SUSTAINABLE ENGINEERING LAB.

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SMART SOLAR IRRIGATION SAVES MONEY AND THE ENVIRONMENT IN SENEGAL

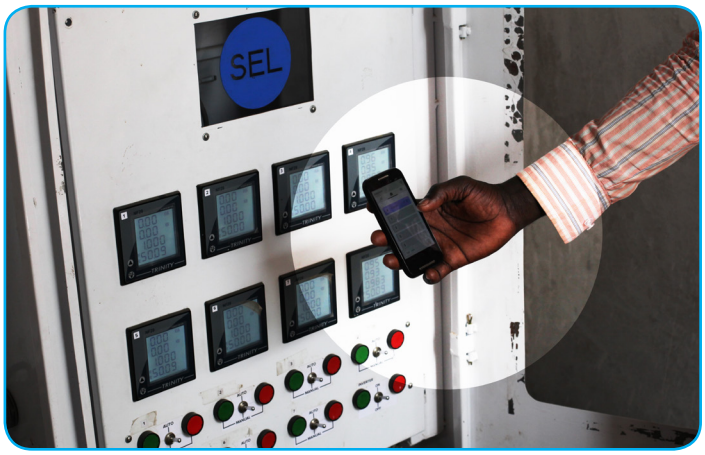
Potou, Senegal

The Sustainable Engineering Lab (SEL) has launched an innovative batteryless solar PV irrigation system in northern Senegal. The centralized 6.8kW solar array provides distributed 3-phase AC power to seven horticulture farmers that have their own shallow wells and 1-hp AC pumps. Our pre-paid smart-control system distributes energy to individual pumps as it becomes available throughout the day, enabling us to meet irrigation demand without the high capital and recurring costs of battery storage. Farmers maintain their existing gas-powered pumps as backups but we have set the price of solar energy slightly lower than the price of gasoline so that the farmers opt for the cheaper solar.

A "pay-as-you-go" model makes solar PV more affordable for small-scale farmers.

System uses low cost locally available AC pumps that are grid compatible.

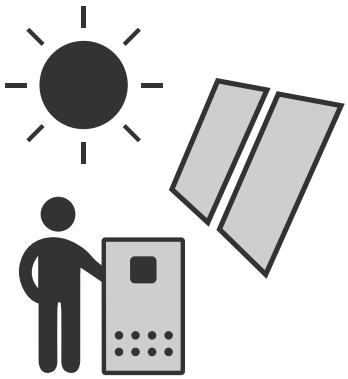
Multiple users and loads increases utilization.



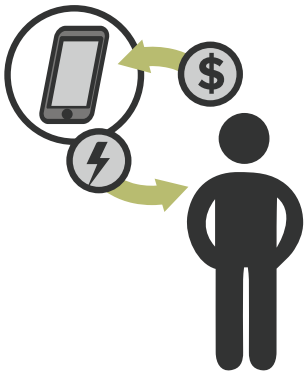
The pay-as-you-go metering allows smaller payments at a time, incremental growth and capex costs to be recovered over time, reducing the initial investment hurdle for the farmer. The pre-paid system ensures transparency and accountability for the farmers and the operator, and generates revenue from day one to cover O&M costs. Collecting payment up front eliminates non-revenue water issues that plague typical unmetered solar irrigation systems. Shifting away from gasoline-based pumping protects farmers from volatile fuel prices and reduces carbon emissions and the risks of environmental pollution from fuel spills and leakages.

The Niayes zone of Senegal is responsible for more than half of the country's horticultural production. Finding a way to reduce production costs for farmers in this area can potentially lead to major economic gains.

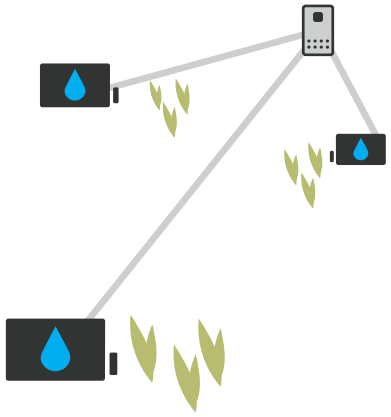
How it works



Centralized solar & monitoring
Electricity is generated centrally by a single, solar PV array. A custom-made battery-less AC smart-controller distributes and meters power consumption for 7+ farmers.



Pre-paid credit
Electricity is sold by a micro-utility to farmers using a pre-paid credit system similar to cell phone scratch card systems, only paying for what they consume.



Decentralized pumps
Farmers retain autonomy of their individual wells and pumps.

Benefits

Fuel and Time Savings

Farmers typically spend $2/day on fuel for gasoline-powered irrigation pumps. These pumps are over-sized and consume more fuel than necessary. Properly sized AC pumps require less energy to meet the same crop water requirements.

Carbon reductions

The gas-powered pumps produce approximately 2.4kg of CO_2 per liter of gasoline—0.45 tons of CO_2 in a typical 100-day season per farmer. Additionally, fuel spills are common. Switching to solar will eliminate both sources of pollution.

Project Innovations

Grid compatible AC pumps

Surplus power could be a profitable energy supply for domestic and commercial customers,.

Distribution of electricity to decentralized pumps

Centralized electricity production, with decentralized distribution allows farmers to retain autonomy of their own wells and pumps and creates a model for micro-utilities that can also be compatible for feed-in tariffs in the future.

Battery-less systems

The system is built without the need for battery storage to keep capital and recurring costs low. System integration is designed to work in off-grid markets such as our pilot site, Potou, Senegal.

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