

SUN TO TAP: SOLAR-POWERED WATER TREATMENT SYSTEM

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India, a nation renowned for its rich cultural heritage and rapid economic growth, is grappling with an increasingly critical challenge—severe water scarcity. With a population exceeding 1.45 billion and faster urbanization, the demand for clean water is surging at an unprecedented rate. This crisis is further exacerbated by declining groundwater levels, inefficient water use in agriculture, and rising water pollution.

The scale of India's water crisis is staggering. According to a report by NITI Aayog, over 600 million people in India are facing extreme to severe water stress and 21 big cities are expected to run out of groundwater, further affecting around 100 million people. It has also been reported that approximately 70% of India's water is contaminated and water-borne diseases cause a huge burden while also resulting in significant loss of life. It is a major cause of death in Children under five. According to a report, 1 in every 10 people does not have access to a safe drinking water source.

Among the four major water-borne diseases in India, diarrhoea is the most widely reported one, followed by typhoid and viral hepatitis. The cases of cholera are very minimal in comparison to these three. Over the years, diarrhoea accounted for more than 85% of all the cases reported. Rest is comprised of Typhoid, also called enteric fever, with around 14% of the cases and hepatitis with 1% of all the cases. Nine states accounted for more than 65% of all the cases reported on diarrhoea and typhoid. The states are both relatively developed states like Karnataka, Maharashtra, Andhra Pradesh, and relatively less developed states like Odisha, UP, Madhya Pradesh, and Rajasthan.

Climate change is intensifying the problem, with erratic monsoon patterns disrupting traditional water cycles. Many regions experience either prolonged droughts or sudden, intense rainfall leading to heavy floods, both contributing to water insecurity. The agricultural sector, which consumes about 80% of India's freshwater, faces significant challenges. Inefficient irrigation practices, coupled with water-intensive crop choices like rice and sugarcane in water-stressed regions, compound the issue.

In urban areas, rapid population growth strains existing water infrastructure. Many cities struggle with outdated distribution systems, resulting in substantial water loss through leakages and pilferages. The lack of adequate wastewater treatment facilities leads to the pollution of rivers and groundwater sources. India currently generates over 72 billion litres of municipal wastewater from urban centres, but only about 40% of it is treated before disposal, leaving a significant gap in wastewater management.



Addressing these challenges requires a multi-faceted approach. The government has initiated several programs, including the Jal Shakti Abhiyan, aimed at water conservation and management. Efforts are being made to promote rainwater harvesting, restore water bodies, and improve irrigation efficiency.

The evolving landscape for water and wastewater treatment in India is a crucial aspect of the country's sustainable development. There's a growing emphasis on adopting advanced technologies for water purification and recycling. However, the implementation of these solutions faces hurdles such as high costs, lack of skilled personnel, and inadequate infrastructure.

As India strives to balance its developmental needs with environmental sustainability, effective water management remains a pivotal challenge. The country's ability to innovate, implement, and scale up sustainable water treatment solutions will be critical in securing its water future and supporting its continued growth and prosperity.

THE INNOVATIVE APPROACH: SUN TO TAP

The quest for sustainable and reliable clean water solutions has led to the development of solar-powered water treatment systems. These systems use renewable solar energy to power the entire water purification process, making them especially valuable in areas with limited access to traditional energy sources or where water infrastructure is underdeveloped.

Solar-powered water treatment systems utilize solar energy to provide clean drinking water directly

from a tap. They integrate innovative treatment technologies to ensure the water is free of contaminants and safe for consumption. These systems are particularly advantageous in off-grid locations or remote communities where conventional power and water treatment facilities are either unavailable or impractical.



Solar panels are the backbone of these systems. They convert sunlight into electrical energy using photovoltaic (PV) cells. The size and efficiency of the panels determine the amount of power available for running the system's various components. High-efficiency panels are crucial for maximizing energy production, especially in regions with less sunlight. The system connects to a local water source, which could be a well, river, rainwater catchment, or another untreated water supply. The quality of this source water directly impacts the treatment process and determines the type of filtration needed to produce safe drinking water.

Several filtration stages are used to purify the water depending upon the contamination in source water. A UV (Ultraviolet) disinfection is employed to kill any remaining bacteria, viruses, and other pathogens. Once treated, the clean water is stored in a tank. The tank helps maintain a steady supply of water and may include additional filtration or disinfection features to keep the water safe until it is used.

These solar-powered water treatment systems include advanced control and monitoring features. These systems track energy production, water flow, and treatment processes. Remote monitoring capabilities can provide real-time data on system performance and alert users to maintenance needs. Solar-powered systems reduce reliance on fossil fuels and minimize greenhouse gas emissions, thus

gaining with carbon credits. By using renewable solar energy, these systems contribute to a lower carbon footprint and promote environmental sustainability.

AQUALITY INTELLIGENT SOLUTIONS PIONEERING INNOVATIONS

Aquality Intelligent Solutions Pvt. Ltd. has been a pioneer in delivering clean drinking water, clean air, and advanced technology solutions to both people and industries. In its ongoing efforts, the company has been focusing on providing sustainable and renewable water filtration solutions specifically designed for Indian security forces stationed in remote and forested areas where conventional energy sources and clean water are scarce.

The concept for a Solar Powered Water Filtration System was conceived in 2015 when the company introduced a prototype to the Ministry of Water & Sanitation, targeting various establishments, including local communities in areas with severe water challenges.



This groundbreaking solar water filter features a high-speed filtration unit capable of purifying water from nearly any source, including hand pumps, swamps, wells, floodwaters, rivers, and even wastewater. By employing advanced purification techniques, the system effectively eliminates impurities, providing high-quality drinking water without relying on electricity.

KEY FEATURES

- Fully mobile, capable of installation anywhere.
- Quick deployment in emergencies or disaster situations.
- Available in various sizes, from small to large-scale community or commercial use.
- Stand-alone, user-friendly system for water purification and disinfection.

- Solar-powered alternative to traditional water treatment methods.
- Provides clean water to armed forces in the field, regardless of source water quality.
- Reduces the logistical challenges of transporting water tankers or bottled water.
- Highly scalable, with a single unit capable of producing 500 to 20,000 litres of clean water daily.
- Promotes sustainability by lowering demand for electricity and bottled water.
- Minimizes carbon footprint, energy consumption, and bottled water transport disposal.
- Portable, modular unit ideal for providing safe drinking water during humanitarian missions.
- Can be vehicle-mounted to deliver clean water to different locations each day.
- Solar-powered purification offers a viable solution for providing safe, clean drinking water.

Solar-powered water treatment systems are more than just technological innovations; they symbolize hope, providing a sustainable approach to tackling critical water challenges. Harnessing solar energy, these systems offer an environmentally friendly solution, representing a crucial step towards the mission to ensure access to clean water for everyone.

The purification unit is compact, approximately the size of a large box, and operates with minimal power requirements. It is designed to be low-maintenance, with no replaceable components like carbon filters or reverse osmosis membranes. Additionally, the system can recycle water for toilet flushing, addressing the challenge of water shortages.

This innovation not only eliminates the logistical burden of transporting bottled water but also significantly reduces the risk of waterborne diseases that could jeopardize mission success. It ensures a consistent supply of clean water to remote areas where security forces are stationed and to villages suffering from water scarcity due to the lack of electricity.

NEXT STEP

Solar-powered water treatment systems represent a significant advancement in providing clean, reliable drinking water while leveraging renewable energy. These systems offer a sustainable and cost-effective solution for improving water accessibility and quality, especially in remote or underserved areas. As technology continues to evolve, solar-powered systems will play an increasingly important role in meeting global water needs and supporting environmental sustainability.

ABOUT THE AUTHOR



Mohammed Naser Azeez is the Managing Director of Aquality Intelligent Solutions Pvt. Ltd., a leading ISO 9001:2015 certified company focused on cutting-edge water treatment technologies. His impactful work in delivering clean drinking water solutions has greatly enhanced the quality of life for many, reflecting his deep dedication to technological advancement and maintaining the highest standards of quality.

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