Using the sun to power air conditioning

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Introduction

One of the largest consumers of fossil fuels within MSF field operations is air conditioning (AC). AC is medically essential for establishing controlled temperatures within pharmacies, operating theatres and laboratories, which can otherwise be challenging to provide in a reliable way. In addition, AC in offices and residences provide improved working and living conditions. Existing estimations suggest a total fuel cost across MSF for AC of the order of €3 million/year. In addition to the financial cost, AC also contributes to global warming via approximately 6000 tons of CO_2 emissions, and to local pollution. The project we describe aimed to identify and test solar power solutions for cooling within MSF, with as little battery use as possible.

Methods

We identified requirements, and use cases, for solar power cooling solutions through the expertise of the energy referents of all operational sections of MSF. Existing projects were used to collect data on cooling needs as well as energy consumption for conventional generator powered ACs. We selected and benchmarked promising equipment by doing an international landscape market and research analysis. A field test of the chosen technology was then carried out in MSF's Drouillard Hospital, Haiti. Monitoring data were and still are collected continuously within this project, focusing on the ability to keep temperatures constant over day/night, availability of solar power and consumption of energy for AC's as functions of ambient temperatures and building insulation levels.

Ethics

This innovation project did not involve human participants or their data; the MSF Ethics Framework for Innovation was used to help identify and mitigate potential harms.

Results

We piloted three different technologies relating to specific use cases in the field. One AC unit was tested with solar photovoltaic (PV) direct power with generator power backup, providing 24 hour AC within an operating theatre (similar applicable use cases include intensive care units and other critical medical wards, pharmacies and laboratories). Two units were tested using only direct PV power, for use in daytime only within consultation rooms (similar applicable use cases include offices and medical wards with moderate night-time

temperatures). Finally, two units were tested using PV power supply with battery backup, for night-time use within residences. The units were installed in November 2018 and are running satisfactorily.

Conclusion

The hybrid AC systems tested – with PV power only as well as with generator backup – were found suitable for field hospital conditions, both with respect to installation and economy (return on investment). Following the successful test results, they are already being implemented more widely within MSF. Next steps for the project involve supporting wider implementation as well as continuous monitoring, extended through the hot season during 2019, to provide data for an entire yearly cycle.

Conflicts of interest

None declared.

Marpe Tanaka

Marpe is the Innovation Lead at the MSF Sweden Innovation Unit (SIU). He has degrees in industrial design, as well as development studies, from Lund University. After running his own companies and working as a field logistician for MSF, he has been working with the SIU since 2012. His work has included everything from outlining strategies and method development, to starting up and coordinating process oriented innovations, ranging from sterilization equipment, solar energy solutions, and improvements to patient referral systems.