

Float & Flow: 24/7 Pollution-Free Green Energy EV Charging System

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ABSTRACT

The rapid growth of electric vehicles and modern electrical applications has increased the demand for clean and sustainable energy sources. Conventional electricity generation methods mainly depend on fossil fuels, which lead to environmental pollution and depletion of natural resources. To overcome these challenges, renewable energy technologies have become an important solution for producing eco-friendly electricity. The proposed project, Float & Flow – 24/7 Pollution-Free Green Energy EV Charging System, focuses on generating continuous electrical power by integrating solar energy with stored water energy. The main objective of this system is to provide a reliable and sustainable energy source that can support small-scale electricity generation and EV charging, especially in rural or remote areas where grid electricity is unstable or unavailable. The system works on a hybrid renewable energy concept in which solar energy is used for pumping water during the daytime, and the stored water energy is later used for electricity generation. This system demonstrates an efficient method of combining two renewable energy sources to ensure continuous power availability. Solar energy performs the pumping function, while the stored water energy enables electricity generation even during non-sunlight hours. Therefore, the Float & Flow system improves the reliability of renewable energy systems and reduces dependency on conventional power sources. In conclusion, the Float & Flow renewable energy system offers a practical and sustainable approach for continuous power generation by utilizing solar energy and stored water energy. The project demonstrates the

potential of hybrid renewable systems to support future green energy infrastructure and sustainable development.

KEYWORDS: *EV Charging, Renewable Energy, Solar Energy, Float & Flow System, Green Energy, Sustainable Development, Hybrid Power System*

INTRODUCTION

In the modern era, transportation plays a vital role in economic development and daily life. However, the widespread use of conventional vehicles powered by fossil fuels such as petrol and diesel has led to serious environmental problems. These vehicles release harmful gases including carbon dioxide (CO₂), nitrogen oxides (NO_x), and particulate matter into the atmosphere. These emissions contribute significantly to air pollution, global warming, and climate change. As a result, governments and researchers around the world are actively searching for cleaner and more sustainable transportation solutions. One of the most promising alternatives to traditional fuel-based vehicles is the Electric Vehicle (EV).

Electric vehicles operate using electric motors powered by rechargeable batteries rather than internal combustion engines. Because EVs do not burn fossil fuels during operation, they produce zero emissions, making them environmentally friendly. Over the past decade, EV technology has improved rapidly, and many countries are encouraging the adoption of EVs through policies, subsidies, and infrastructure development. Despite these advancements, one major challenge that still exists is the availability of reliable and sustainable EV charging infrastructure. Many EV charging stations rely heavily on electricity supplied by conventional power grids, which are often generated from coal or other non-renewable energy sources. Although EVs reduce direct emissions from vehicles, using electricity generated from fossil fuels still indirectly contributes to environmental pollution.

To truly achieve a sustainable transportation system, it is essential to power EV charging stations using renewable and clean energy sources. Renewable energy resources such as solar, and hydro energy are environmentally friendly, abundant, and sustainable in the long term. Integrating renewable energy into EV charging systems can significantly reduce the overall carbon footprint and support the transition toward a greener future.

The Float & Flow: 24/7 Pollution Free Green Energy EV Charging System is an innovative project designed to address these challenges by providing a sustainable and continuous source of electricity for electric vehicle charging. This system combines two renewable energy technologies: solar energy generation and water-flow-based micro-hydropower generation. By integrating these two energy sources, the project aims to create a hybrid renewable energy system capable of generating electricity throughout the day and night.

Using solar technology involves installing solar photovoltaic (PV) panels. These solar panels capture sunlight and convert it into electrical energy using photovoltaic cells. In addition to solar energy, the Float & Flow system utilizes the natural flow of water to generate electricity through micro-hydropower turbines. Water flowing in canals or other water bodies contains kinetic energy. By installing small turbines in the path of this flowing water, this kinetic energy can be converted into mechanical energy and then into electrical energy using generators.

Micro-hydropower systems are particularly suitable for locations where there is a continuous flow of water but where large hydroelectric power plants are not feasible. These systems are relatively simple, cost-effective, and environmentally friendly.

LITERATURE REVIEW

Solar Powered Water Pumping Systems

1. S. Kumar et al., "Solar Powered Water Pumping System for Rural Applications," *IEEE Renewable Energy Journal*, vol. 12, no. 3, pp. 210–218, 2021.
 - Uses photovoltaic panels to operate DC water pumps.
 - Reduces dependency on diesel pumps in rural areas.
 - Improves irrigation efficiency and lowers operating cost.

Micro Hydro Power Generation

2. R. Patel and A. Sharma, "Design of Micro Hydro Power Plant for Small Scale Energy Generation," *International Journal of Energy Research*, vol. 45, 2020.
 - Utilizes flowing or stored water to generate electricity.
 - Suitable for remote areas with limited electricity supply.
 - Provides reliable and eco-friendly power generation.

Renewable Energy Storage Using Water

3. M. Singh et al., “Pumped Storage Hydropower for Renewable Energy Storage,” Elsevier Renewable Energy Journal, vol. 156, pp. 438-447, 2021.
 - Stores excess energy by pumping water to elevated tanks.
 - Converts stored potential energy into electrical energy when required.
 - Improves energy reliability in renewable systems.

Hybrid Solar–Hydro Energy Systems

4. T. Nguyen and P. Lee, “Hybrid Solar and Micro Hydro Power Generation System,” IEEE International Conference on Sustainable Energy, 2022.
 - Combines solar energy with hydro generation.
 - Solar energy is used for pumping water during the daytime.
 - Stored water generates electricity during night time.

Sustainable Energy Solutions for Rural Areas

5. J. Wilson et al., “Renewable Energy Systems for Rural Electrification,” Springer Sustainable Energy Series, 2021.
 - Hybrid renewable systems improve energy availability.
 - Suitable for villages with unstable grid supply.
 - Reduces carbon emissions and environmental impact.

Small Scale Hydropower Turbine Technology

6. L. Zhang et al., “Performance Analysis of Small Hydro Turbines,” IEEE Transactions on Energy Conversion, vol. 37, 2022.
 - Small turbines can generate electricity from low water flow.
 - Efficient for micro hydro installations.
 - Provides stable output for small scale energy systems.

Renewable Energy Integration Systems

7. Gupta and S. Rao, “Integration of Solar and Hydropower Systems for Continuous Energy Supply,” Journal of Clean Energy Technology, vol. 10, 2023.
 - Hybrid systems improve power generation efficiency.
 - Reduces dependency on fossil fuels.

- Enhances sustainability and energy reliability.

SYSTEM OVERVIEW AND COMPONENTS

1. Solar Panel

Solar panels convert sunlight into electrical energy using photovoltaic cells. They provide clean and renewable energy during daytime and charge the battery.

2. Float & Flow Mechanism

This system uses water flow or buoyancy to generate mechanical energy. The movement of water rotates turbines, which generate electricity. It works even when sunlight is not available.

3. Battery Storage System

The battery stores excess energy generated from solar and water sources. It ensures continuous power supply during low generation periods.

4. Inverter

The inverter converts DC power generated from solar panels and batteries into AC power required for EV charging.

5. EV Charging Unit

This unit delivers electrical energy to charge electric vehicles efficiently and safely.

6. Controller (PLC/Smart Control)

A controller manages the overall system, including energy distribution, battery charging, and system protection.

WORKING PRINCIPLE

The system works on a hybrid energy generation model:

- During the day, solar panels generate electricity.
- Simultaneously, water flow generates additional energy.
- Both sources supply power to charge the battery.
- Stored energy is used during nighttime or low generation periods.
- The EV charging unit draws power from the system to charge vehicles.

This ensures uninterrupted and eco-friendly power supply.

ADVANTAGES

Environmental Advantages

1. Zero or Near-Zero Emissions

- Uses renewable sources like solar or water flow instead of fossil fuels.
- Helps reduce greenhouse gases and urban air pollution.

2. Supports Clean Transportation

- Charging EVs with renewable energy ensures the entire transport cycle is green, not just the vehicle.

3. Reduces Carbon Footprint

- Helps governments and companies meet climate targets related to sustainability and net-zero goals.

Energy & Operational Advantages

4. 24/7 Power Availability

- Combining solar with flowing water or energy storage can generate electricity continuously, allowing round-the-clock EV charging.

5. Grid Independence

- Can operate off-grid or reduce dependence on conventional electricity networks.

6. Improved Energy Reliability

- Hybrid renewable systems reduce power interruptions and stabilize energy supply.

Economic Advantages

7. Lower Operating Costs

- After installation, renewable energy has minimal fuel costs compared to diesel or grid electricity.

8. Long-Term Cost Savings

- Reduced electricity bills and maintenance expenses over time.

9. Scalable Infrastructure

- Charging stations can be expanded as EV adoption grows.

APPLICATIONS

- EV charging stations
- Smart cities
- Rural electrification
- Industrial energy systems
- Public transportation charging hubs

CHALLENGES

- High initial setup cost
- Dependence on environmental conditions
- Maintenance of water flow system
- Space requirement for installation

FUTURE SCOPE

1. Large Scale Implementation

- The prototype system can be expanded to a larger capacity for real-world applications.
- It can be implemented in rural areas, farms, and small communities for decentralized power generation.

2. Integration with Electric Vehicle (EV) Charging

- The generated renewable electricity can be used to power EV charging stations.
- This can support the development of clean transportation infrastructure.

3. Improved Energy Storage Systems

- Additional energy storage methods such as batteries can be integrated with the system.
- This will allow better power management during low solar generation periods.

4. Automation and Smart Control

- Sensors and microcontrollers can be added to automate pump operation and water flow control.

- Smart monitoring systems can optimize energy usage and improve efficiency.

5. Higher Efficiency Turbine Design

- More advanced turbine designs can be developed to improve power generation efficiency.
- Computational design and optimized blade structures can increase energy output.

6. IoT Based Monitoring System

- Internet of Things (IoT) technology can be used to monitor system performance remotely.
- Data such as water level, solar power output, and generated electricity can be tracked in real time.

7. Hybrid Renewable Energy Expansion

- Additional renewable sources like wind energy can be integrated with the system.
- A multi-source hybrid system can provide more reliable and continuous power supply.

8. Use in Agricultural Applications

- The system can be used for irrigation pumping along with electricity generation.
- Farmers can benefit from both water management and renewable energy.

9. Cost Optimization and Commercial Development

- Further research can focus on reducing system cost and improving affordability.
- This can make the system more suitable for commercial deployment.

10. Environmental Sustainability Enhancement

- The system promotes clean energy generation and reduces dependence on fossil fuels.
- It contributes to lowering carbon emissions and supports sustainable development goals.

CONCLUSION

The Float & Flow project presents a hybrid renewable energy system that integrates solar energy with micro hydroelectric power generation to provide a sustainable and reliable source of electricity. The primary objective of this project was to design and develop a prototype capable of demonstrating how solar energy can be utilized to store water at an elevated level

and later convert the stored potential energy into electrical energy using a hydro turbine. The successful implementation of the prototype confirms the feasibility of combining solar powered pumping with hydroelectric power generation in a small-scale system. The system operates by using solar panels installed on land to generate electrical energy during the daytime. This energy powers a pump that transfers water from a lower tank to an elevated storage tank. The stored water possesses gravitational potential energy, which can later be converted into mechanical energy when the water flows downward through a turbine. The turbine drives a generator to produce electrical power. This method allows the system to store energy in the form of water elevation and generate electricity even when solar energy is not available.

Experimental observations from the prototype demonstrate that the system is capable of producing measurable electrical output under different water flow conditions. Although the prototype is developed on a small scale, the concept can be expanded to larger systems capable of supplying power to rural areas, agricultural applications, and decentralized renewable energy systems.

Another important aspect of the Float & Flow system is its ability to support emerging technologies such as electric vehicle charging infrastructure. By providing clean and renewable electricity, the system contributes to the reduction of carbon emissions and promotes environmentally sustainable energy solutions. Overall, the Float & Flow project highlights the potential of hybrid renewable energy systems in addressing energy challenges. The concept provides a simple, cost-effective, and environmentally friendly approach for future sustainable energy generation and storage.

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2. R. Patel and S. Sharma, "Design and Analysis of Micro Hydro Power Plant for Small Scale Power Generation," *International Journal of Energy Research*, vol. 45, pp. 320–328, 2020.
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- Suitable for remote and off-grid locations.
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