

SolarChill - Development, Testing and Technology Transfer

Background

Refrigeration of vaccines and food is problematic in parts of the world where there is no electricity or where the electricity supply is unreliable. In these regions safe vaccine storage temperatures are maintained by either kerosene or battery-based solar refrigeration systems.

SolarChill technology aims at improving the cold chain for vaccines as well as providing more reliable refrigeration for perishable foods in off-grid areas or those areas with unstable electricity supply.

The Danish Technological Institute (DTI) started the development of a solar powered direct drive system without batteries. This provided the basis for the GEF SolarChill project, formed in 2016.

The project will be implemented in three partner countries, Kenya, Swaziland and Colombia.

Vaccine Coolers

Vaccines are sensitive to heat. Adequate storage needs to be secured throughout the entire cold chain.

Many off-grid areas cannot provide sufficient energy for cooling or they rely on expensive technology like kerosene or gas. As a solution, the first solar driven refrigerators were introduced in the 1980.

SolarChill aims to help deliver vaccines and refrigeration to regions of the world without electricity or with inadequate electrical supply. SolarChill is developing a versatile refrigeration technology that is environmentally sound, battery free, technologically reliable, affordable and solar powered.

Key Criteria and Challenges

For the project's success some key criteria need to be considered and challenges overcome:

- Keep the temperature range within 2-8°C for vaccines
- Systems must be WHO/PQS prequalified
- Long autonomy during periods of no sun (up to 3 days)
- Reduce the cost of the systems and provide reliability
- Protect the vaccines from being frozen
- Environmentally friendly systems with no need for batteries and running on natural refrigerants

Solar chilled refrigerators are an optimal solution to many developing countries and emerging economies, as they have optimum solar irradiation.

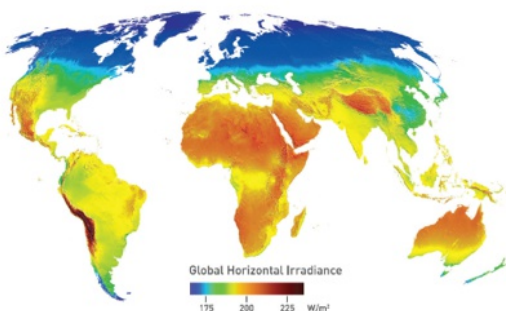


Fig.1: Map showing solar irradiation

SolarChill bridges health, development and environmental issues through practical cooperation between major international organizations, research institutes and industry.

SolarChill Technology

The sun's energy is harvested via solar panels and used to freeze water. Energy is stored without batteries. Autonomy is reached for more than 3 days. This guarantees safe storage and thus supply of vaccines.

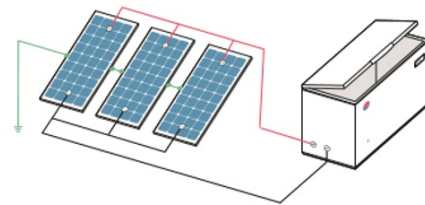


Fig. 2: SolarChill system set up

SolarChill combines several breakthrough features.

No batteries: Energy is stored in ice, instead of batteries. An ice compartment keeps the cabinet at the needed temperature during the night. The system uses direct current (DC), thereby avoiding the need for a converter.

Environmentally friendly: SolarChill refrigeration systems use natural refrigerants, hydrocarbons, instead of refrigerants containing fluorinated greenhouse gases (F-gases). Hydrocarbons are environmentally safe and do not deplete the ozone-layer or harm the climate.

Off-grid installation: SolarChill system can be installed off the grid as they receive their energy directly from the installed solar panels.

Affordability: The costs for the systems including the solar panels is up to 40-50% lower than existing solar vaccine coolers on the market today. This is due to the fact that SolarChill systems will be produced locally in the project countries. Additionally, mass produced freezer cabinets and components are used, instead of expensive custom design features.

Type of Appliances

Two types of appliances are being developed under the SolarChill project.

- SolarChill A: Vaccine storage
- SolarChill B: small commercial/domestic use



Fig. 3: SolarChill Type A



Fig. 4: SolarChill Type B

SolarChill A is WHO/PQS certified and a combined vaccine refrigerator and water pack freezer is already commercially available.

Solar Chill B will be made available for small commercial or domestic use.

SolarChill - Development, Testing and Technology Transfer

Technology Transfer

A central aim for the SolarChill project is to transfer relevant technology to the partner countries. This is done through the following steps:

- Engagement of relevant ministries
- Test site identification and selection
- Procurement of units
- Capacity building through training on SolarChill technology (incl. technology design, installation, maintenance and repair)
- Production of the units at a national level
- Transportation to and installation at selected sites
- Monitoring of the results and lessons learnt

These steps help to anchor relevant knowledge within the partner countries. Technology and knowledge can then further be disseminated from the partner countries.

Case Study - Kenya

In cooperation and close collaboration with the Ministry of Health of Kenya and the Christian Health Association Kenya (CHAK) more than 35 off-grid health facilities were selected for the installation of SolarChill Type A vaccine refrigerator.

At those test sites safe and environmentally clean off-grid vaccine coolers will be provided. This will allow for additional testing of the technology.



Fig. 5: SolarChill Type A arriving on site in Kenya

The different sites selected in Kenya, will allow for a basic as well as advanced monitoring of the systems' performance in different climatic conditions.

At the moment there is no manufacturer for SolarChill systems in Kenya. Therefore the systems installed in Kenya will be imported from the manufacturing site in Swaziland with the support of the Ministry of Health and UNICEF. A potential partner for future manufacturing of SolarChill systems in Kenya has already been identified. That company will also be the responsible partner for servicing and maintenance of the systems throughout the test period.

Currently two trainings are planned. During these training service and maintenance technicians will be trained in the safe and efficient service and maintenance of the systems.

As the majority of rural households and communities in Kenya are not able to afford the systems, microfinance options are currently being assessed and discussed with Kenyan stakeholders. With the wider distribution of the systems and the potential for national manufacturing, the costs of the systems are expected to decrease, thereby making them more affordable.

The installed systems will prove to the end users the reliability and efficiency of SolarChill.

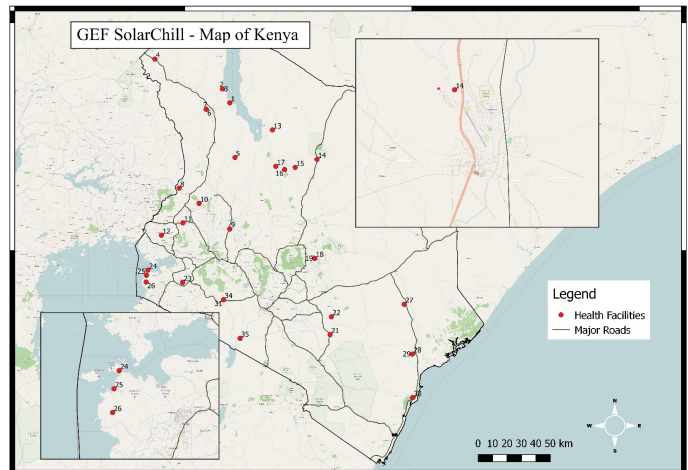


Fig. 6: Map of selected sites in Kenya

25 out of 47 counties in Kenya will be part of the pilot roll out of SolarChill systems. The project partners in Kenya decided to focus on health facilities with strong refrigeration demands.

Overall Project Outcomes

- Promotion and awareness raising of SolarChill system Type A and extensive testing of the appliances under real-life conditions in different climatic conditions
- Promotion and testing of SolarChill system Type B for small commercial and domestic applications
- Capacity building through training in the partner countries Kenya, Colombia, and Swaziland
- Technology transfer of SolarChill for on-site manufacturing to partner countries
- Encourage additional refrigerator manufacturers to produce and supply SolarChill Type A and B technology.

The overall aim is to disseminate both Type A and B at a large scale, to make the systems easily procurable and affordable.

General Project Information

Project Title: SolarChill Development, Testing, and Technology Transfer Outreach

Countries: Colombia, Kenya, Swaziland

Funding Agency: Global Environment Facility (GEF)

Implementing Agency: UN Environment

Executing Partners: SKAT Foundation, supported by UNICEF, HEAT GmbH, Greenpeace International, Danish Technological Institute (DTI)

Project Duration: 2016-2018

Project Summary: To commercialize and transfer the SolarChill vaccine refrigerator (SolarChill Type A) and to begin the process of commercializing and transferring the SolarChill household and light commercial refrigerator (SolarChill Type B)

Target Groups: End users of refrigeration systems, health centres, hospitals, domestic households in off-grid regions, small commercial food centres

Project Focal Areas: Climate Change, Human Health

Overall Project Budget: 2.200.000 USD

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