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## Minor Irrigation Systems By Incorporating Solar Power

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**Abstract:** Water scarcity and irregular electricity supply are major problems in rural irrigation systems. This paper presents a minor irrigation system powered by solar energy for agricultural applications. The system consists of a solar panel, charge controller, battery, water pump, water tank, and drip irrigation system. Solar energy is used to operate the water pump, which pumps water from the tank to the crops through a drip irrigation system. This system reduces electricity consumption, saves water, and provides an eco-friendly irrigation solution for farmers. The proposed system is cost-effective, reliable, and suitable for rural areas where electricity is not available.

**Index Terms** – Solar Irrigation, Drip Irrigation, Solar Panel, Water Pump, Renewable Energy, Agriculture.

### I. INTRODUCTION

Agriculture is the backbone of the Indian economy, and irrigation plays an important role in agriculture. Traditional irrigation systems require electricity or diesel pumps, which are expensive and not environmentally friendly. Solar energy is a renewable energy source that can be used for irrigation systems. The minor irrigation system using solar power is designed to provide water to crops using a solar-powered water pump and drip irrigation system. This system is especially useful in rural and remote areas where electricity supply is not available. Government initiatives, particularly in countries like India, are promoting solar irrigation through subsidies and schemes, encouraging wider adoption. Overall, solar-powered minor irrigation systems provide an eco-friendly, cost-effective, and efficient solution, though further research is needed to address economic and environmental concerns.

### II. LITERATURE REVIEW

Several researchers have investigated the application of minor irrigation systems in irrigation. Minor irrigation systems are essential for improving agricultural productivity, particularly in rural and water-scarce regions. Traditional irrigation methods relying on diesel and grid electricity face challenges such as high costs, unreliable power supply, and environmental pollution. To overcome these issues, solar-powered irrigation systems have emerged as a sustainable alternative. Solar irrigation uses photovoltaic technology to generate electricity for water pumping, offering benefits like reduced operational costs, low maintenance, and zero emissions. Integrating solar power with minor irrigation sources such as wells and tube wells enhances efficiency, ensures reliable water supply, and supports decentralized farming practices. Recent advancements include the use of smart technologies like soil moisture sensors and automated irrigation systems, which optimize water usage and improve crop yield. However, challenges such as high initial investment, land requirements, energy storage limitations, and potential groundwater over-extraction still exist.

### III. METHODOLOGY

#### A. SYSTEM COMPONENTS

The system consists of the following components:

- Solar Panel
- Charge Controller
- Battery
- Water Pump
- Water Tank
- Drip Irrigation System
- Crops Field

#### B. WORKING PRINCIPLE

The working of the system is as follows:

Solar panel converts sunlight into electrical energy.

The charge controller regulates voltage and current.

Battery stores electrical energy.

The battery supplies power to the water pump.

The water pump pumps water into the water tank.

Water flows from the tank through drip irrigation pipes.

Crops receive water drop by drop, saving water.



Figure 1. Minor Irrigation System

### IV. RESULTS

The solar irrigation system successfully pumped water using solar energy and supplied water to crops through a drip irrigation system. The system reduced water wastage and electricity consumption. The performance of the system depends on solar intensity and battery capacity.

### V. DISCUSSION

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## VI. SCOPE

- 1. Reduced Operating Costs & Pollution:** Eliminates reliance on fossil fuels, reducing greenhouse gas emissions and operational expenses.
- 2. Technological Advancement & Automation:** Integrates smart sensors (soil moisture, temperature) and IoT-enabled, solar-driven pumps to optimize water usage.
- 3. Water Conservation:** When combined with drip or sprinkler systems, solar irrigation can significantly reduce water wastage compared to conventional flood irrigation.
- 4. Energy Generation:** Excess solar energy generated can be fed back into the grid in some models (e.g., PM-KUSUM), allowing farmers to generate income.
- 5. Development:** Will help for development of remote, off-grid locations where reliable electricity is unavailable.

## VII. CONCLUSION

The minor irrigation system using solar power is an efficient and eco-friendly solution for agricultural irrigation. It reduces dependency on electricity and diesel pumps and saves water through drip irrigation. This system is highly suitable for rural and remote agricultural areas.

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