SYMBIOTIC FOOD AND ENERGY PRODUCTION IN AN ENERGY RESILIENT FUTURE

Temasek POLYTECHNIC

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Diploma in Clean Energy, Year 3

PROJECT OBJECTIVE

This project aims to study the effects of how effective evapotranspiration from plants helps in lowering solar photovoltaic module temperature. It is an enhanced version of a previous prototype that was showcased at the Youth Energy Showcase in 2021.

PROJECT SUMMARY

The project features a hydroponics setup underneath solar panels, with key performance indicators (e.g. water temperature, PH level and electrical conductivity) monitored by sensors and nutrients for the plants dispensed by an automated system. Recirculated water is used to enhance cooling of the solar modules, leading to increased module efficiency. Plant growth is further aided by shielding the plants from direct sunlight.

Key enhancements made from previous prototype:

- Solar cooling using recirculated water instead of evaporative cooling and copper coils not only results in better heat transfer but cleans the panel surface, thereby minimising maintenance.
- Use of more powerful microcontroller, Raspberry Pi 4, as compared to Arduino.
- Introduction of automated nutrient dispenser reduces manpower effort.

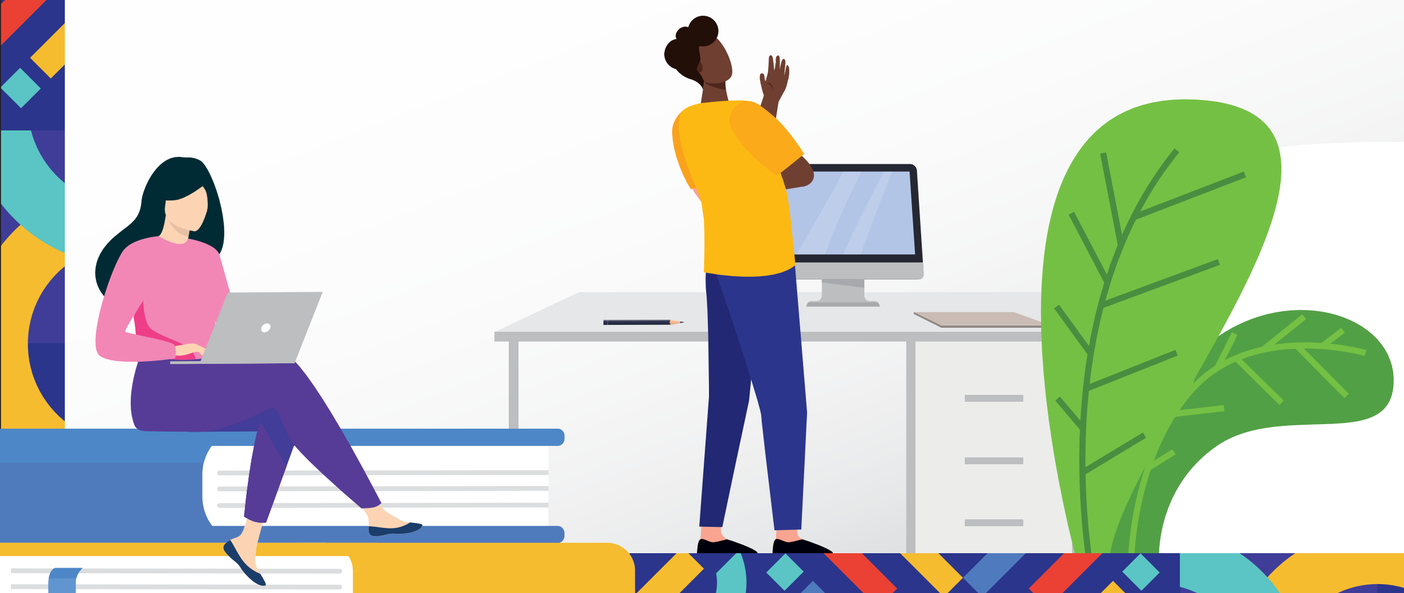
SETTING UP THE PROJECT

PROJECT OUTCOMES

- Maximises roof space installed with solar panels by cultivating vegetables underneath the solar panels. This also lowered the solar module temperature by 1-2 degrees Celsius for shaded plants and by 7-10 degrees Celsius for plants with water cooling.
- Increased energy output of 7% (previously was 3.5%) as compared to the solar panel setup without cooling measures.
- Reduces user intervention in dispensing nutrients at optimal electrical conductivity levels at least 1800 S/cm at remote areas such as rooftops.

OVERVIEW OF THE SETUP

BOK CHOY GROWING INSIDE THE SYSTEM



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