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Team 2020-12 - Solar Powered Hydroponic Fodder Unit

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Theme – Agriculture

Proposal

We have designed a community level solar powered hydroponic fodder unit for off-grid regions. The fundamental principle behind the design is the maximum utilisation of under-utilised assets is already owned by these communities. A low-cost automated hydroponic fodder unit has been designed to help boost livestock productivity and a base income for people with low levels of income.

Project summary

The design uses the hydroponic method to grow green fodder in a short period of eight days, resulting in an almost six-fold mass increase during the same period. This method is soilless, requires up to 95% less water than conventional fodder production, and due to its vertical scalability, reduces stress on small land holdings as well.

Key design highlights

The design includes an Arduino based micro-controller, which regulates the watering cycle through nozzles. Temperature control within the unit is achieved through evaporative cooling. Green shade nets seem to be an effective facade material. A closed loop water circulation system ensures zero wastage and rainwater harvesting structures aim to minimise water inputs. Sensor based cooling ensures energy efficiency through proper selection of set-points.

Cost

The cost of a fodder unit with a daily output of 50 kg comes out to be around $100 USD without the power conditioning equipment. However, the price per unit falls exponentially with an increase in the capacity of the system, which encouraged us to propose a community fodder solution.

How does your design help to work towards the Sustainable Development Goals (SDGs)?

By leveraging our commitment to SDG 7, primarily through 7.1 (Access to Affordable Energy) and 7.3 (Energy Efficiency), we simultaneously address nine other SDGs. SDG 1 (No Poverty) and SDG 2 (Zero Hunger) are at the heart of the design, which is inspired by the idea of progressive universalism. SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities) guide our social model of employment, which aims to rehabilitate marginalised populations. The model of local entrepreneurship and boosted revenues from livestock products breathes life into SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure). Our commitment to SDG 13 (Climate Action) is realised through the GHG mitigation potential of hydroponic fodder, in comparison to traditional processes. This sustainable route of fodder production further addresses issues under SDG 12 (Responsible Production and Consumption) and SDG 15 (Life on Land).

Social, environmental and economic considerations

Our design is a socio-technical solution for low income off-grid communities. This is a robust framework as it relies on the inherent gaps in the labour availability in these communities.

On the environmental front, the land sparing nature of our design helps in habitat conservation and secondary carbon dioxide mitigation. By foregoing the use of fertilisers, pesticides and huge quantities of water, a significant portion of the embedded energy in fodder can be reduced over time.

The economics of the system have been charted with respect to consumer payment models, hybrid models of operation and access to credit facilities.

Link to the Full Report

Video Submission