

Feasibility Study of Solar Powered Water Pumping System

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Abstract- Solar-powered water pumping systems are an efficient and sustainable alternative to conventional diesel and electric pumps. This study evaluates the technical, economic, and environmental feasibility of such systems. Solar photovoltaic (PV) technology converts sunlight into electrical energy to operate water pumps, making it highly suitable for rural and agricultural applications. The results show that although initial costs are high, the system offers low operating cost, long lifespan, and zero emissions, making it a viable long-term solution.

Keywords: Solar Powered, Pumping System, Maximum Power Point Tracking (MPPT), Total Dynamic Head (TDH)

I. INTRODUCTION

Water pumping is essential for irrigation and drinking water supply. Traditionally, pumps rely on diesel or grid electricity, which are costly and environmentally harmful.

Solar energy provides a renewable alternative because:

- It is abundant and freely available
- Suitable for remote areas without electricity
- Reduces dependency on fossil fuels

Solar PV water pumping systems are increasingly adopted worldwide due to rising fuel costs and environmental concerns.

II. OBJECTIVES OF STUDY

- To analyze the working of solar water pumping systems
- To evaluate technical feasibility
- To assess economic feasibility (cost vs benefit)
- To study environmental impact

III. COMPONENTS OF SOLAR WATER PUMPING SYSTEM

Main Components:

1. Solar Panels (PV Modules)
 - Convert sunlight into electricity
2. Controller (Inverter/MPPT)
 - Regulates voltage and improves efficiency
3. Electric Motor
 - Converts electrical energy into mechanical energy
4. Water Pump
 - Surface pump or submersible pump
5. Storage Tank (Optional)

The system may operate directly (without batteries) during sunlight hours, reducing cost and complexity.

IV. WORKING PRINCIPLE

- Solar panels absorb sunlight and generate DC electricity
- Electricity is supplied to the motor
- Motor drives the pump
- Water is lifted from source (well/river) to storage

VI. TECHNICAL FEASIBILITY

- Solar radiation availability
- Water table depth
- Required discharge (L/day)
- Pump efficiency

Solar pumping systems are technically feasible in regions with high solar irradiation, such as India.

VII. ECONOMIC FEASIBILITY

Cost Analysis:

Parameter	Solar Pump	Diesel Pump
Initial Cost	High	Low
Operating Cost	Very Low	High
Maintenance	Low	High
Lifespan	20–25 years	5–10 years

- Solar systems have high initial investment
- But almost zero fuel cost
- Long-term savings make them economically viable

Studies show that life-cycle cost of solar pumps is lower than diesel pumps over time.

VIII. ENVIRONMENTAL FEASIBILITY

Benefits:

- Zero greenhouse gas emissions
- No air or noise pollution
- Supports sustainable agriculture

Solar pumps help reduce dependence on fossil fuels and support climate goals

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