



Vietnam National EPI

Solar Direct-Drive Refrigerators in Vietnam

Summarizing the Needs, Feasibility, and Challenges

Dr. Nguyen Van Cuong, Vietnam National EPI



Contents

- **Vietnam and its NEPI profile**
- **Our goal**
- **Health system needs**
- **Monitored sites**
- **Results**
- **Acceptability and feasibility**
- **Challenges and lessons learned**
- **Conclusion**



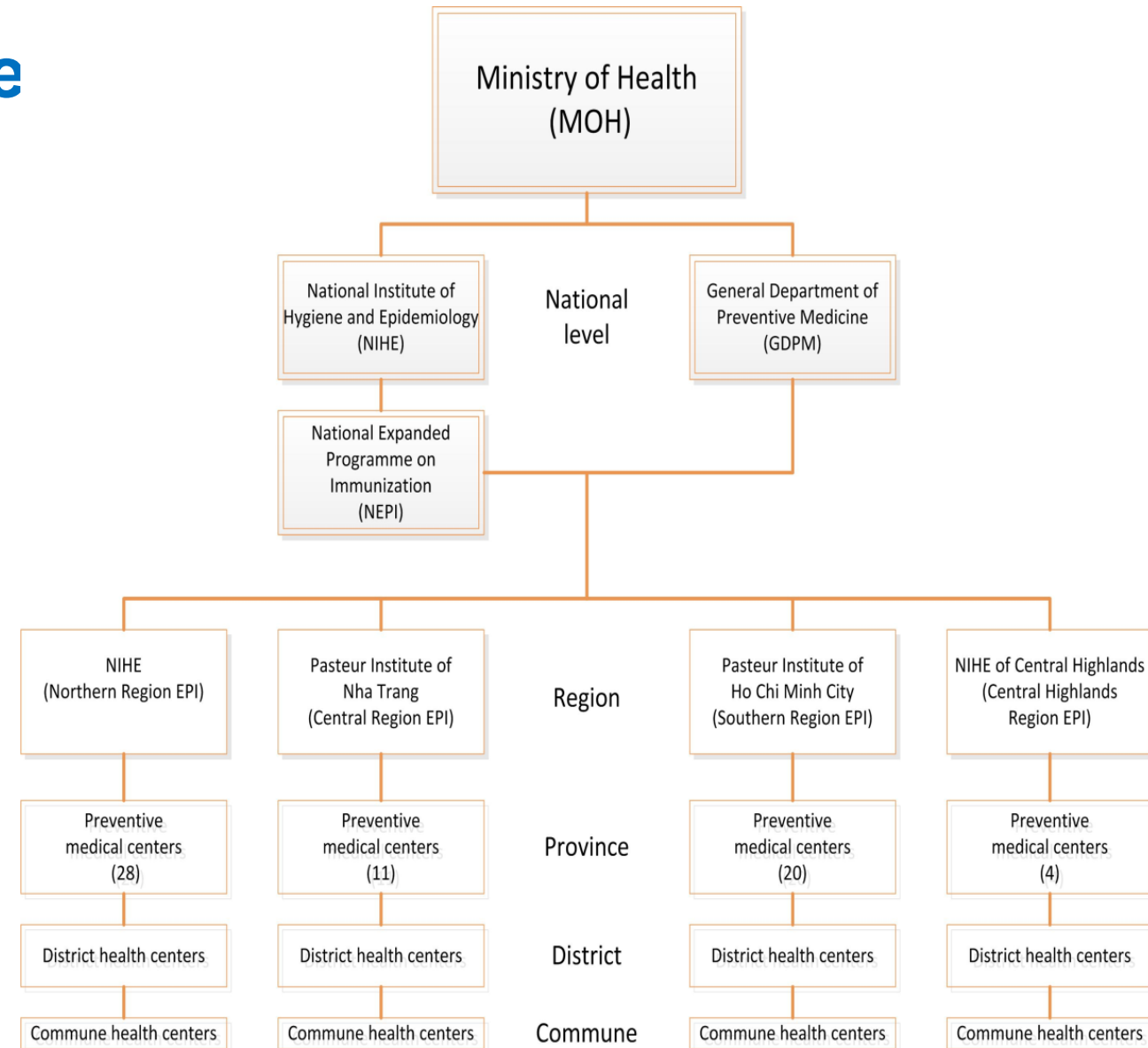
Vietnam and its NEPI profile

Vietnam

- **Population:** 90.7 million people (2014).
- **Surviving birth cohort:** 1,718,012 (2014).
- **Climate:** The winter monsoon between October and March brings damp, cold conditions to the north, and hot, dry weather to the south. Between May and October, the summer monsoon brings hot, wet, humid conditions.

Vietnam National Expanded Program on Immunization

Harmonious combination between the state management from commune, district, provincial, regional, to national structure.





Our goal

Assessing the viability of solar direct-drive technologies for storing vaccines in different regions of Vietnam with regard to equipment performance, cost, and available solar energy.



Health system needs

Problems

- Required temperature: 2°C to 8°C.
- Unreliable power conditions.
- Previous solar vaccine refrigerators were expensive. Battery was large and costly for maintenance.

Possible solution

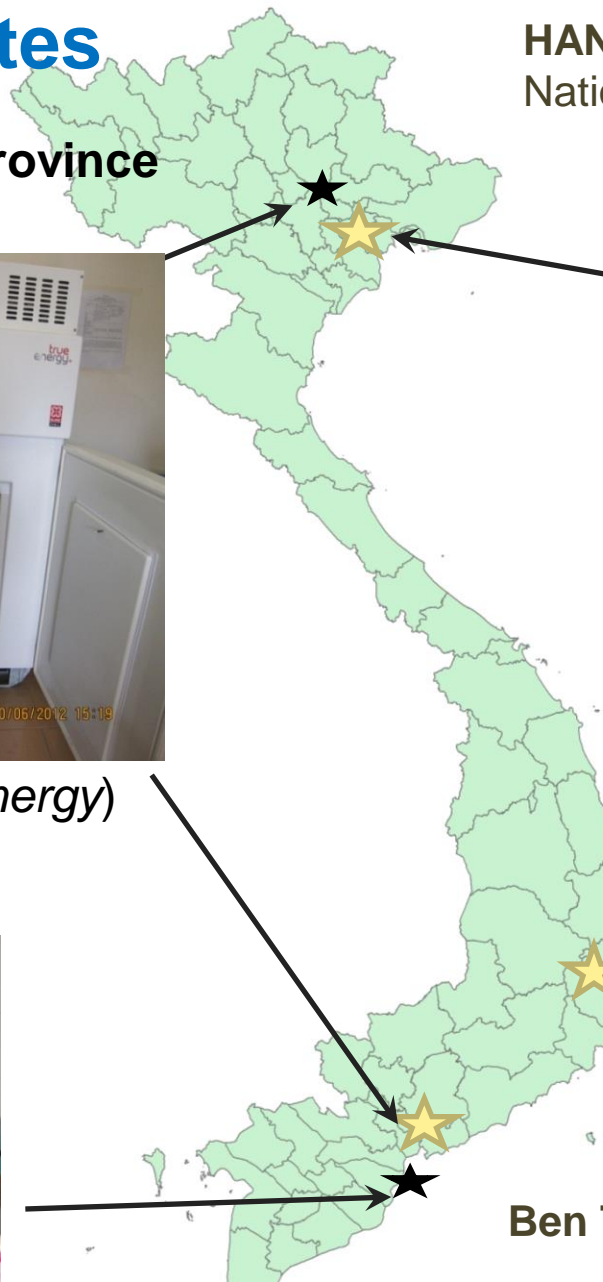
- Direct-drive solar refrigerators store energy in the form of ice in the cooling system.
- True Energy BLF 100 DC Sure Chill® vaccine refrigerator.
- Dometic TCW 2000 SDD: Ice-lined refrigerator and ice pack freezer (PQS certified E003/035).
- Dometic TCW 40 SDD refrigerator.

6 Monitored Sites

HANOI
National Institute of Hygiene and Epidemiology (2014)



Phu Tho province



Sure Chill® solar (True Energy)
Optimize Project
(Dec. 2011 Oct. 2012)



TCW 40 SDD (Dometic)
(From Jan. 2015)

TCW 2000 SDD (Dometic)

Hoang Sa

Nha Trang Pasteur Institute
(From Jan. 2015)

Ben Tre province

Truong Sa



RESULTS

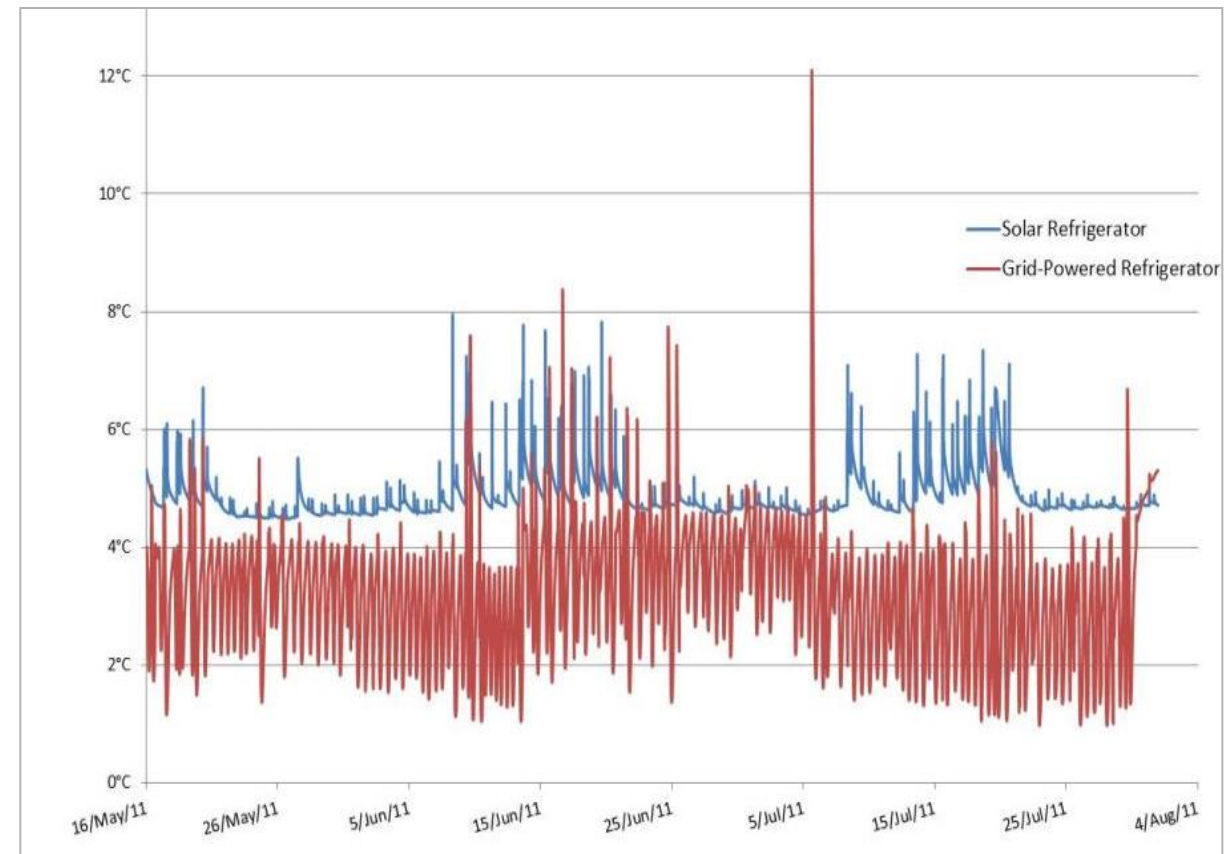


Temperature performance of Sure Chill®

- Sure Chill® solar refrigerator maintained extremely stable temperatures.
- Fluctuated only between 4°C and 5°C for most of the operating period of the year.

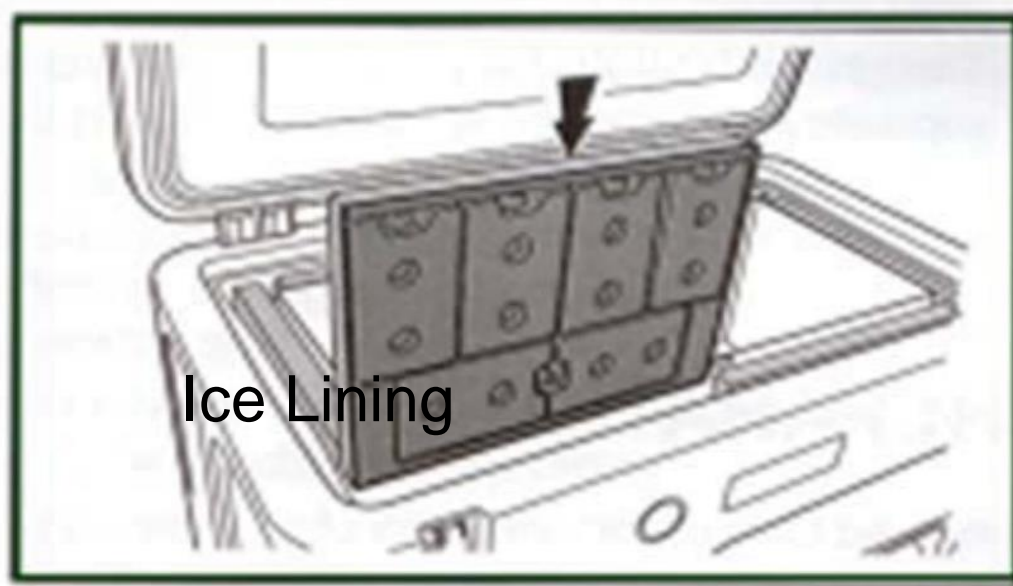


Comparison of solar refrigerator and grid-electric refrigerator temperatures in Phu Tho.





Dometic TCW 2000 SDD: Ice-lined refrigerator and ice pack freezer



Refrigerator

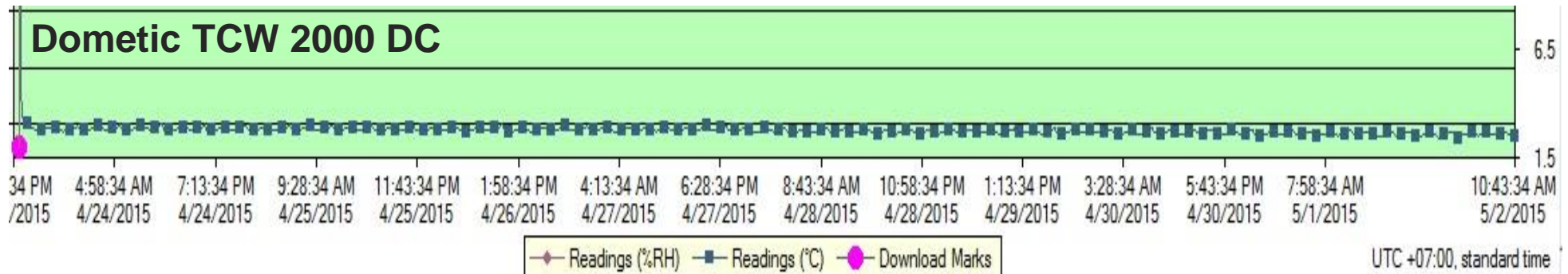
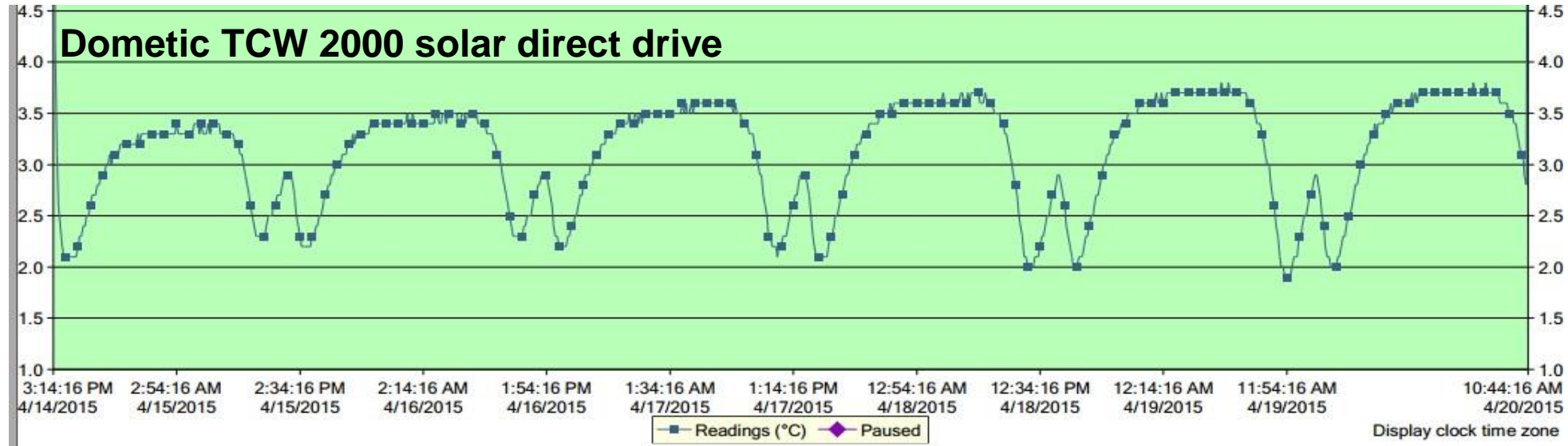


Freezer

In Hanoi, temperatures inside TCW 2000 SDD are always above 8° C



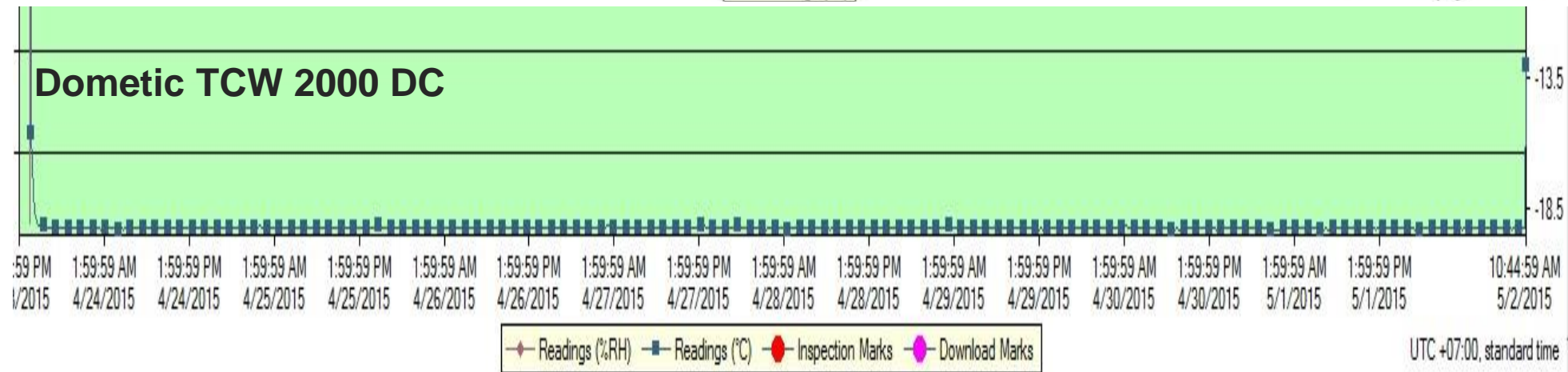
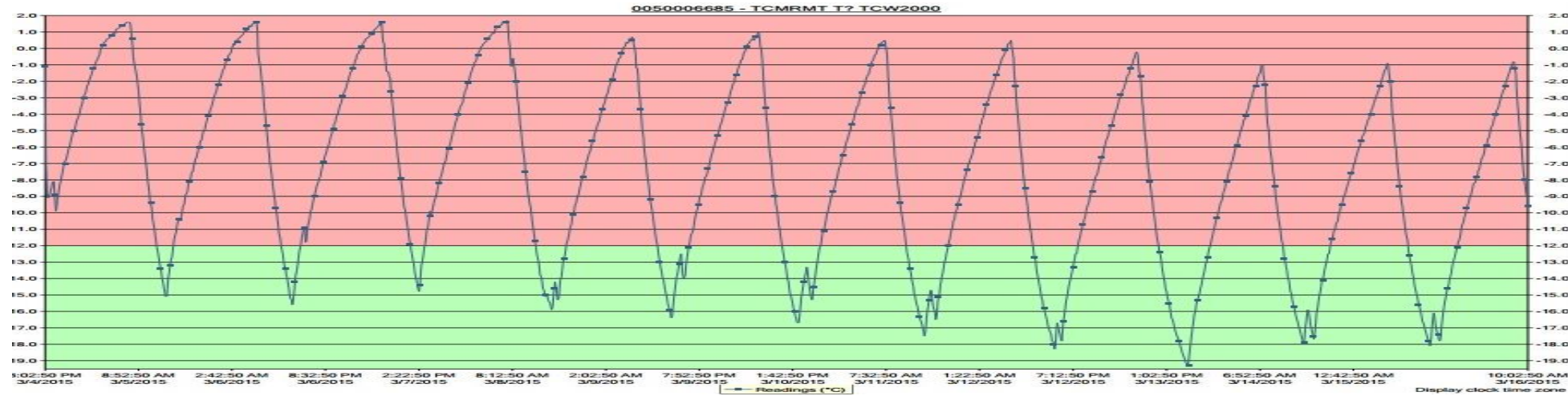
Comparing electric refrigerator temperatures in Nha Trang (refrigerator box)





Comparing electric refrigerator temperatures in Nha Trang (freezer box)

Dometic TCW 2000 solar direct drive





Temperature performance of Dometic TCW 40 SDD refrigerator in Ben Tre





Technical issues

Both Sure Chill® solar refrigerators experienced major system failures in November/December 2011 and again in the summer and fall 2012.

- Compressor controller and the compressor failed.
- True Energy and Secop determined the cause was an internal component.

Dometic TCW 2000 SDD—ice-lined refrigerator and ice pack freezer:

- Ice-lined refrigerator temperature performance is acceptable in the South (Nha Trang: 1° C to 4° C) but not in the North (Ha Noi: >8° C).
- Ice pack freezer temperature performance very different by day and by night (-19° C to 1° C) in Nha Trang.



Acceptability and feasibility

Pros

- Stable temperature, which makes it secure for vaccines.
- No freezing temperatures.
- No need to worry about vaccines during power cuts.
- Saves electricity cost.
- Functions even in winter when the weather is cloudy (north) for Sure Chill® solar.

Cons

- Too much condensation in the refrigerator, which makes it very wet, and it is loud (Sure Chill® solar).
- Difficult and scary to climb to the roof to clean the solar panels.
- No one available with the right knowledge and experience to fix the refrigerator if it breaks.
- Temperature fluctuation between days and nights is significant (TCW 2000 SDD freezer box).



CHALLENGES AND LESSONS LEARNED



Fungus growth on vaccine boxes (Sure Chill® solar refrigerator)

- Condensation constantly formed on cold surfaces, including the vaccine boxes.
- Unacceptable wet condition; water was pooled in the shelf and dripped down.
- Trial: Air-tight plastic boxes to hold vaccine boxes to protect against the moist air and mold growth.





Technical support for refrigerator maintenance and repair

- Lack of knowledge and expertise of local technicians with the equipment.
- Rely heavily on the manufacturer.
- Recommendation: Identify and train local technicians.



Conclusion

- Dometic TCW 2000 SDD: Ice-lined refrigerator and ice pack freezer and TCW 40 SDD refrigerator can be used for storing vaccine only in the South of Vietnam (e.g., hot dry weather).
- BLF 100 DC Sure Chill® demonstrated extremely stable temperature performance (4°C to 5°C) throughout the year (even in the low-light condition during the winter in northern Vietnam).
- Valuable experience for NEPI, manufacturers, and other potential users around the world. New Sure Chill® model was developed incorporating modifications from the experience in Vietnam.



Acknowledgment

We thank the following organizations for their support:

- Project Optimize (a PATH and World Health Organization collaboration)
- Dometic
- True Energy



THANK YOU!