



SolarChill 2010

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SolarChill Presentation

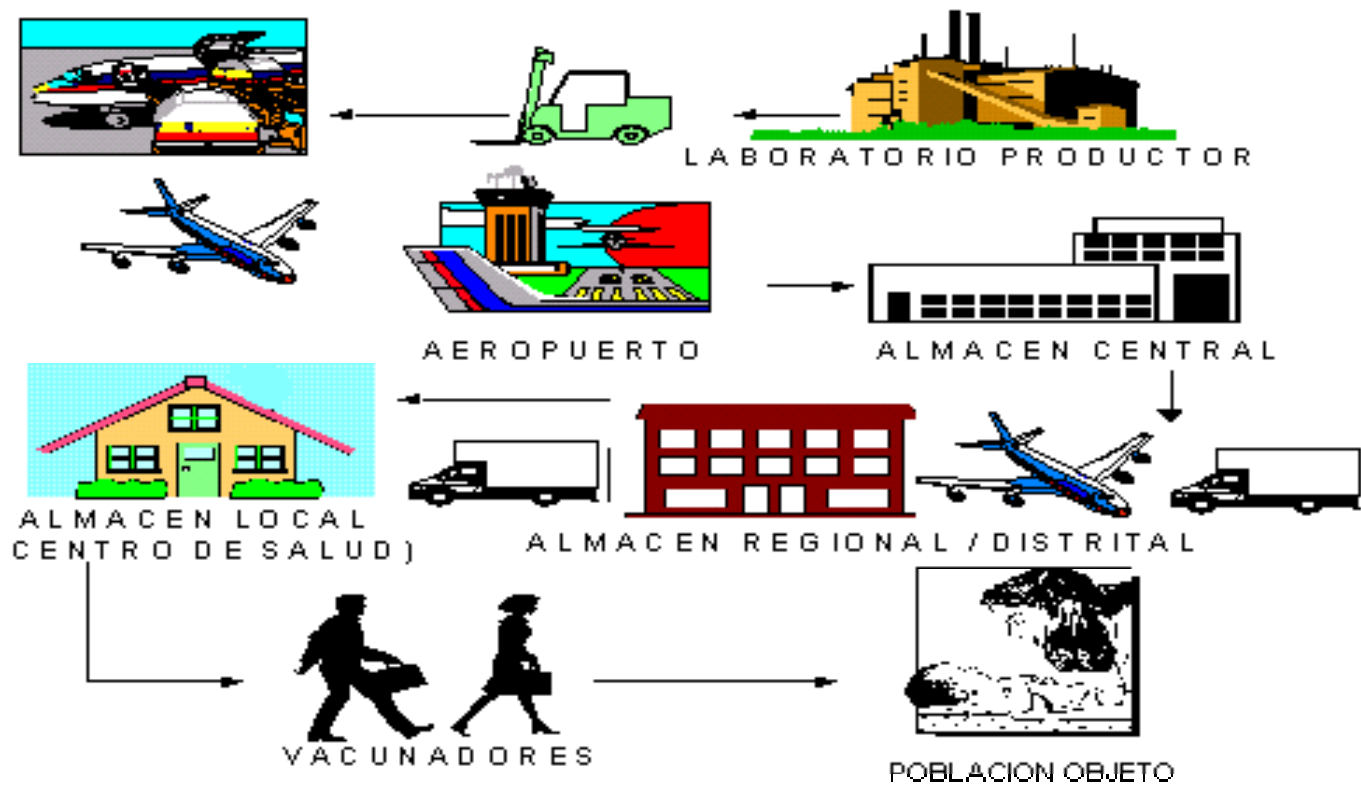
1. What is SolarChill Technology and Partnership?
2. Ice storage versus battery storage
3. Concept for SolarChill refrigeration systems
4. SolarChill-A vaccine cooler
5. SolarChill-B coolers
6. Other future types of SolarChills
7. GEF funding of test in Colombia and Kenya

The need

- To provide solar powered, led storage battery free, climate friendly and affordable vaccine/medical cooling and food refrigeration for parts of the world without reliable electricity.
- Over 2 billion people live in such regions.
- Currently kerosene, propane and to far lesser extent, solar powered refrigerators with batteries are used in these regions.



COLD CHAIN



SolarChill Partnership

- Danish Technological Institute
- GTZ ProKlima
- Greenpeace
- PATH
- UNEP DTIE
- UNICEF
- WHO
- World Bank
- Industry Participants: Vestfrost & Danfoss



SolarChill History

- In 2000 UNEP & Greenpeace conceived of the need for an environmentally friendly solar vaccine cooler and refrigerator.
- Concurrently the Danish Technological Institute (DTI) began the development of a solar powered vaccine cooler without batteries.
- In 2001, Greenpeace, UNEP and GTZ organized a meeting attended by WHO and UNICEF. Soon PATH joined. In 2009 the World Bank became a partner.

SolarChill History Con't.

- Greenpeace International provided \$200,000 (\$150,000 from Dutch National Lottery) for research, development and field testing.
- Danish Energy Agency provided \$150,000 for technical development.
- All founding partners participated in the development work and provided funding to cover their participation (total of about \$500,000)
- Danfoss and Vestfrost were industrial participants.

First prototype

2002: SolarChill exhibited
at the World
Summit on Sustainable
Development
in South Africa



SolarChill History Con't.

- SolarChill prototypes were field tested over 18 months in Senegal, Indonesia and Cuba in 2004-2005.
- Field tests coordinated by DTI and overseen by PATH in Senegal and Indonesia and by GTZ ProKlima in Cuba.

Installing solar panels in Cuba



SolarChill in Indonesia



SolarChill Concept

- To be affordable coolers are built into existing mass produced cabinets.
- Coolers must not use any fluorocarbons in insulation or refrigerant cycle.
- No lead batteries for storage.
- Solar energy stored in ice.

SolarChill Models

- SolarChill A: vaccine coolers in a 50 litre small chest cabinet with 100 mm of polyurethane insulation.
- SolarChill B: food refrigerator in a 100 litre “ice liner” chest cabinet with 100 mm of polyurethane insulation.
- SolarChill B: food refrigerator in an upright freezer cabinet with 80 mm of polyurethane insulation

Ice batteries versus lead batteries

- Batteries are vulnerable due to degradation and theft.
- Analysis shows that the energy content in ice and in lead batteries is of the same order of magnitude.

SolarChill A-vaccine cooler



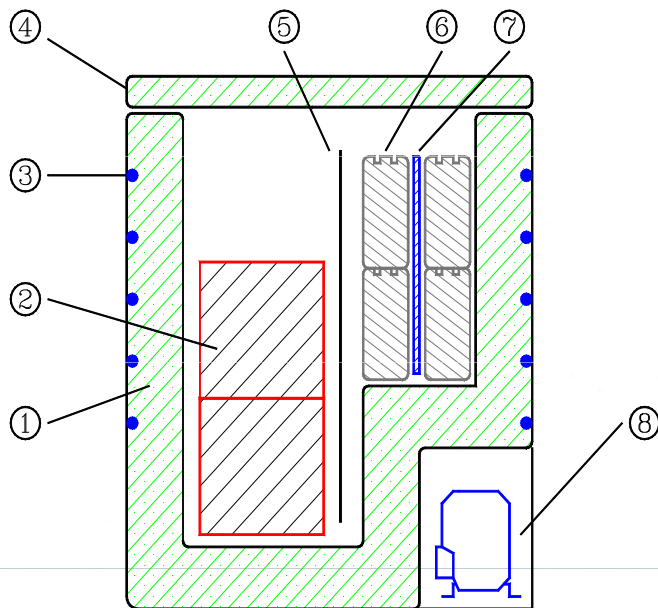
SolarChill design

1- Cabinet with 100 mm PU 2-Vaccine compartment

3- Skin condenser 4-Lid

5- Internal wall, insulated 6-Ice Storage

7- Evaporator, wire on tube 8-Compressor



SolarChill A

- 48 grams of 600a
- Capillary tube expansion, internal heat exchange
- Requires three 60 W PV panels on rooftop
- About 200 coolers have been manufactured so far

Intelligent fan in SolarChill A

- In 2009, a new generation of SolarChill-A was developed. It is equipped with an “intelligent fan”, which circulates air in the cooler during night-time. The fan is powered by a long life, rechargeable battery. It was developed to fulfil new WHO PQS standards for vaccine coolers, and the cooler was tested at DTI in 2010.
- Hold over time at 32°C is 4.75 days (no electricity)
- Autonomy time at 32°C is 6.12 days (very cloudy days)
- Vaccines must be maintained between + 2 C and + 8 C

Intelligent fan with rechargeable battery



WHO PQS approval

- In 2010 the Vestfrost, Model MKSO44 SolarChill vaccine cooler received the WHO PQS pre-qualification (WHO code E003/009)
- Ambient temperature 20 to 32^o C
- Vestfrost is currently testing up to 42^oC
- Direct drive with ancillary battery

SolarChill B refrigerators

- For domestic and commercial use
- Same compressor as SolarChill A
- Prototypes working since 2005 on 3* 60W panels
- Net volume 100 litres



SolarChill B upright

- Refrigerant charge: 60 grams of R600a
- Ice storage in box type Roll Bond evaporator (about 10 kg)
- Natural convection in cooling compartment
- Hold over time 2.5 to 3 days (32° C ambient)

SolarChill B chest type

- Prototype developed and tested at DTI in 2009. Ice liner cabinet.
- 160 litres volume
- 5 baskets
- 48 grams R600a
- 17.5 kg ice storage
- Ice storage in walls



SolarChill B chest type

- Hold over time 2.7 days (up to +7°C)

at 30°C ambient temperature

- Cooling capacity: More than 20 soft drink cans a day (replaced at sunset).

Environmental Benefits

- Eliminates use of fossil fuels by relying on three 60 watt solar panels.
- Eliminates the use of fluorocarbons by using hydrocarbons.
- Eliminates the use of kerosene. Average kerosene cooler uses 292-365 litres of kerosene each year. There are about 100,000 kerosene coolers in the world.
- Kerosene is a dirty fuel, harmful to human health.

Environmental benefits con't.

- Eliminates the use of lead batteries.
- Tens of millions of lead batteries are disposed off each year in unsafe ways. There are about 12.2 kilograms of lead in each battery leading to contamination of land, water and air, and lead poisoning in children.

UK Cooling Industry Award

In 2006 the SolarChill Project received the UK Cooling Industry Award in the Environmental Pioneer category



President Kalam of India

In 2006 President Kalam of
India

takes delivery of 2 SolarChill

Units for testing purposes.



World Bank SolarChill Projects

- In 2009 the World Bank joined the SolarChill Project.
- GEF approved 2.7 million dollars for demonstration and technology transfer projects with SolarChill A in Colombia and Kenya
- GEF project supports further development and field testing of SolarChill B.

Future projects

In the future, other types of SolarChill units will be possible:

- Coolers with greater cooling capacity for commercial use (requires larger compressors but components are almost commercially ready today)
- Coolers for higher ambient temperatures
- Specially designed milk coolers for small farms
- SolarChills for freezing and conserving food

Present Developments

Palfridge Company of Swaziland in 2010 unveils 3 SolarChill prototypes for vaccine cooling, domestic and commercial refrigeration

Project developed in cooperation with GTZ ProKlima

Additional benefits of SolarChill

- SolarChill can also be used in human made and natural disaster areas, such as war, earthquakes, tsunamis.
- Already in use in refugee camps in Chad.

Bridging health, environment, and development

Harnessing the
power of the sun
to save human
Lives.

