.org/10.1108/SR-02-2021-0068)



A review of previous studies on dam leakage based on distributed optical fiber thermal monitoring technology

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Yajie Zeng

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Feng Xiong and Jiang Chen

MOE Key Laboratory of Deep Earth Science and Engineering, College of Architecture and Environment, Sichuan University, Chengdu, China, and

Fei Cheng

College of Biomass Science and Engineering, Sichuan University, Chengdu, China

Abstract

Purpose – Seepage of the dam is an important safety problem, which may cause internal erosion of the structure. In the field of seepage monitoring in civil engineering, the distributed optical fiber sensing technology based on the temperature tracing method has been paid more attention due to its unique advantages of high sensitivity, good stability and high resolution. The purpose of this paper is to make a review of the existing related research, so as to facilitate the later scholars to understand and further study more systematically.

Design/methodology/approach – In this paper, three kinds of commonly used distributed fiber temperature measurement technologies are introduced. Based on the working principle, monitoring system, theoretical analysis, experimental research and engineering application of the fiber seepage monitoring technology, the present situation of dam seepage monitoring based on distributed fiber is reviewed in detail and their advantages and disadvantages are compared.

Findings – The thermal monitoring technology of seepage measurement depends on the accuracy of optical fiber temperature measurement (including the accuracy of the system and the rationality of the discrimination method), the correct installation of optical fiber and the quantitative analysis of temperature data. The accuracy of the current monitoring system can basically meet the existing measurement requirements, but the correct installation of optical fiber and the calibration of temperature data need to be further studied for different discrimination methods, and this field has great research value.

Originality/value – At present, there are many applications and research studies of optical fiber sensing in the field of structural health monitoring, and there are also reviews of related aspects. However, there is little or no review only in the field of seepage monitoring. This paper summarizes the research and application of optical fiber sensing in the field of seepage monitoring. The possibility of the gradient method to find its new prospect with the development of monitoring systems and the improvement of temperature resolution is discussed. The idea of extending the seepage monitoring method based on distributed optical fiber thermal monitoring technology to other monitoring fields is also given in the paper.

Keywords Sensors, Fiber optic sensors, Wireless sensor networks, Distributed optical fiber, Dam, Seepage monitoring, Temperature tracing method

Paper type Literature review

1. Introduction

Seepage is one of the main causes of the dam and its foundation failure. Among 206 earth rock dam accidents in the USA, 39% were caused by seepage, such as the break of the Teton Dam in the USA (Busch, 2002). In addition, the investigation results of earth-rock dam accidents in Japan and Switzerland show that more than 40% of accidents are caused by seepage (Becker *et al.*, 2004). Therefore, seepage monitoring is one of the important contents in the field of

geotechnical engineering safety monitoring. Seepage monitoring methods are diverse, including Traditional detection methods. These methods are simple in structure, easy to use and have rich experience in engineering application. There are piezometers, osmometers, measuring weir method, etc. However, these methods are all point-type instruments, which are easy to damage and have the disadvantages of low resolution and high rate of missed detection. Electric exploration methods, such as self-potential method, resistivity method, etc. The disadvantages of the resistivity

The current issue and full text archive of this journal is available on Emerald Insight at: <https://www.emerald.com/insight/0260-2288.htm>



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Title : Floating solar photovoltaic as virtual battery for reservoir based hydroelectric dams: A solar-hydro nexus for technological transition
Authors : Herman Zahid, Abdullah Altamimi, Syed Ali Abbas Kazmi, Zafar A. Khan, and Abdulaziz Almutairi
Online Database : Mandeley (Elsevier)
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DOI : <https://doi.org/10.1016/j.egy.2022.08.088>



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The 5th International Conference on Electrical Engineering and Green Energy, CEEGE 2022,
8–11 June, Berlin, Germany

Floating solar photovoltaic as virtual battery for reservoir based hydroelectric dams: A solar-hydro nexus for technological transition

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Abstract

This paper presents a policy approach for the technological transition from hydropower to green energy in developing countries. Conventional electricity generation technologies have proven to be a burden on the economy of a country, as they have to depend on fossil fuels to meet their energy needs, such as diesel and gasoline. Pakistan has been taken as a case study to show the growing electricity demand of a developing country that implores major technological initiation. This serves as the assessment of suitability and resource regarding the installation of floating solar photovoltaic (FSPV) on reservoirs of hydroelectric dams, thus acting as a virtual battery. Generation from FSPV can complement the hydropower generation in the dry period, consequently meeting the peak demand. In real-time, by employing both technologies at the same substation, hydropower covers the intermittency issues of floating PV technology by improving power quality. Seven dams selected for this study have been analyzed based on their percentage surface area of the reservoir for electricity generation, water conservation, and emission reduction. Tarbela dam has been further analyzed for demonstrating the virtual battery effect by improving the electricity generation profile. The proposed approach meets the electricity needs of about 15.5% of the total population and serves the water need of 2.3 million people in the country.

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Peer-review under responsibility of the scientific committee of the 5th International Conference on Electrical Engineering and Green Energy, CEEGE, 2022.

Keywords: Renewable energy; Floating solar; Photovoltaic; Virtual battery; Hydroelectric dam; Technological transition

1. Introduction

The common dilemma of third-world countries is energy security in addition to lack of access to electricity, energy shortage, and ever-increasing population. International Energy Agency (IEA) defines energy security as the

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Peer-review under responsibility of the scientific committee of the 5th International Conference on Electrical Engineering and Green Energy, CEEGE, 2022.

LIST OF CASE STUDY

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

Title : Micro hydropower plant potential study based on Landsat 8 operational land imager satellite data
Authors : Yuliana Susilowati, Pudji Irasari, Yugo Kumoro, and Wawan Hendriawan Nur, Yunarto
Online Database : Mendeley
Format : e-Article
DOI : DOI: 10.11591/eei.v10i6.3208

Bulletin of Electrical Engineering and Informatics
Vol. 10, No. 6, December 2021, pp. 3167–3177
ISSN: 2302-9285, DOI: 10.11591/eei.v10i6.3208

3167

Micro hydropower plant potential study based on Landsat 8 operational land imager satellite data

Yuliana Susilowati¹, Pudji Irasari², Yugo Kumoro³, Wawan Hendriawan Nur⁴, Yunarto⁵
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Landsat 8 satellite
Micro hydropower plant
Potential study
Remote sensing

ABSTRACT

Remote sensing technology has been widely applied in various fields, including oil, gas, and mineral exploration, spatial planning, and environmental monitoring. This paper describes the application of remote sensing technology for the potential study of a renewable micro hydropower plant (MHP) using Landsat 8 satellite data. The Sukaati Watershed, West Java, Indonesia, was selected as the case study area. Landsat 8 satellite data, acquired on August 21, 2020, was applied to extract information on land use, geology, and potential landslides. Drainage patterns, watershed boundaries, and head height were obtained from topographic map data. Drainage patterns, watershed boundaries, and land use are used to calculate flow rates. Geological map and landslide are the basis of layout of MHP components, such as water intake, dam, waterway, settling tank, penstock, and powerhouse. A field survey to acquire actual flow rate and head height was conducted to validate the results of the remote sensing data interpretation. Two potential sites of MHP were selected with a hydropower design of 129 kW and 5.18 MW. This study showed that remote sensing technology is beneficial for studying the potential of MHP because fieldwork can be done more quickly and efficiently.

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1. INTRODUCTION

The level of electricity expenditure can be observed as an assessment measure of a country's development level. The rise in the demand for energy worldwide is an affirmation that energy is the engine of growth in this 21st century [1], [2]. Renewable hydropower is an alternative source of energy that can meet energy needs and reduce dependence on fossil energy sources. Renewable hydropower is a clean, reliable, versatile, and low-cost source of electricity generation [2]-[10].

Hydropower potential studies carry huge uncertainties about the technical, economic, and environmental feasibility. Building a hydropower plant requires thorough studies of water drainage patterns, geological lithology, surface and subsurface structures. Image processing technology can play a vital role in the studies of the categories mentioned. Detailed field studies can be followed, once image processing accomplishes the initial stage of the studies. Remote sensing technology can generate, maintain, and renew up-to-date data of the earth's surface and its combination with socio-economic information. Remote sensing and GIS technology are very helpful for the hydropower plant feasibility study [11]-[16].

Journal homepage: <http://beei.org>

LIST OF NEWSPAPER ARTICLE

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

Article Name : Three Gorges Dam: a model of modern manufacturing
 Authors : -
 Newspaper : Global Times-Weekend
 Date of Published : 27 July 2024
 Online Database : PressReader

6 July 27-28, 2024

WEEKEND BIZINSIGHT GLOBAL TIMES

► Construction of China's infrastructure becomes greener, more innovative

By Chi Jingyi in Yichang

Three Gorges Dam: a model of modern manufacturing

Editor's Note:
 As the Chinese economy has faced challenges in recent years, some Western officials and media pundits have stepped up their smear campaign against China. They cherry-pick information and distort facts to hype their narratives such as "Peak China," but they always turn a blind eye to China's economic resilience and development potential. In order to set the record straight, the Global Times is launching a multimedia project, including in-depth articles, objective analysis and visual arts, to present a comprehensive and true picture of the economy. This is the 11th installation of the series.

Since the start of the construction of the Three Gorges Dam, China's hydropower ecosystem has overcome difficulties and realized the independent design and manufacturing of hydropower equipment and the localization of important materials.

The Global Times recently made a visit to the Gezhouba Dam and the Three Gorges Dam to discover how China's infrastructure construction, taking the building of hydropower stations as example, started from scratch to become a global leader, and how infrastructure construction becomes smarter, greener and more creative.

The Gezhouba Hydropower Station, located in Yichang, Central China's Hubei Province, was the first large-scale water control project on the main artery of the Yangtze River and was a milestone of China's hydropower generation. The first group of generator units was commissioned in 1981, with the hydropower station already being operational for more than 40 years.

In 2003, the first batch of electricity generator units of the Three Gorges Hydroelectric Power Station, commonly known as the Three Gorges Dam, entered service. The Three Gorges project, which started construction in 1994 based on experience from the construction of the Gezhouba station, remains as the world's largest hydroelectric power plant in terms of installed capacity.

Hard-won achievements

The six mega hydropower stations along the upper and middle reaches of the Yangtze River – The Three Gorges, Wudongde, Baihetan, Xiluodu, Xiangjiaba, and Gezhouba – form the world's largest clean energy corridor, which spans over 1,800 kilometers with a water level drop exceeding 900 meters.

The construction of the corridor has taken nearly half a century, and was completed in December 2022, when the Baihetan Hydropower Station, located in the upper reaches of the

Yangtze River – the lower reaches of the Jinsha River – in Southwest China, became fully operational.

The corridor, an enormous project, has become the best in class globally for many aspects of its construction and operation, such as being the world's thinnest 300-meter-level ultra-high arch dam, the world's highest underground powerhouse, and the world's largest single unit of power generator in terms of capacity.

After the completion of the Three Gorges Dam project, China started the development and construction of cascade hydropower stations in upper reaches of the Yangtze River.

Domestically-driven innovation

Domestic enterprises for hydropower equipment design and manufacturing have continuously set new records in the field of major hydropower technical equipment.

On June 28, 2021, the first generation of hydro-generator units with a capacity of 2 million kilowatts at the Baihetan Hydropower Station successfully entered operation, achieving breakthroughs in leading the world's hydropower development.

Behind the improvement of unit capacity is the comprehensive research and development and application of new things.

China's hydropower ecosystem has realized independent design, manufacturing, and localization of key raw materials. Some technologies have filled the gaps in related fields at home and abroad, meaning that transformation from "made in China" to "created in China" has been achieved, enabling China's hydropower equipment manufacturing to remain at world's leading position, industry insiders told the Global Times.

They also noted that the construction of the Three Gorges Dam represents the epitome of China's infrastructure building and the transformation in its manufacturing industry.

So far, a total of 110 hydroelectric generators are operational in the world's largest clean energy corridor. The total installed capacity of the six hydropower stations has already hit 71.695 million kilowatts, producing about 300 billion kilowatt-hours of clean electricity annually, which can meet the annual electricity demand for roughly 360 million people.

Beneficial project

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Source: official data
 Graphic: Xia Qing/GT

Digitalized operation

Apart from smart construction, China's traditional energy industry has embarked on a digital transformation in operation and maintenance.

Despite its immensity, the operations of the Three Gorges Dam have been simple and easy, streamlined through a digitalization process. Technicians only need to use mobile phones or tablets to complete various tasks, including equipment maintenance management, operation scheduling management, safety and reliability monitoring, and document management.

By April 2024, the industrial internet platform has been deployed in all six cascaded hydropower stations along the mainstream of the Yangtze River, the Global Times learned.

After the application of the industrial internet platform in the Yangtze River basin hydropower stations, the comprehensive utilization rate of water resources, the operation efficiency of the power stations, and the operation safety and reliability will be further improved, a vivid example of "5G+ Industrial Internet" enabling new industrialization, said China Yangtze Power Co (CYP), a subsidiary of CTG and the constructor of the industrial internet platform.

CYP has independently developed the industrial internet platform for the cascade hydropower stations to enable intelligent operation, maintenance, scheduling, decision-making, and other scenarios, the Global Times learned.

The Three Gorges Dam in Yichang, Central China's Hubei Province on May 22, 2024 Photo: Chen Tao/GT

Page Editor: [chenyonghui@globaltimes.cn](#)



Article Name : Sarawak Energy aims to progress Malaysia's sustainable energy goals, expand regional collab.
Authors : -
Newspaper : The Borneo Post
Date of Published : 12 July 2024
Online Database : PressReader

Sarawak Energy aims to progress Malaysia's sustainable energy goals, expand regional collab

KUCHING: In its commitment to advancing hydropower and renewable energy in Malaysia, Sarawak Energy recently participated in a discussion with Deputy Prime Minister Datuk Seri Fadillah Yusof, the International Hydropower Association (IHA), and Global Renewables Alliance (GRA), at the Malaysia High Commission in London.

The discussion aimed to progress Malaysia's sustainable energy goals and expand regional collaboration opportunities with the global hydropower community to accelerate hydropower development towards meeting the nation's net zero target by 2050, according to a Sarawak Energy statement.

Representing Sarawak Energy was its group chief executive officer Datuk Sharbini Suhaili, who also serves as a board member of IHA for Asia (East and Pacific). IHA and GRA were represented by their chief executive officers Eddie Rich and Bruce Douglas, respectively.

Fadillah, who is Energy Transition and Water Transformation Minister, discussed Malaysia's efforts to address resource security and environmental impact concerns by pursuing renewable energy alternatives, including solar and hydro, to diversify the energy mix and promote sustainable electricity generation.

He said in 2021, the Malaysia Renewable Energy Roadmap outlined a strategic framework to achieve the ambitious targets for diversifying the nation's energy mix and the potential of hydroelectric power stands out significantly.

He also highlighted the future of hydropower, including mini and micro-hydro projects, which offer sustainable energy solutions for rural electrification while minimising environmental impact. Smaller hydro projects require modest infrastructure and integrate well into existing water management systems.

Fadillah also expressed interest for his ministry to collaborate with Sarawak Energy, IHA, and GRA on policy, advocacy, and renewable energy capacity building. The discussions also covered pumped storage, cascading power sources, and integrating hydropower into Asean energy programmes.

During the discussion, Sharbini emphasised Sarawak Energy's commitment to accelerate hydropower development towards net zero and shared insights on how renewable hydropower has powered Sarawak's sustainable growth.

"Renewable hydropower can power sustainable socio-economic growth in Sarawak and serve as one of the key enablers for regional growth," he said.

He noted that while Southeast Asia's installed hydropower capacity is expected to continue growing to meet electricity demand, many policymakers in the region have not included hydropower in net zero strategies yet – as reflected in IHA's published 2024 World Hydropower Outlook.

With increased resources and strengthened partnerships, Sarawak Energy aims to support global energy transition efforts and contribute to the region's energy transition.

"Malaysia recognises large hydropower as a contributor to renewable energy targets at the national level.

"With this, Malaysia can play a very important role in driving this regional shift towards renewable hydropower – becoming an energy transition leader in Southeast Asia," said Sharbini.

Rich emphasised hydropower's role in supporting global climate action and shared IHA's plans to focus more on regionalisation to meet Southeast Asia's needs in accelerating sustainable hydropower development.


He also detailed IHA's recommendations for Malaysia and the role of advocacy going forward. Meanwhile, Douglas emphasised hydropower's role in tripling global renewable capacity by 2030, stressing its flexibility and resiliency.



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