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Team 2020-20 - Solar Powered Oxygen Concentrators in Sub-Saharan Africa

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Theme – Healthcare

Proposal

Our aim was to design a direct current (DC)-compatible concentrator, to match the performance of commercial alternating current (AC) models and to the design and implementation challenges present in Sub-Saharan Africa.

Project summary

Our project aimed to double the outflow of DC devices and look for alternative technical solutions to climatic, efficiency and usability challenges. Additionally, we built up a solid business model, including a field study, while carefully considering end users' needs.

Key design highlights

Our team chose to try out two DC compressors in parallel to help improve the performance of existing DC devices so that they match commercial AC ones. We also added a motor controller which enabled control of the motor speed, a reduction of the power demand and improvements to energy efficiency. All of this was successfully prototype-tested.

Our design recommendations are to add a pre-filter before the bacteria filter to tackle dust issue and maintenance, to add a two-stage evaporation cooling system to help deal with both humidity and temperature which hinder the concentrator's performance, and use a flow splitter to potentially allow for up to four babies to be connected to the same device.

Cost

This report recommends a hub-and-spoke distribution model with a fee-for-service style subscription rather than a financing to own model. County 'hub' hospitals would partner with smaller health care centres 'spokes' within a reachable radius. The revenue shared with the hub will be reinvested to further improve care services within the network.

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

Our design works towards the following SDGs:

- **SDG 3 (Good Health and Well-being):** through the innovation of an essential medical appliances which will expand oxygen accessibility across the region and raise the standard of care.
- **SDG 7 (Affordable and Clean Energy)**

Social, environmental and economic considerations

The business model incentivises the avoidance of expensive stock replacement while guarding against accelerated wear and tear on the concentrator. Lithium-ion batteries hold reuse potential, and Sub-Saharan Africa is considered a region that would benefit from a circular economy program.

The innovations in the design and implementation can help expand affordable access to oxygen therapy in resource-strained locations, dramatically improving survival rates from respiratory infections. The savings realised by health care centres can help reduce patients' out-of-pocket costs. Furthermore, local mechanics and electricians can be recruited and trained for technical staffing, hence empowering busy medical staff to focus solely on care and not worry about machine maintenance.

Link to the Full Report
Video Submission