1st Open Day and Workshop
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INSTITUTO DE SISTEMAS E ROBÓTICA
UNIVERSIDADE DE COIMBRA

Off-Grid Solar Systems for Sustainable Development - Design and Optimization of a Cold-Storage System with Thermal Energy Storage for Developing Countries

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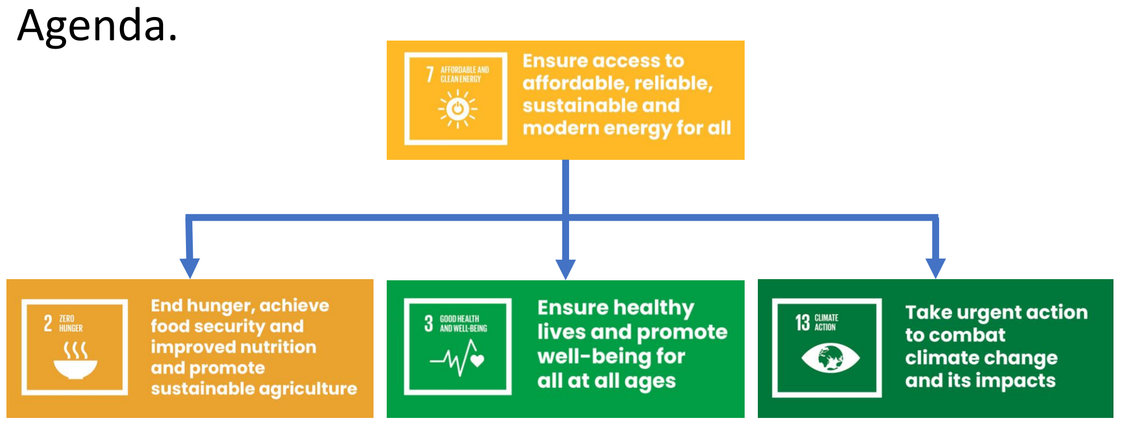
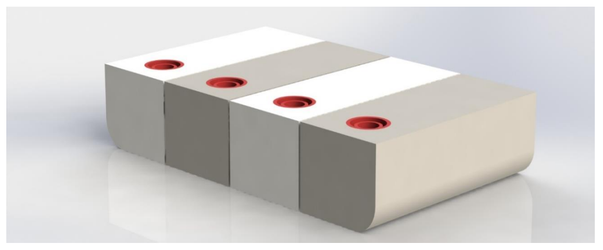
Motivation and Objectives

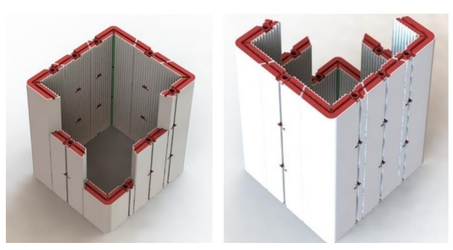
- Food losses can reach 40% due of the lack of cold storage infrastructure in developing countries.
- Cold storage for vaccines (from +2°C to +8°C) reaches only 86% of global coverage.
- There are over 700 million people worldwide without energy access. Most of them living in developing countries.

The main objectives are to develop a super efficient and low-cost solar off-grid cold storage with improved insulation and thermal energy storage (TES) using phase change materials (PCM), as well as a smart controller to manage the entire system and run adaptive energy optimization strategies.

By using appliances powered by a renewable energy source and aiming to assist developing regions to improve their socio-economic levels, this project fits under the United Nations' Sustainable Development Agenda.







Results

- TES containers were developed using 3D-printers to perfectly fit into the cold storages.
- PCM using saline solution have been used as thermal batteries into the TES containers.
- A DC variable speed compressor with permanent magnet motor were integrated to the system.
- A solar off-grid station was set up in the lab to power the entire system.
- A smart controller to measure the temperatures and control the system is running and being improved.
- Improved insulation to enhance energy efficiency are under tests.