Solar cold chain equipment vs solar facilities: where should we be going?

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SELF’s CCE partners know energy's a problem

- **WHO** – advisor (PQS, Solar Guidelines)
- **World Bank/WHO** – advisor (health facility Energy Access)
- **UNICEF** – contractor (assessments, installations)
- **BMGF** – GCE awardee (SDD development)
- **AMP Logivac** – contractor (training, installation)
- **GAVI** – advisor (proposal assessment)
- **CDC** – advisor (national solar planning)
- **Partners in Health** – contractor (solar health facilities)
- **USAID** – contractor (mini grid installation)
- **Industry** – contractor (various projects)
- **Ministries of Health** – contractor (e.g. Haiti)
- **Local health workers** - across the globe.
Importance of energy to health services (in particular access to electricity)

- Easier recruitment and training
- Better staff morale
- Continued medical education

- Improved cold chain
- Laboratory testing
- E-health

- Prolonged opening hours
- Wider range of services
- Better functionality of medical devices

- Better communication
- Improved records management

- General hygiene improved
- Enhanced safety
- Staff and patient sense of security and safety

Rationale

Health Care Facilities with No Electricity Access

- Uganda (2007): 58%
- Tanzania (2006): 50%
- Guyana (2004): 38%
- Sierra Leone (2012): 35%
- Ghana (2002): 31%
- Nigeria (2011): 30%
- Kenya (2010): 26%
- Zambia (2005): 20%
- Rwanda (2007): 18%
- Ethiopia (2008): 14%
- Namibia (2009): 4%
- Egypt (2004): 1%
- Gambia, The (2004): 0%

Source: WHO/IHE database.
Thousands of Health Facilities do not … have reliable electricity.
Thousands of Health Facilities go without

...good light, day & night.
Thousands of Health Facilities lack …critical communications.
Questions to explore today?

- Should we expand solar beyond just powering Cold Chain Equipment?
- What are the risks of expanding solar beyond Cold Chain Equipment?
- If we do expand solar electricity,
  - What to focus on?
  - Where to focus?
  - How to implement?
Energy supply problems

- **Facility type**
  - New construction
  - Existing

- **Energy availability/Solution(s) for needs**
  - *Not available* = requires new solution
  - *Available unreliable* = requires repair or new solution
  - *Intermittent* = backup systems
  - *Cost too high* = energy efficiency and/or alternatives
  - *Negative health/environmental impacts* = alternatives
Where is the need?

Health Centers & Health Posts
Where is the need?

Clinics with Labs

Health Centers & Health Posts
Where is the need?

- Hospitals
- Clinics with Labs
- Health Centers & Health Posts
Different Energy Requirements

Health Centers & Health Posts

Hospitals

Clinics with Labs

Health Centers & Health Posts
Different Energy Requirements

- Clinics with Labs
- Health Centers & Health Posts
- Hospitals
  - Clinics with Labs
  - Health Centers & Health Posts
Different Energy Requirements

- Hospitals
- Clinics with Labs
- Health Centers & Health Posts
Energy supply options plentiful

• WHY FOCUS ON SOLAR?
Ample solar is widely available.
Reliability, Quality, Continuous, Clean

...as an example, consider solar fridges

- Recent advances have improved reliability
- Quality of electricity is not an issue.
- Continuous energy for operation even in hottest climates.
- Solar has less environmental impacts, is cleaner than many other widespread options.
- Better temperature control than absorption.
Figure 1. Example average estimated annualized cost for purchase, installation, operation and maintenance of PQS-prequalified refrigerator types

Acronyms: LPG – liquid petroleum gas; ILR – ice-lined refrigerator; SDD – solar direct drive.

Source: Cold Chain Refrigeration Life-Cost Model, 2014. PATH.
## Example power need differences

<table>
<thead>
<tr>
<th>Service</th>
<th>Loads</th>
<th>Ave. Consumption</th>
<th>Solar power system (3.5 pk sun)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunization only</td>
<td>Refrigerator/freezer</td>
<td>700 Wh/day</td>
<td>400 Watts, no battery (SDD)</td>
</tr>
<tr>
<td>Health Post</td>
<td>Add lights, cell phone charging, RTMD, laptop</td>
<td>1,000 Wh/day</td>
<td>400 – 600 Watts, battery needed</td>
</tr>
<tr>
<td>Health Center with basic lab</td>
<td>Add lab/medical devices, internet</td>
<td>10,000 Wh/day</td>
<td>2400 Watts, large battery, inverter</td>
</tr>
<tr>
<td>Clinic with standard lab</td>
<td>Add more internet, lab/medical devices, and staff housing</td>
<td>25,000 Wh/day</td>
<td>6000 Watts, battery &amp; inverter (generator?)</td>
</tr>
</tbody>
</table>
Immunization: Solar Vaccine Refrigerator

PV Array  Refrigerator/Freezer (DC Load)
SDD = Simple systems, no large battery
Health Center with Basic Lab

PV Array → Charge Controller/Load Controller → Lighting, Medical Equipment, Computers

Storage Battery
More equipment, complexity & battery
Clinic with Standard Lab & Generator

- PV Array
- Charge Controller/Load Controller
- Fuel-based Generator
- Storage Battery
- Lighting
- Medical Equipment
- Computers
Larger systems = more space, complexity, and capital costs
...can we agree that...

- many “functionally off grid” health facilities exist,
- energy needs range from basic to sophisticated,
- as needs increase costs and complexity increase,
- solar electricity is a widely available option,
- solar vaccine fridges are a workable solution,
- solar fridge purchases are expected to continue, so we are already going to power problem areas.

**But solar power systems for vaccine fridges do not meet other electric needs.**  Why? Why not?
WHO PQS E003 PV01.2 Solar power system for vaccine refrigerators.

“No additional loads, such as lighting or pumping, are to be connected to the solar power system.”

- Specification intended to protect vaccines.
- Originated with battery based solar refrigerators.
- Solar was sized just for the predictable fridge because adding other loads is unpredictable and can overtax the power and battery capacity.
Proposed PQS change for 2017

“A system that is able to provide spare power for other approved facility electrical loads (e.g. rechargeable cold chain support devices such as temperature monitoring devices, mobile phone charging, computing, and lighting) is acceptable provided the refrigerator is always prioritized ahead of other power uses”.

How? Harvest surplus electricity without compromising vaccine storage.
Your turn now!

- What do you think is the best way ahead for the Immunization community?
What are the risks of expanding solar beyond Cold Chain Equipment?

Should we expand solar beyond just powering Cold Chain Equipment?

If yes,
  • What to focus on?
  • Where to focus?
  • How to implement?
Thanks to You!
Let’s do it!