



INTRODUCING SOLAR-POWERED VACCINE REFRIGERATOR AND FREEZER SYSTEMS

**A GUIDE FOR MANAGERS IN NATIONAL
IMMUNIZATION PROGRAMMES**



**World Health
Organization**



INTRODUCING SOLAR-POWERED VACCINE REFRIGERATOR AND FREEZER SYSTEMS

A GUIDE FOR MANAGERS IN NATIONAL
IMMUNIZATION PROGRAMMES



WHO Library Cataloguing-in-Publication Data Introducing solar-powered vaccine refrigerator and freezer systems: Guidance for managers in national immunization programmes.

I. World Health Organization.

ISBN 978 92 4 150986 2

Subject headings are available from WHO institutional repository

© **World Health Organization 2015**

All rights reserved. Publications of the World Health Organization are available on the WHO website (www.who.int) or can be purchased from WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland (tel.: +41 22 791 3264; fax: +41 22 791 4857; e-mail: bookorders@who.int).

Requests for permission to reproduce or translate WHO publications –whether for sale or for non-commercial distribution– should be addressed to WHO Press through the WHO website (www.who.int/about/licensing/copyright_form/en/index.html).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

All reasonable precautions have been taken by the World Health Organization to verify the information contained in this publication. However, the published material is being distributed without warranty of any kind, either expressed or implied. The responsibility for the interpretation and use of the material lies with the reader. In no event shall the World Health Organization be liable for damages arising from its use.

Design and layout: L'IV Com Sàrl, Villars-sous-Yens, Switzerland.

Printed by the WHO Document Production Services, Geneva, Switzerland.

CONTENTS

| | |
|---|------|
| Executive summary | v |
| Acronyms | vi |
| List of figures and tables | vii |
| List of figures | vii |
| List of tables | vii |
| Glossary | viii |
| Acknowledgements | xi |
| 1. Introduction | 1 |
| 1.1. Who is this guide for? | 1 |
| 1.2. How is this guide organized? | 1 |
| 1.3. The challenge of vaccine refrigeration in areas without reliable electricity | 2 |
| 1.4. Partners | 5 |
| 1.5. Technical resources | 6 |
| 1.6. Pilot projects | 7 |
| 2. Prerequisites | 8 |
| 2.1. Availability of solar energy | 8 |
| 2.2. Suitability of solar energy | 9 |
| 2.3. Solar service provider | 11 |
| 2.4. Secure and ongoing funding | 12 |
| 3. Equipment selection | 13 |
| 3.1. Identify facilities that require solar refrigerators and water-pack freezers | 13 |
| 3.2. Identify storage and freezing capacity requirements | 16 |
| 3.3. Assess climate conditions | 17 |
| 3.4. Conduct site assessments | 18 |
| 3.5. Specify required equipment | 21 |
| 3.6. Compile capital and operating costs | 21 |
| 4. Procurement | 22 |
| 4.1. Issuing a request for quotation | 22 |
| 4.2. Negotiating a contract | 23 |
| 5. Installation | 25 |
| 5.1. Installation preparation | 25 |
| 5.2. Staff and technician training | 28 |
| 5.3. Installation verification | 28 |
| 5.4. Final acceptance | 28 |

| | |
|---|----|
| 6. Temperature monitoring | 30 |
| 7. Maintenance and repair | 32 |
| 7.1. Maintenance and repair planning | 32 |
| 7.2. Preventive maintenance | 32 |
| 7.3. Corrective maintenance and repair | 33 |
| 7.4. Battery replacement | 34 |
| 7.5. Reusing a solar array | 35 |
| Annexes | 36 |
| Annex A. Site assessment worksheet | 36 |
| Annex B. Specification checklist | 41 |
| Annex C. Example specification checklist | 43 |
| Annex D. Example budget summary sheet | 45 |
| Annex E. Installation checklist | 48 |
| Annex F. 30-day performance checklist | 51 |
| Annex G. Maintenance tools and supplies | 52 |
| Preventive maintenance tools | 52 |
| Technician maintenance tools | 52 |
| Annex H. Maintenance checklist for solar refrigerators and freezers | 53 |
| Maintenance tasks (daily) | 53 |
| Maintenance tasks (weekly) | 53 |
| Maintenance tasks (biannual) | 53 |

EXECUTIVE SUMMARY

Refrigerators powered by gas or kerosene have long been considered the best option for storing vaccines in areas with unreliable electricity. Even so, drawbacks with these devices have made keeping vaccines at temperatures within the safe range of +2°C to +8°C both difficult and expensive. Battery-powered solar refrigerators have addressed some of the drawbacks, but the batteries they rely on are expensive and typically have a lifetime of just three to five years. A new refrigerator technology, named “solar direct-drive” (SDD), eliminates the need for batteries, and therefore has the potential to resolve battery-powered vaccine refrigerator problems and help extend the cold chain into areas that might otherwise be underserved.

This document provides managers in national immunization programmes with guidance on how to implement successful solar-powered vaccine refrigerator and freezer systems. The guidance takes into account important new developments in refrigerator technology, and is based on lessons learned during the 30 years since solar refrigerator systems were first used in immunization programmes. The document is organized according to the key stages in the process of implementing successful solar-powered vaccine refrigerator and freezer systems:

- ◆ Identify key partners and resources (Chapter 1)
- ◆ Ensure that the prerequisites are met (Chapter 2)
- ◆ Select the most appropriate equipment for each facility (Chapter 3)
- ◆ Procure the selected equipment (Chapter 4)
- ◆ Plan the equipment installation (Chapter 5)
- ◆ Monitor equipment performance (Chapter 6)
- ◆ Maintain and repair the equipment (Chapter 7)

The Annex contains additional resources that can assist managers in implementing solar refrigeration systems.

ACRONYMS

| | |
|---------------|--|
| 30-DTR | 30-day temperature recorder/logger |
| cMYP | comprehensive multi-year plan |
| EPI | Expanded Programme on Immunization (WHO) |
| GAVI | GAVI Alliance (formerly Global Alliance for Vaccines And Immunization) |
| LED | light-emitting diode |
| LPG | liquid petroleum gas |
| PQS | Performance, Quality and Safety (WHO) |
| SDD | solar direct-drive |
| SMS | short-message service |
| SOPs | standard operating procedures |
| UNICEF | United Nations Children's Fund |
| WHO | World Health Organization |

预览已结束，完整报告链接和二维码如下：

https://www.yunbaogao.cn/report/index/report?reportId=5_27272

