Gavi
The Vaccine Alliance

COLD CHAIN EQUIPMENT PROGRAMME AND TECHNOLOGY GUIDE

Current as of April 2026

ABOUT THIS GUIDE

This guide aims to provide an overview of the Gavi 6.0 CCE Programme changes and requirements, as well as provide clear advice on CCE technologies to help make planning and purchasing decisions.

PLEASE CONTACT GAVI WITH ANY QUESTIONS OR FOR MORE INFORMATION AT cceplatform@gavi.org OR VISIT gavi.org

Cover: Awudi Felicia Akosua, a health worker and Ernest Nabuel, a volunteer, board a boat for a community visit at Abotoase in the Oti Region of Ghana. Healthcare workers visited families to provide vaccines to zero-dose children, including the Mosquirix vaccine (RTS,S) against malaria.

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This guide is current as of April 2026.

INTRODUCTION

The Challenge:

With support from Gavi, eligible countries made substantial progress between 2017 to 2025 in upgrading and expanding cold chain capacity at the storage and service delivery levels, procuring more than 92,000 units of on-grid (ice-lined, 'ILR') and Solar Direct Drive (SDD) refrigerators and freezers. Despite these achievements, considerable gaps remain as of 2026, and critical needs persist for additional CCE to support new vaccine introductions, reach zero-dose populations, replace aging and obsolete equipment that no longer meets programmatic requirements and to support integration of other temperature-sensitive primary health care (PHC) essential medicines and products.

Cold chain equipment (CCE) remains a critical area of Gavi support during the new Gavi Strategic period (2026–2030, 'Gavi 6.0'). Building on the success of Gavi's Cold Chain Equipment Optimization Platform (CCEOP), which ran from 2016–2025, the 6.0 approach will continue to support countries to upgrade, extend and expand their vaccine cold chains with higher-performing CCE, with a strong focus on reaching last-mile and zero-dose populations. Functional CCE is a critical enabler of resilient immunisation supply chains and programmes, contributing to the Alliance's ambition to reach more children with life-saving vaccines and protect them against deadly diseases.

Gavi's CCEOP programme invested nearly $400 million between 2016 and 2025, complemented by country joint investment contributions. Additional investments in CCE were also made through Gavi Health System Strengthening (HSS) grants, Gavi's COVID-19 support and with other non-Gavi funding sources. The CCEOP aimed to improve the affordability, availability, quality and installation of high-performing CCE in Gavi-supported countries, particularly at health facility level. The success of the CCEOP in improving countries' cold chain systems provides a strong foundation for the Gavi 6.0 CCE Programme. During Gavi 6.0, Gavi aims to invest at least $170 million in CCE and related services through the new "Cold Chain Equipment Minimum Floors" approach, as detailed below.

INVESTING IN NEW COLD CHAIN EQUIPMENT IS KEY TO IMPROVING:

- Sustainable, equitable, immunisation coverage by extending equipment availability into remote areas and better enabling outreach activities
- Reliability, device up-time and overall device lifespan
- Vaccine safety and effectiveness through better temperature control

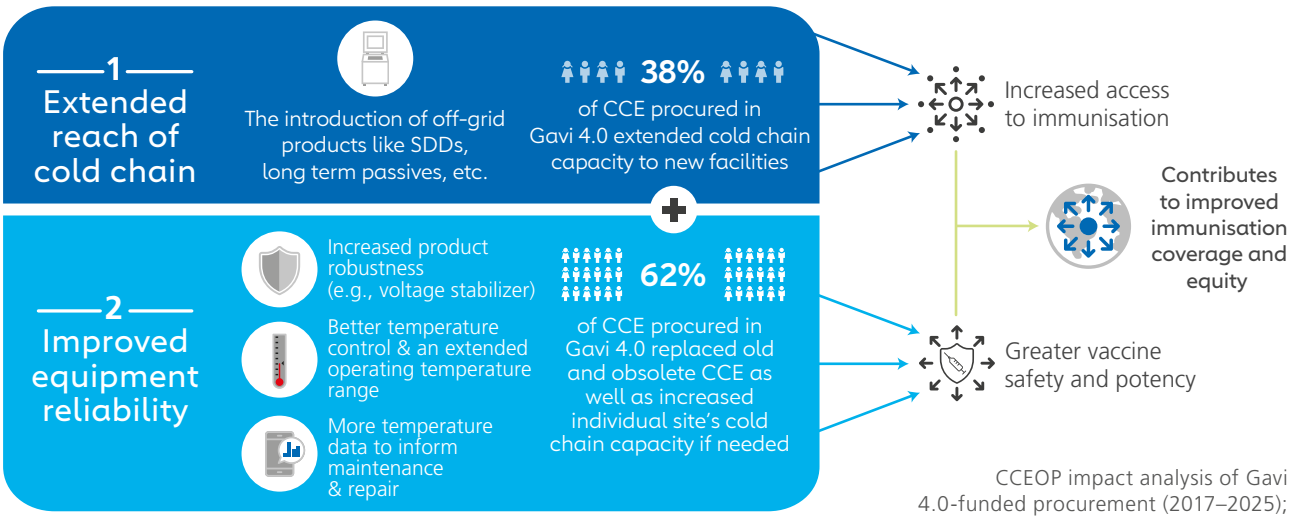
GAVI 6.0 OBJECTIVES FOR THE CCE PROGRAMME

Strengthening immunisation supply chains (iSCs) is critical to enabling delivery of services to underserved communities, ensuring vaccine availability and potency, and maximizing efficiency where possible. CCE support will focus on addressing unmet CCE needs in eligible countries, with countries tailoring strategies to their specific needs, location and context with a focus on deploying CCE that contributes to equity and reaching zero-dose children.

The Gavi CCE Programme between 2026–2030 will focus on the following four goals:

- **Fulfil unmet CCE needs in eligible countries:** CCE support aims to fulfill a large proportion of unmet needs in line with Gavi's equity goals and the objective of reaching zero-dose communities (urban, rural) and tailored to countries-specific contexts (including remote and conflict settings) and strategies.
- **Improve systems strengthening:** Ensure that CCE investments lead to improvements in CCE maintenance, visibility of CCE uptime, increased collection and use of cold chain performance data for planning, maintenance and procurements. This also includes engagement with the private sector where relevant and feasible.
- **Improve sustainability:** Ensuring resources are available to support immunisation supply chain systems that are financially, socially and environmentally sustainable and promoting domestic investments in both CCE procurement and maintenance.
- **Improve CCE market health:** Shape the market to improve the health of the ILR/SDD refrigerator and freezer segment, sustaining and building on the gains from Gavi 5.0, with a focus on the development and uptake of critical innovations and collection and use of field performance data. In 2026, the Alliance will release an updated market shaping strategy (Roadmap) outlining the Alliance's objectives and targets to improve the health of the ILR/SDD and Equipment Monitoring Systems (EMS) market, adapted for the context of the Gavi 6.0 period.

IMPROVED CCE CONTRIBUTES TO IMPROVED IMMUNISATION COVERAGE AND EQUITY



CCEOP impact analysis of Gavi 4.0-funded procurement (2017–2025); source: UNICEF SD, October 2025

CHANGES TO THE GAVI 6.0 CCE PROGRAMME

The Gavi 6.0 CCE Programme introduces several changes and brings uniformity to the previously fragmented approach through which Gavi supported CCE investments in products and services. These changes cover funding levers, funding allocational mechanisms, adaptations to the country joint investment model, CCE eligibility criteria and equipment deployment modalities.

CONSOLIDATION OF CCE FUNDING PATHWAYS

- Gavi consolidated multiple funding streams into one Cash Budget under 6.0. In the context of CCE, this brings together different funding levers through which countries previously financed CCE equipment and services, including CCEOP, HSS grants, Equity Accelerator Funding (EAF) grants, Vaccine Introduction Grants, and operational "campaign" costs.
- Under the new Cash Budget approach, countries will submit one application that includes all their CCE needs over the 5-year strategic period.
- All Gavi 5.0 grants (e.g., CCEOP, HSS, EAF) with CCE procurements approved by the Gavi Independent Review Committee and/or through the CCEOP Decision Letter but not disbursed by end of 2025 will be considered as 6.0 procurements subject to 6.0 CCE Minimum Floor guidance.
- 6.0 CCE procurement processes have been redefined within the Cash Budget framework based on where funds are held, to streamline procurement mechanisms.
- UNICEF Supply Division (SD) remains the standard procurement agency for Gavi's CCE funding support under the Cash Budget.

ESTABLISHMENT OF "CCE MINIMUM FLOORS"

- Countries are expected to make a minimum investment in eligible CCE products and services from within their Cash Budget.
- CCE Minimum Floors have been established within the Cash Budget to enable CCE demand forecasting, enhance market predictability and visibility, and ensure countries invest in a critical base of CCE as a key backbone of immunisation programmes.
- Within each country's Cash Budget, a CCE Minimum Floor is defined with a recommended level of funding that countries are encouraged to allocate to eligible CCE products and services, based on an Alliance-validated CCE needs estimate across all countries.
- CCE Minimum Floors are not ring-fenced; countries may invest above the minimum floor as needed, but must justify spending below the recommended level. Countries retain the flexibility to allocate funds across approved CCE categories within the Minimum Floor.
- Under Gavi 6.0, the CCE Minimum Floors collectively amount to an indicative Gavi investment of $170 million across all eligible CCE products and services.

PRODUCT & SERVICES ELIGIBILITY FOR CCE MINIMUM FLOORS

- This Programme and Technology Guide overviews the CCE products and service categories that are eligible under the CCE Minimum Floors. Specific eligible products are not listed in the Guide, but are available **here**.
- All Gavi-funded CCE must meet World Health Organization (WHO) Performance, Quality and Safety (PQS) standards.
- CCE must also meet Gavi's programme and technical specification requirements, often derived from past or current WHO Target Product Profiles (TPPs). In some cases, these requirements may exceed current PQS standards or UNICEF Long-Term Arrangements (LTA), a framework agreement that UNICEF establishes with a supplier (manufacturer or service provider) for a defined period of time, usually 1–3 years, with potential for extension.

- Countries can access two broad categories of CCE through Gavi support:
  - **CCE products and services eligible under the CCE Minimum Floors:** These correspond to categories previously supported under the CCEOP and are detailed in this CCE Programme and Technology Guide. These products and services are subject to joint investment requirements and the associated UNICEF procurement fee, including when countries invest above or below the suggested Minimum Floor level.
  - **Walk-in cold rooms/freezer rooms (WICRs/WIFRs) and refrigerated vehicles:** Although not eligible under the CCE Minimum Floors nor included in this CCE Programme and Technology Guide, countries may procure these products through their Gavi Cash Budget. These products are not subject to a joint investment requirement.
- Country ownership of any data generated by CCE products procured with Gavi funding remains a requirement in 6.0 for all categories of CCE products and services.
- Gavi is introducing a CCE pricing threshold for mains-powered and Solar Direct Drive refrigerators and freezers. Under this approach, only products priced at up to 40% of the average price for the specific volume band of the product category will be eligible for Gavi support and listed on the Gavi-Eligible CCE Product list. The average price is based on UNICEF's 2025 tender for ILR / SDDs.

CCE JOINT INVESTMENT MODEL

- The Gavi 6.0 CCE Programme will continue to apply a joint investment model at the time of application submission, with exemptions introduced.
- To benefit from Gavi funding support, countries must jointly invest in eligible CCE products and services under the CCE Minimum Floors.
- Joint investment requirements for each segment have been reduced compared to Gavi 5.0 levels.

Gavi 6.0 CCE Minimum Floor Country Joint Investment Requirements by Gavi Transition Phase:

–10%	Initial Self Financing
–20%	Preparatory Transition
35%	Accelerated Transition

- Domestic or donor-funded CCE procurements (excluding Gavi funds) across product and service categories eligible under the CCE Minimum Floors or grade A CCE on the UNICEF LTA or PQS catalogue procured between 2026–2030 may count towards the country joint investment requirement.
- Countries may be exempted from the joint investment requirements in exceptional circumstances, in alignment with the Gavi Fragility, Emergencies and Displaced Populations Policy and under the specific circumstances described in Gavi's Vaccine Co-financing Policy.

CCE DEPLOYMENT APPROACHES

Two CCE deployment modalities* are available during Gavi 6.0:

- **Supplier-led deployments:** The majority of CCE deployments will continue to be supplier-led, where suppliers or their Local Service Providers (LSPs) manage in-country storage, distribution, installation of CCE, end-user training as well as centralised technician training on installations, maintenance etc. This supports timely deployment.

*The selection of these modalities was informed by the 2025 evaluation of the CCEOP in Gavi 4.0 (2017–2022 implementation) and the COVAX CCE country-led deployment approach.

- **Country-led deployments:** Selected countries will have the option of managing in-country storage, distribution, installations and end-user training on their own with support from UNICEF Country Offices (CO), particularly to address high supplier deployment costs, security-related access constraints and to strengthen government ownership & local technician empowerment.
  - **Country eligibility:** The approach is an option for up to 24 countries (e.g., fragile/conflict countries, accelerated transition countries and countries that previously implemented the modality) upon request from an eligible country through the application process.
  - **Criteria:** Countries will need to meet the criteria below to opt for this modality.
    - Government leadership: Functional coordinating bodies (e.g. National Logistics Working Groups, Project Management Team) between MoH, UNICEF, partners & subnational levels to also manage country led deployments
    - Past experience: Previous implementation of country-led deployments.
    - Minimum capacity: available and adequately trained government technician workforce for CCE; storage and transport capacity (Government or UNICEF CO); sufficient and strong UNICEF CO resources and capacity
    - Deployment readiness: local capacity to conduct independent post installation inspection for the first batch for new countries.
    - Cost efficiency especially in non-fragile states e.g. deployment costs <40%–65%* of supplier led deployment costs

APPLICATION AND PROCUREMENT APPROACH

- Under Gavi 6.0, the CCE Programme uses a 'brandless approach,' specifically a brand-neutral, requirements-based application and procurement model to ensure equipment selection is driven by technical performance, programmatic needs and product and services lifecycle value. Countries will define their CCE needs based on cold chain capacity gaps, replacement requirements and service delivery priorities, including reaching zero-dose populations.
- Applications focus on functional and performance specifications – rather than brand names – including vaccine storage capacity, holdover or autonomy time, energy consumption, deployment and mobility suitability, serviceability and after-sales support, operational track record and contextual fit.
- Procurement decisions will be made in a structured, two-stage process. At the first stage, UNICEF SD evaluates applications against the full set of technical criteria, including purchase, installation, operation, and maintenance costs over the equipment lifecycle. Only suppliers whose products meet these requirements are shortlisted. In the second stage, a competitive tender is conducted among the shortlisted suppliers to identify the option that delivers the best value for money, considering technical performance, operational suitability and market shaping goals.
- This requirements-based, lifecycle-focused model promotes transparency, ensures technically robust and cost-efficient procurement, strengthens market competition and maximises the number of CCE needs that can be met during Gavi 6.0, while ensuring countries' programmatic priorities are fully addressed.

PROCUREMENT MODALITIES

- Procurement processes for CCE have been streamlined through integration of the CCE Programme into the Cash Budget.
  - **Equipment eligible under the CCE Minimum Floors:** Procurements of CCE and services will be managed by UNICEF SD under the existing Memorandum of Understanding (MOU) between Gavi and UNICEF SD for

*2025 Evaluation of CCEOP 1 and COVAX CCE country led deployment modality2025 evaluation of the CCEOP in Gavi 4.0 (2017–2022 implementation) and the COVAX CCE country-led deployment approach

supplier-led projects. Gavi will retain the funds and transfer them directly to UNICEF SD on behalf of countries.

- For country-led projects, procurement of CCE will be managed by UNICEF SD under the existing MOU between Gavi and UNICEF SD. Gavi will retain the funds and transfer them directly to UNICEF SD on behalf of countries. However, contracting for services and disbursement of deployment funds for in-country activities will be managed through UNICEF COs as per the Grant Agreement and Harmonized Approach to Cash Transfers modality under UNICEF's Financial Regulations and Rules.
  - **Walk in cold rooms/freezer rooms and refrigerated vehicles:** Procurements may follow one of the two UNICEF procurement processes currently in place depending on where the Gavi funds are held. If funds are held by Gavi, the procurement services approach via UNICEF SD is recommended. If funds are already in-country, a programme order via the UNICEF CO is recommended instead.

CCE PRODUCT AND SERVICE CATEGORIES ELIGIBLE UNDER GAVI CCE MINIMUM FLOORS

Gavi funding support through the CCE Minimum Floors is available for the following CCE product categories:

- **Mains-powered Ice-lined Refrigerators (ILR) and combined ILR refrigerator/freezers** are able to maintain vaccines safely within the recommended temperature range (+2 °C to +8 °C), even during intermittent or extended power outages. However, **standalone mains-powered freezers** typically have limited holdover time and are therefore less suitable for maintaining required frozen vaccine temperatures (–15 °C to –25 °C) during power interruptions.
- **Solar Direct Drive (SDD) Refrigerators and Freezers** that do not require batteries while keeping vaccines safely.
- **Temperature and CCE Performance Monitoring Devices** (integrated and standalone) (e.g., RTMDs, EMS) that send automatic alerts to health facility staff and/or national maintenance centers when ILRs/SDDs malfunction, ensuring quick corrective action.
- **RTMD/EMS Level 3 Data Subscriptions** to enhance remote monitoring of CCE to guide implementation of corrective actions where needed.
- **Voltage Stabilisers** for mains-powered refrigerators and freezers, which is more reliable and robust to challenging power conditions.
- **Longterm Passive Devices** designed to keep vaccines cold for long periods without any source of power and continuity in service provision for remote, hard to reach communities or facilities without power.
- **Freeze-Preventive Passive Devices:** Insulated passive containers (cold boxes or vaccine carriers) designed to prevent the risk of accidental freezing of vaccines.
- **Traditional Passive Devices** (cold boxes and vaccine carriers) which are exceptionally available for procurement in 6.0 to support outreaches and vaccine transport where scale up of freeze preventive technologies is not feasible.
- **Transportable, Powered Vaccine Storage Devices (TPVS)** that provide active cooling of vaccines during transport and storage, aimed at

servicing last-mile communities, including zero-dose populations.

- **Service bundles** (in-country distribution, warehousing, installation of CCE and end user training) for ILRs, SDDs, RTMDs, EMS etc
- **Trainings** on installation, maintenance and system management for on-grid ILR & SDD Refrigerator/ Freezer, TPVS, WICs/WIFs, RTMD/ EMS to enhance user, technician, and system administrators' capacities to monitor and maintain performance of cold chain equipment.
- **CCE Accessories**, including spare parts, ice packs, additional temperature monitoring devices such as 30-Day Electronic Temperature Loggers, User-Programmable Temperature Data Loggers, and Irreversible Freeze Indicators, which ensure the proper functioning, reliability, and effectiveness of vaccine storage and transport equipment.

Many products supported under Gavi CCE Minimum Floors funding reflect WHO PQS Target Product Profiles (TPPs). TPPs outline desirable product design characteristics, features, and enhanced performance functions but are not typically requirements for WHO prequalification at the time of TPP publication. The latest TPPs for ILRs and SDDs were published in 2022 and are available **here**.

ADDITIONAL AVAILABLE TOOLS

GUIDANCE AND TOOLS

This guide is about choosing the right technology to meet your country's cold chain needs.
In addition, the following guidance and tools are available to help strengthen your cold chain and vaccine supply chain.

KEY RESOURCES

WHO Immunization Devices Performance, Quality & Safety (IMD-PQS) Catalogue of Prequalified Devices (EN)

This catalogue provides detailed specifications on each WHO PQS prequalified cold chain device, as well as WHO guidelines for device selection. PQS prequalification means that a device has passed a set of performance, quality and safety tests set by WHO.

WHO EPI supply chain tools (EN | FR)

This page includes links to the WHO's various tools for helping countries plan and implement a functional, end-to-end supply chain and logistics systems for safe and effective vaccine management. The available tools include:

- Immunization Supply Chain Sizing Tool – for national programme managers to estimate the size of the required supply chain infrastructure for vaccine storage and transportation at each level and facility
- Cold Chain Equipment Inventory (CCEI) and Gap Analysis Tool – for conducting and analysing a cold chain equipment inventory
- Vaccine Volume Calculator – for determining the total supply chain storage volume needed for the set of vaccines included in a country's vaccination programme
- Cold chain equipment and dry store temperature mapping tool–for mapping temperatures in various types of cold chain equipment and dry stores

GUIDANCE ON SYSTEM DESIGN

Joint Statement on temperature-sensitive health products in the Expanded Programme on Immunization cold chain (WHO and UNICEF)

In 2020 WHO and UNICEF issued a joint statement encouraging greater health commodity supply

chain integration for temperature-sensitive pharmaceuticals where appropriate. The statement provides reference to plan tools and other existing mechanisms to design and implement a safe and efficient integrated cold chain system.

Introducing solar-powered vaccine refrigerator and freezer systems: a guide for managers in national immunization programs (WHO and UNICEF)
This document provides managers in national immunization programmes with guidance on how to implement successful solar-powered vaccine refrigerator and freezer systems. The guidance considers 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. Additional WHO guidance on SDDs is available **here**.

How to calculate vaccine volumes and cold chain capacity requirements (WHO and UNICEF)
This module of the WHO Vaccine Management Handbook describes how to calculate vaccine volumes and evaluate the cold chain capacity requirements of a vaccine supply chain. This module also provides guidance on how to calculate cold chain storage needs for coolant-packs and the dry-storage capacity needed for immunization-related commodities.

How to use passive containers and coolant-packs for vaccine transport and outreach operations (WHO and UNICEF)
This module of the WHO Vaccine Management Handbook (VMH) provides guidance on how to develop a transport strategy that minimises the risk of exposure to freezing through the correct use of passive containers and their associated coolant-packs. It covers vaccine transport down to health facility level and transport for outreach operations.

Guidance on selecting, commissioning and using freeze-preventative vaccine carriers (PATH, UNICEF, and WHO)
This guidance document is intended to help inform which type of vaccine carrier to select based on local context, to maintain vaccine quality, especially at service delivery points.

Immunization supply chain interventions to enable coverage and equity in remote rural settings (UNICEF)
This document summarises the challenges faced by the iSC in reaching the communities with the most zero-dose children, namely urban poor, remote rural and conflict-affected communities. It also provides guidance on the iSC strategies and interventions that may be used to address them. It ultimately aims to enhance coverage and equity in the three most underserved community types – remote rural, urban poor and conflict settings.

Effective Vaccine Management (EVM) assessment and continuous improvement planning (cIP) tool (WHO and UNICEF)
EVM is a national EPI planning process endorsed and supported by WHO and UNICEF to assess and prioritise improvements in the immunization supply chain. Launched in 2009, EVM is embedded within the iSC continuous improvement planning process. Drawing on lessons learnt conducting EVM assessments in more than 80 countries, and by leveraging developments in mobile and cloud-based computing, EVM2, released in 2019, builds upon the original EVM assessment tool to provide countries with a broader, more powerful, more agile and more sustainable solution for improving ISC systems.

Cold chain integration (TechNet Hot Topic)
This page provides supply chain managers with a list of key resources when planning to integrate temperature-sensitive health products into the vaccine cold chain.

RTMD Maturity Level Assessment Tool (UNICEF)
This assessment tool is intended for countries to conduct a self-assessment with regards to their current level and capacity to utilise RTMDs and related data. This assessment will guide countries on additional technical assistance required to reach higher capacity levels. Further, it will also guide

procurement of RTMDs vis-à- vis a country's capacity level for optimal usage of equipment and funds. Please contact UNICEF directly for the tool.

Strengthening Data Use through CCE Performance Monitoring (UNICEF)
This guidance document provides countries with practical guidance on how to implement and use temperature monitoring devices – 30-day temperature recorders (30DTRs) and remote temperature monitoring devices (RTMDs) – to strengthen cold chain performance monitoring and data-driven decision making. It outlines the technical, digital, financial, and human-resource requirements needed to ensure reliable temperature data, effective alarm response, and sustained operational management across all levels of the vaccine supply chain. Please contact UNICEF to access this guidance document.

WHO-UNICEF Joint Statement on Equipment Monitoring Systems *(Forthcoming)*
WHO and UNICEF will soon be issuing a Joint Statement on Equipment Monitoring Systems. A description and link to the statement will be included in this Guide once available.

Guidance on Transportable, Powered Vaccine Storage Devices (TPVS) *(Resource forthcoming)*
This forthcoming guidance will outline best practices, core considerations, and appropriate use cases for lightweight transportable, powered vaccine storage devices (TPVS), helping countries understand where these technologies add the most value. It draws on insights and evidence from recent multicountry TPVS pilots to inform practical, field ready recommendations for improving last-mile vaccine delivery.

GUIDANCE ON PROCUREMENT

Cold chain technical support (UNICEF)
Technical guidelines on CCE and services procured through UNICEF. These documents provide commercial and technical guidance for different cold chain product categories such as cold/freezer rooms, mains-powered ILR & SDD refrigerators/ freezers, cold boxes and vaccine carriers, and temperature monitoring devices for you to use during procurement of cold chain equipment through the UNICEF SD.

UNICEF supply catalogue
The catalogue provides a comprehensive list, specification and price of cold chain equipment available under UNICEF LTAs for procurement, helping countries source equipment efficiently while ensuring compliance with technical and programmatic requirements. *(Note: not all products available in UNICEF's supply catalogue are available for procurement with Gavi funding support).*

Total cost of ownership tool for cold chain equipment (PATH)
The total cost of ownership (TCO) tool for CCE is designed to help users understand the costs of purchasing and maintaining CCE over time. The tool allows country-specific customisation for modelling capital and operating expenses of WHO PQS prequalified equipment via interactive worksheets.

GUIDANCE ON COLD CHAIN EQUIPMENT MANAGEMENT

How to develop a repair and maintenance system for cold chain equipment (WHO and UNICEF)
This module of the WHO Vaccine Management Handbook (VMH) introduces the policy, technical, material, budget and management requirements of an effective cold chain equipment maintenance and repair system.

Module 2 The vaccine cold chain, Immunisation in Practice (WHO)
This module provides guidance for workers at the health facility level. It covers the use of cold-chain and temperature-monitoring equipment and the preventive maintenance of cold-chain equipment.

How to monitor temperatures in the vaccine supply chain (WHO and UNICEF)
This module of the WHO Vaccine Management Handbook (VMH) focuses on temperature

monitoring and provides updated implementation guidance on vaccine vial monitors, and various temperature monitoring tools for cold rooms and fridges, including the new devices which monitor and log temperatures electronically.

Equipment monitoring systems (EMS) (TechNet Hot Topic)
EMS is a set of WHO PQS specifications that enable standardised, interoperable collection of CCE performance data. It aims to make those data available to service technicians, health facility workers, and optionally to remote viewers or to aggregate reporting. EMS is a WHO PQS requirement for SDD vaccine refrigerators and ILRs. This page lists key resources and publications on EMS.

User guides for temperature monitoring devices (TechNet Hot Topic)
This page contains a list of user guides for WHO-PQS prequalified CCE temperature monitoring devices (PQS E006), including shipping indicators, freeze indicators, threshold indicators, Vaccine Vial Monitors, RTMDs, user-programmable temperature data loggers, and 30-DTRs.

Cold chain equipment management (TechNet Hot Topic)
This package of technical resources has been designed to ensure that in-country CCE managers and technicians, as well as anyone who will be involved or is interested in immunization supply chain, have access to concise yet precise information and guidance on key steps of the cold chain equipment management process. The package can also be used to develop the documentation needed to develop application to funding mechanisms to finance CCE needs

Freeze-preventive passive containers (TechNet Hot Topic)
This page features background information and guidance on freeze prevention in the immunization supply chain, also known as the cold chain, as it relates to passive containers.

Cold chain equipment and dry store temperature mapping tool
This WHO technical tool supports countries in conducting temperature mapping across cold chain equipment and dry storage areas, helping ensure that refrigerators, freezers, cold rooms, and dry stores maintain appropriate conditions for vaccines and other temperature sensitive products. It provides an Excel based application compatible with multiple data loggers and includes integrated guidance to help users plan, record, analyse, and validate three dimensional temperature variations within storage spaces.

Decommissioning and safe disposal of cold chain equipment
This guidance document provides practical procedures for the safe decommissioning and environmentally responsible disposal of cold chain equipment, outlining key risks, regulatory considerations, and technical steps to manage end of life CCE. It aims to build country capacity by offering a structured roadmap, tools, and best practices to ensure that disposal processes protect health, safety, and the environment.

Guidance on Repurposing Ultra Low Temperature (ULT) Freezers
This guidance document provides countries with practical, technical advice on how to repurpose ultra low temperature (ULT) freezers acquired during the COVID 19 response, offering options for future health related use, emergency preparedness, and research applications. It serves as a reference for ministries of health and partners on how to optimize surplus ULT capacity, safely relocate equipment, and maintain readiness for future UCC needs.

CCE performance and warranty evaluations
This report summarizes a 2025 PATH analysis of ILR/SDD performance under the CCEOP, drawing on temperature monitoring data, EVM assessments, warranty claims, and country inventory records to evaluate the effectiveness and reliability of commonly procured vaccine refrigerators.

It is intended as a practical resource for EPI programme managers and cold chain logisticians, highlighting key performance patterns and offering actionable recommendations based on the study's findings, and will be shared directly with EPI programme managers during 2026.

Study protocol for temperature monitoring in the vaccine cold chain

This is a study protocol for monitoring temperature in the vaccine cold chain. A temperature study tool is also available to be used for collecting, analysing, and reporting temperature data as part of a temperature monitoring study.

COMMUNITIES OF PRACTICE

TechNet-21

TechNet-21 is a network of immunisation professionals from around the world. The goal of the network is to strengthen immunisation services by sharing experiences, coordinating activities, and helping to formulate optimal policies. The website provides a variety of useful tools, including a forum to discuss important topics and recent developments in immunisation and an area for members to review WHO PQS-prequalified cold chain equipment. The TechNet-21 Knowledge Hub provides an extensive repository of immunization resources, including journal articles, user guides, photographs, videos, useful links and tools.

OVERVIEW OF HOW TO MAKE PURCHASING DECISIONS

This guide is designed to help you think through which equipment categories to purchase and to understand some of the requirements for equipment and services to be eligible for Gavi funding support.

Please use the following key steps to help you complete the decision-making process:

Step 1: Categorize your health facilities based on CCE needs

Update your CCE inventory and learn how to divide health facilities and other cold storage points in your country into different groups.

Step 2: Choose your device types

For each group, learn how to determine what types of devices are appropriate and what are the Gavi requirements.

STEP 1

CATEGORISING YOUR HEALTH FACILITIES AND OTHER COLD STORAGE FACILITIES BASED ON COLD CHAIN EQUIPMENT NEEDS

COLD CHAIN INVENTORY UPDATE

To improve decision-making over time it is advised to outline relevant information and record strategic choices for future reference and improved monitoring. UNICEF's **Immunization Supply Chain Interventions toolkit** to enable coverage and equity in remote rural, urban poor and conflict settings, found in Appendix 1 of the Immunization Supply Chain Interventions report assists in tracking your landscape's cold chain variables and requirements through an easy-to-use checklist.

CATEGORISATION QUESTIONS

Before making any planning and procurement decisions, it is necessary to update your country's existing CCE inventory. First, this process will help you sort out which facilities need CCE, and which do not. Second, this process will also help you assess which product categories and technical requirements are needed to fill your CCE gaps and/or complement your existing CCE. Third, this process will help you plan out and budget for your procurement needs over time, as equipment at different locations is expected to reach the end of its useful lifespan (estimated at 10 years for fridges and freezers) or for new locations (existing or planned to be built) where cold chain equipment may be deployed for the first time.

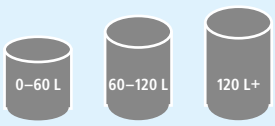
Choosing the correct cold chain solutions for your country's health facilities and cold storage points will require you to assess each location's characteristics. For purchasing fixed storage devices (i.e., non-portable devices such as refrigerators, freezers and long-term passive devices), the following three questions will help you categorise your health facilities and cold storage points:

DECIDING CCE BASED ON POWER AVAILABLY & OUTREACH NEEDS

1. **Does the location have access to reliable electricity?**

2. **Does the location need to either freeze or chill cool water packs to support outreach?**

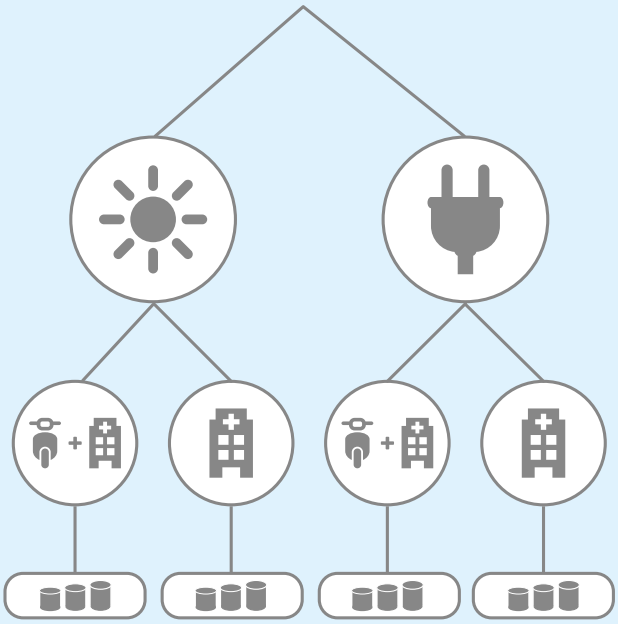
3. **What is the required vaccine* storage capacity of the location over the next 5-10 years?**



*If your country is implementing joint storage of vaccines and other temperature sensitive primary health care commodities, the total storage capacity needs for both should be estimated.

Accurately categorising your country's health facilities and cold storage points before purchasing any equipment will help you ensure that the diverse needs of facilities and cold storage points are met, and that you understand the total budget needed and appropriately budget for ongoing CCE operating and performance monitoring costs over time.

DECISION TREE SAMPLE



1

DOES THE LOCATION HAVE ACCESS TO RELIABLE ELECTRICITY?

Begin by dividing your country's full set of health facilities and cold storage points in need of CCE into two segments based on access to electricity via mains or generator.

On-grid
On-grid locations can access a minimum of eight hours of electricity per day from mains and/or generator power, and experience power outages of less than 48 hours.

Off-grid
Off-grid locations access less than eight hours of electricity per day, experience recurring power outages that last more than 48 hours or have no access to electricity at all.

PURCHASING IMPLICATIONS

On-grid locations should use mains-powered devices – such as ILRs and on-grid freezers – since they have a lower TCO than solar or passive devices for the same amount of storage.

Between on-grid locations, you might see variation in the degree and reliability of electricity access. Your choice of devices should correspond to the number of hours of electricity that a location can access per day, and the length of electricity outages it experiences.

Number of hours of electricity per day
After a few days of near-continuous power to fully freeze its ice lining, a typical mains- or generator-powered ILR requires at least eight hours of electricity per day to keep its lining frozen and maintain a long holdover time. For locations

that can reliably access more than eight hours of electricity per day, you can choose from a wide variety of ILRs.

However, locations with only four to eight hours of electricity per day will require specially-rated ILRs or should likely select off-grid solutions. Planning conservatively is key, as actual conditions where a device is used may be more demanding than those where it was tested.

Length of power outages should also be taken into account. Current WHO PQS requirements require ILRs to have a minimum holdover time of 20 hours. If you expect that a given location will experience long power outages, you will need to request an ILR with an appropriately long holdover time. Locations at risk of prolonged power outages (e.g., due to natural disaster, conflicts) may be better served by off-grid solutions.

Another consideration is the ability of on-grid facilities to reliably pay for power. For locations where reliable payment is not possible, off-grid solutions might be more advisable.

Off-grid locations should use devices that can generate their own power (such as SDDs) or keep vaccines cold for long periods of time without power. These devices often cost much more to purchase than on-grid devices, and their operational costs tend to be higher than for those of ILR devices. For example, SDDs require more routine maintenance practices, such as regular cleaning of the solar panels, and long-term passive devices require regular ice pack replenishment. However, they also either greatly reduce or completely eliminate electricity costs, and solar may be a more reliable power supply than some grids.

2

DOES THE LOCATION NEED TO EITHER FREEZE OR CHILL COOL WATER PACKS TO SUPPORT OUTREACH, OR WILL ACTIVE TRANSPORT SOLUTIONS BE USED?

After you narrow down your device categories based on locations' power access, you can further divide locations by whether or not they need to produce coolant packs (i.e., freeze ice packs or chill cool water packs) for outreach.

Fixed-post immunisation

These locations rarely rely on outreach and conduct nearly all immunisations on site. As a result, they often do not need to freeze or chill water packs on site. For rare occasions when conditioned ice packs, frozen ice packs or cool water packs are needed, they can be provided by the district store.

Fixed-post immunisation and outreach

These locations conduct immunisations on site and through multiple outreach sessions per month. They need appropriate on-site capacity to freeze or chill cool water packs for outreach activities. Alternatively, does the site (and potentially outreach destination) have appropriate access to the relevant power source in cases where a transportable, powered vaccine storage device (TPVS) will be used to support longer duration outreach activities (e.g., multiple days).

For outreach activities with passive devices, the choice of coolant pack type depends on the type(s)

of vaccines being provided and the temperature in the area where the device is used. WHO currently recommends using water-filled coolant packs. If freeze-preventive cold boxes or vaccine carriers are used, ice packs should not be conditioned before use. However, for standard cold boxes or vaccine carriers, ice packs should be properly conditioned before use so vaccines do not freeze. For more information on choice, preparation and use of coolant packs for transport and outreach, please reference WHO vaccine management handbook, Module VMH-E7-02.1: "How to use passive containers and coolant packs for vaccine transport and outreach operations."

PURCHASING IMPLICATIONS

Fixed-post immunisation sites do not need to produce coolant packs on site, as they conduct little to no outreach. You need only to consider refrigerators or long-term passive devices for storage. For the rare outreach sessions, coolant packs should be provided by the district store.

Fixed-post immunisation and outreach sites conduct more than one outreach session per month. For these locations, you can assess whether coolant packs need to be either frozen or chilled on site, or whether it might be more cost-effective and programmatically feasible to freeze or chill them off site in other reliable refrigerator or freezer spaces. You can compare the costs of nearby options in the local community or at the district store with the cost of purchasing a dual compartment fridge-freezer or additional fridge or freezer unit for the facility.

It is important to note that coolant packs should not be stored in the same compartment as vaccines. You should use either a dual compartment device, or two separate devices – one for storing vaccines and one for storing coolant packs. The table below will help you factor the coolant type into your device choice.

DEVICE SELECTION BASED ON NEED TO FREEZE OR CHILL COOLANT PACKS

COOLANT	APPROACH	DEVICE FOR VACCINE STORAGE	DEVICE FOR COOLANT PRODUCTION
Ice packs	Two devices	Fridge or long-term passive device	Freezer
	One dual compartment device	Dual compartment fridge-freezer	
Cool water packs	Two devices	Fridge	Fridge

Devices used to freeze or chill cool water packs should be selected based on the volume and number of packs needed, and their type according to the container used. These devices should be able to completely refreeze or re-chill the required number of packs in the time between sessions.

3

WHAT IS THE REQUIRED VACCINE STORAGE CAPACITY OF THE LOCATION?

The required storage capacity determines the right device size for a site. The required vaccine storage capacity takes into account three factors:

- Volume of vaccines per fully immunised child (or per capita);
- Target population size;
- Vaccine supply frequency and reliability.

In assessing these factors, it is important to plan not only for current needs, but also for future needs over the lifetime of the device. Considerations could include:

- Expected population growth;
- Expected new vaccine introductions or scale ups, such as the malaria vaccine, as well as non-infant immunisations such as human papillomavirus vaccines;
- Improved coverage targets;
- Supplemental immunisation activities, such as campaigns;
- Potential surge capacity needed to support outbreaks or other health emergency response activities;
- Supply chain design considerations, including integrated storage of vaccines and other primary healthcare commodities and/or plans for supply chain redesign.

To calculate required vaccine storage capacity, you can use the WHO vaccine volume calculator.

PURCHASING IMPLICATIONS

If you are making purchases for multiple sites, it will be useful to group devices into storage capacity bands, or size segments (0–60 L, 60–120 L, and 120 L+). This might enable you to receive volume discounts from bulk purchases.

On-grid sites should consider ILRs, dual compartment ILR refrigerator-freezer and on-grid freezers that have the capacity to store the required number of vaccines and produce the required amount of coolant packs. Sites with very large storage requirements (e.g., state or district stores) might also consider cold rooms and freezer rooms.

Off-grid sites should consider SDD refrigerators, SDD dual compartment fridge-freezers or SDD freezers. Off-grid sites requiring less than 5 to 10 L of storage – and that have the ability to receive regular ice pack replenishments – may also consider long-term passive devices.

OTHER CONSIDERATIONS FOR DEVICE SELECTION

In addition to the three questions on page 14, before selecting the correct CCE for your health facilities and cold storage points please consider the following additional factors:

- **Ambient temperature range:** All Gavi-eligible devices comply with the PQS requirement of "extended temperature range'. ILR and SDD refrigerators and combined refrigerator/freezers are available for ambient ranges of +5 °C to +43 °C or +10 °C to +43 °C. Mains-powered and SDD Freezers are available with an operating temperature up to +43 °C.
- **Specific additional requirements:** Some countries or settings may require specific additional features, such as security /anti-theft features or pelleting. Specific requirements must be explicitly noted in the Cash Budget application and requested to UNICEF SD at the time of tendering.
- **Remote monitoring:** Some cold chain storage points will require remote temperature monitoring. If any of the fridges selected are intended to have remote temperature monitoring you should ensure that the fridge is selected to come with EMS Level 3 capability and subscription. Existing (non-EMS) fridges are eligible to be equipped with RTMDs through the CCE Minimum Floors.
- **Ability to use solar devices:** Solar devices are not suitable for all locations. Buildings, trees, or limited sunlight may reduce their effectiveness, and some areas may not receive sufficient sunlight year-round. A site evaluation is therefore essential to determine suitability. Solar panels can be mounted on a roof, if structurally sound and well exposed to sunlight, or on a separate pole. While pole mounting may involve additional costs, it provides greater flexibility in panel placement. Operational Deployment Plans should specify the required mounting type (roof or pole) for each site, based on assessments, and indicate the number of installations to ensure appropriate resource planning.
- **Physical space considerations:** Ensure the receiving health facilities have enough space for the selected CCE. Ensure the unit can fit through the door and be placed in a secure, appropriate location, especially at district and health facility levels. Please also ensure there is a dedicated power outlet available for ILRs.
- **Maturity level assessment for remote data monitoring:** For countries planning to procure RTMDs for existing fridges, or EMS Level 3 for their new fridges for lower levels of the cold chain, a maturity level assessment should be conducted by the country to assess the country's readiness to receive the remote monitoring equipment and capacity to utilize the remote data for decision making (e.g., maintenance activities). Several parameters are likely to be assessed to guide decision making such as network connectivity, EVM scores and maintenance plans.
- **Network connectivity:** Following the maturity assessment referenced above, if you will have an RTMD or EMS Level 3 at a given location please confirm network availability in order to ensure the remote transmission of data. Otherwise the device may not reliably transmit alarm notifications to the responsible person, as well as may not send the CCE temperature and other performance data to the on-line portal.

If you need further assistance, please contact either a WHO PQS representative or UNICEF SD representative who can help you choose the right product category and technical requirements for your CCE needs.

PQS representatives can be contacted via email at pqsinfo@who.int and UNICEF SD representatives can be contacted via email at sd.coldchain@unicef.org.

SELECTING THE RIGHT PASSIVE OR ACTIVE TRANSPORT DEVICES FOR YOUR IMMUNISATION PROGRAMME

Vaccine carriers and cold boxes are a vital part of immunisation cold chains. The Gavi CCE Programme only supports Grade A 'freeze preventive' vaccine carriers and cold boxes, with exceptional approval of traditional passives subject to sufficient justification in the Cash Budget application for Gavi 6.0. Choosing the correct Grade A freeze-preventive passive cold chain solution for your country's facility supply chain transport needs will require you to assess the transport-specific use cases and then determine the most appropriate product characteristics that fit the intended objective for delivering adequate quantities of vaccines safely to each site and from facilities as part of outreach services.

In addition, some newly developed TPVS are allowing longer range transport of vaccines (e.g., multiple days) to aid in outreach to harder to reach settings.

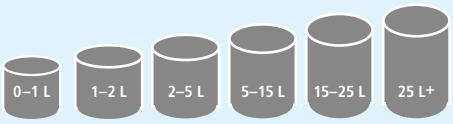
For purchasing the correct passive or active transport solutions, the following two questions will help you categorise and select your device options.

1

Do vaccines need to be transported between higher and lower level facilities or cold storage points or transported for last mile fixed and outreach immunization sessions?

2

What is the required vaccine volume that needs to be transported for delivery across multiple sites or for fixed and outreach session activities?



When choosing between active and passive devices for transport or outreach, consider the following factors in your decision:

- Compliance with Gavi's 6.0 CCE requirements, which determines eligibility for Gavi funding and reflects a model's higher level of technological capability;
- Duration of cold life to keep vaccines at safe temperatures for an entire transport or outreach session (including travel to and from the outreach session);
- If consecutive outreach sessions over multiple consecutive days would be desirable and feasible from a planning and budgeting perspective;
- Required capacity based on the volume of vaccines that must be transported at any one time for outreach or transport between facilities or cold storage locations and the number of transport or outreach activities that must be supported at any time;
- Type of cold chain equipment and power sources available at different levels of the cold chain and at outreach sessions sites to enable use of different passive transport solutions (whether freezers available for freeze-preventive vaccine carriers and freeze-preventive cold boxes icepacks, refrigerators for cool/conditioned water packs, or mains-power sockets & power charging stations for TPVS);

- Fully loaded weight of the vaccine carrier, cold box or TPVS device to ensure that healthcare workers are able to comfortably and safely carry and walk with the vaccine carrier/ TPVS device and/or lift the cold box;
- Size, type and number of coolant packs required (if passive), and their compatibility with other coolant packs used in the country;
- Type of transport available and suitability of devices for mode of transportation.

ADDITIONAL CONSIDERATIONS FOR LONG-TERM PASSIVE DEVICES

Long-term passives are mostly used by small, off-grid facilities because of their limited storage capacity. They are not suitable for facilities that perform high levels of outreach unless paired with a separate freezer, as they cannot freeze or chill cool water packs.

Long-term passive devices need a regular and predictable supply of large volumes of ice packs. Some also require special types of ice packs, which are larger than standard WHO-approved ice packs and shaped differently. Long-term passive devices have two major requirements in order to receive ice packs:

1. Ice pack delivery hub: A nearby delivery hub that can produce enough ice packs per month for each long-term passive device it supports. As each device's ice packs must be replenished every three to five weeks, this process often involves having a spare set of ice packs and using a freezer at the delivery hub. The number of devices that one delivery hub can support will vary. This number should be evaluated based on the existing or planned freezing capacity at the hub, as well as the ice demands of the device(s) being supported.
2. Ice pack delivery system: A delivery system capable of delivering a monthly shipment of enough ice packs (the ice must be transported in a box that can keep it frozen). Motorcycles may not be able to transport large shipments, which can limit ease of access to last-mile facilities. The distance and road conditions between the delivery hub and facility also need to be considered when evaluating the cost and sustainability of this delivery system.

If either one of these requirements is not met, there is a risk for vaccine wastage as well as for interruptions in immunisation service at the facilities served by the delivery hub.

Given these restrictions, **an SDD device should be chosen over a long-term passive device unless a facility meets all of the following conditions:**

- An SDD device is inappropriate for a particular site or population (e.g., due to insufficient exposure to sunlight);
- On-grid, dependable freezing of ice packs is possible at a nearby supply point;
- Routine and cost-effective delivery systems are capable of stable ice delivery;
- The required vaccine storage capacity is less than 10 L and storage needs are not likely to increase over 10 L over the next 5-10 years.

LOCATION CATEGORISATION MAP

Once you have categorised your country's health facilities and cold storage locations by CCE needs, the next section of this guide will assist you in choosing the appropriate device types. Below, please find some hypothetical examples to help illustrate device selection.

These examples are not representative of any specific country, but rather, are intended to help you start assessing the attributes of your sites.

Large on-grid site

Eight hours or more reliable electricity per day

Large target population

Completes all immunisations at the clinic

Potential solution: ILR

Small off-grid site

Less than 8 hours of electricity per day with frequent outages of more than 48 hours

Small target population

Completes all immunisations at the clinic

Potential solution: long-term passive or small SDD refrigerator

Small on-grid site

More than 8 hours of reliable electricity per day

Several outreach sessions per month

Potential solution: small dual compartment fridge-freezer ILR

Mid-size off-grid site

Less than 8 hours of electricity per day with frequent outages of more than 48 hours

Large target population

Completes all immunisations at the clinic

Potential solution: SDD refrigerator

Large on-grid site

More than 8 hours of electricity per day

Several urban outreach sessions per month

Potential solution: large dual compartment fridge-freezer ILR or separate ILR and on-grid freezer

National cold store

Not addressed in this Guide

Used primarily as vaccine storage, rather than point-of-service immunisations

Mid-size off-grid site

Less than 8 hours of electricity per day with frequent outages of more than 48 hours

Large target population

Frequent outreach sessions

Potential solution: SDD dual compartment fridge-freezer or separate SDD refrigerator and freezer

WORKSHEET

Categorising your country's health facilities and cold storage locations will help you group those with similar traits together. This activity is designed to prepare you to use the next section to choose the right CCE devices and models. By filling out the worksheet below, you can divide your country's health facilities and cold storage locations into categories and count how many fit into each group.

How many locations are in need of new cold chain equipment (e.g., for replacement, expansion, extension) today or in the next few years?

_____

On-grid sites

_____

Off-grid sites

_____

Immunisation and outreach

_____

Immunisation only

_____

Immunisation and outreach

_____

Immunisation only

_____

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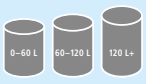

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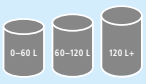

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STEP 2

CHOOSING YOUR DEVICE TYPES

GAVI CCE PROGRAMME REQUIREMENTS

Through the CCE Minimum Floors, Gavi has committed funds to co-invest with countries to equip sites for the first time with CCE, and for sites already equipped, to upgrade aging or non-functional equipment to higher-performing equipment and expand capacity if needed.

1. **User-independent ("Grade A") freeze protection: WHO PQS defined three grades of freeze protection:** A (user-independent), B (requiring one user intervention to prevent freezing), C (requiring more than one user intervention to prevent freezing). Equipment must be Grade A only, i.e., not requiring any user intervention to prevent freezing, to be eligible for Gavi funding support.

2. **Extended operating temperature range:** This requirement matches what is currently defined by WHO PQS: +10 °C to +43 °C for refrigerators and long-term passive devices; +15 °C to +43 °C for freeze-preventive cold boxes and vaccine carriers. This feature keeps the equipment operating correctly even during large changes in ambient temperature. For additional details on operating temperature ranges, please reference the WHO PQS Catalogue, as well as the target product profiles for specific devices on the WHO PQS Catalogue Specifications web page.

3. **Temperature monitoring and logging:** The Gavi CCE Programme requires a minimum of EMS Level 2 (e.g., local user functionality) in all newly procured refrigerators from April 2026. All refrigerators intended for higher levels of the cold chain (i.e., district level and higher) are recommended but not required to have EMS Level 3 (e.g., local user and remote monitoring functionality) based on a country's maturity level. During Gavi 6.0, countries can additionally request for a 30-DTR for EMS-enabled fridges at the time of the initial procurement; however, replacement 30-DTRs for EMS-enabled fridges will not be eligible. RTMDs will be eligible only for the existing installed base (e.g., non-EMS-enabled equipment).

4. **Extended voltage stabilisers (for on-grid devices only):** WHO PQS requires every mains-powered refrigerator, combined refrigerator & freezer or freezer to be provided with a PQS pre-qualified voltage stabiliser and the Gavi CCE Programme requires that all voltage stabilisers procured in 6.0 are extended voltage stabilisers. Voltage stabilisers can also be procured for existing mains powered equipment already deployed to protect CCE from electrical damage.

5. **Warranty:** All equipment will meet the minimum warranty period required by WHO PQS (e.g., 3 years for mains-powered ILR and SDD refrigerators and freezers; 2 years for WICR/WIFR). Warranties are intended to cover manufacturing defects or component failures and do not replace routine preventive or corrective maintenance. Equipment failure resulting from improper handling, misuse or extreme power fluctuations will be at the cost of the country. Countries are expected to carry out regular maintenance in line with their national policies and procedures. For further details on warranty terms and conditions, please contact UNICEF SD.
6. **Country ownership of data:** Countries are considered the owners of data generated by CCE procured using Gavi support including but not limited to equipment performance data. This ownership of data is meant to give governments full control of data, including definition of terms of access and use of data by the manufacturer and other third parties, storage, data protection requirements, transmission and internal processing throughout the full lifespan of the data and device. Countries are responsible for defining the terms under which manufacturers and third parties may access and use this data. Manufacturers can access relevant data for the maintenance or fulfillment of CCE warranties, as they have default access to data as part of operating EMS or RTM portals, EMS and other online systems, etc. As the major funder of CCE in the Gavi-supported countries and with a mandate to market shape in the CCE markets, the Alliance has an interest in understanding the aggregated performance of Gavi-funded CCE deployed in Gavi-supported countries and ensuring that countries have control of and access to such data. At the same time, the Alliance seeks to ensure that countries maintain control over and access to their data. Gavi and Alliance partners' access to and use of any data is and will be governed by separate agreements with countries as the owners of the data.

SOLAR ENERGY HARVESTING

Solar energy harvesting is not a requirement but is an innovative feature available on some SDDs, with additional suppliers considering its inclusion in future models.

In many cases, solar panels installed with SDDs generate more power than is required to operate the refrigerator or freezer. Energy harvesting enables health facilities to utilise this excess power for other purposes. Depending on voltage specifications and the design of the energy harvesting component (EHC), health workers can use devices such as radios, medical equipment or battery-powered lanterns, as well as small appliances like fans and lighting.

This excess energy may be accessed through power outlets integrated into the SDD or via standalone devices connected to the system. While standalone energy harvesting devices are currently not eligible under the CCE Minimum Floors, they may be procured through the broader Cash Budget.

Solar energy harvesting is a promising capability, as it can transform an SDD from a cold chain solution into a broader power source for off-grid health facilities.

As of May 2017, WHO PQS has updated requirements for devices with energy harvesting functionality. SDDs with this feature are evaluated according to specific PQS specifications and testing protocols, with additional guidance available through WHO resources.

TOTAL COST OF OWNERSHIP (TCO)

Cost is an important component in selecting CCE. In particular, TCO is an important concept to consider. TCO refers to the overall cost of purchasing, installing and maintaining CCE over the expected lifetime of the equipment. It is important for countries to calculate the TCO prior to finalizing procurement decisions (e.g., at the Costed Operational Plan stage, or before requesting specific equipment when procuring outside of the Gavi CCE Programme.)

The TCO tool was developed by PATH and is available for download **here**.

The TCO calculations assume an effective life of 10 years for all ILRs and SDDs included in this Guide, and 8 years for all long term passive devices included in this Guide. However, a device's actual life will vary based on equipment reliability, local conditions and its maintenance schedule. TCO is expressed through three measures detailed below. Of the three measures of the TCO methodology, the purchase price is singular and applies to all countries. However, delivery and installation costs, as well as operational costs, will vary by country.

- Purchase price for the unit of equipment (Capex).
- Service bundle costs for delivery and installation of the equipment, as well as training costs.
- Operational expense (Opex), which includes the cost of spare parts, energy, maintenance and repairs for an expected lifetime of ten years. Manufacturer warranties are considered in the operational expense calculations. This is accomplished by exempting labor and spare part consumption under the warranty period proportionally over the useful life of a unit.

The TCO tool includes default estimates for installation costs and allows users to input values for service bundle costs. Please note these costs vary by country, technology and manufacturer. Please consult with UNICEF Supply Division for an estimate at sd.coldchain@unicef.org. TCO estimates are not provided for portable carriers, voltage stabilizers and temperature monitoring devices.

The TCO tool also provides a "Total Solution Cost" analysis. This analysis provides a range of CCE models by quantity required to fulfill the storage requirements that users define in the "Country Input" worksheet by indicating the number of facilities to equip, supply intervals, cold chain storage volume needed, etc. The tool can also help provide TCO comparisons between multiple models or comparing a WICR versus multiple ILRs.

FOR QUESTIONS OR SUPPORT USING THE TCO TOOL PLEASE REACH OUT TO TCO@path.org

ILR/SDD PERFORMANCE AND WARRANTY ANALYSIS FINDINGS

To help shed light on the performance of ILR/SDD supported by Gavi, in 2024-2025 PATH conducted a retrospective analysis of existing CCE performance data to assess the effectiveness and reliability of commonly procured vaccine refrigerators. Data was gathered from four different sources: temperature monitoring data from an anonymized country, effective vaccine management dataset, data on warranty claims and data from country inventories. The findings did not demonstrate any clear standout ILR or SDD manufacturer or model; instead, performance varied by device type, operational context and maintenance quality. Findings on warranty claims in selected countries, (though limited in sample size) showed non-standardized warranty reporting and inconsistent responsiveness to warranty claims made, underscoring the need for clearer warranty processes and stronger accountability. The findings will be provided as a resource to EPI programme managers and cold chain logisticians during 2026.

Source: PATH, 2025

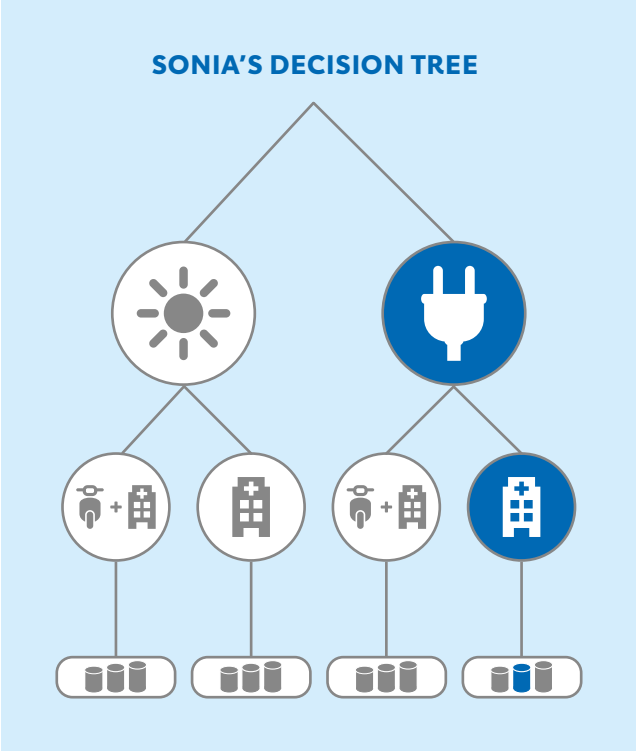
DEVICE SELECTION: A NEW APPROACH IN GAVI 6.0

The Gavi CCE Programme introduces a new approach to product selection in the Gavi 6.0 strategic period. In addition to the launch of the CCE Minimum Floors approach within the Cash Budget structure, Gavi has revised how CCE products and services are selected in country applications. Under this new approach, Gavi is implementing a brand neutral process for CCE applications and procurement. Under this new approach, countries will specify the required product categories and relevant technical specifications but will not indicate preferred brands or models. Based on this information, UNICEF SD will identify and invite suppliers with products available under UNICEF LTAs that meet the stated technical specifications and service requirements to participate in a tender. In addition to the technical requirements outlined in a country's application, UNICEF's selection of suppliers to invite to tender will consider the country's existing installed equipment base and other key factors, such as value for money, service bundle performance and track record and broader market-shaping considerations.

Please check the **list** of Gavi-eligible equipment to see which models are eligible for Gavi support to accurately budget for CCE costs. Additional information on the specific models is available in the UNICEF SD catalogue and the WHO PQS product sheets.

DEVICE SELECTION

EXAMPLE 1



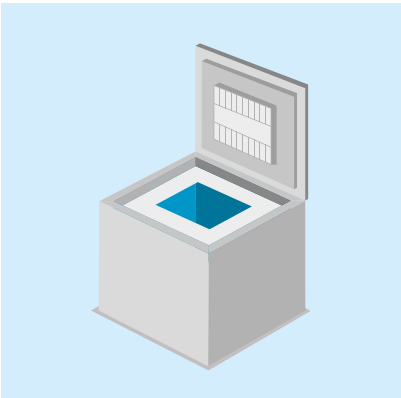
Sonia is a country-level decision maker who has to determine what device will be best for several large, on-grid facilities. These facilities conduct very little outreach and are not distribution points for vaccines or ice packs.

Decision process: although these semi-urban facilities consistently have access to more than eight hours of electricity per day, they have occasional power outages of up to 24 hours. A standard (non-ice-lined) refrigerator would be insufficient, but most ILRs can operate with eight hours of electricity per day.

Health workers primarily complete all immunisations at the facility. While they may do one outreach session per month, workers have access to a nearby store's refrigeration systems to obtain cool water packs. If needed, they can also collect frozen ice packs with their monthly vaccine pickup from the district store for little additional cost.

After grouping facilities according to their target population size (and accounting for population growth and new vaccine introductions), using WHO guidance on vaccine volume per fully immunised child and ensuring that vaccines can be reliably delivered on schedule, Sonia determines she needs devices with between 60 and 120 L in vaccine storage capacity.

Decision Process – New Approach: Sonia notes that in Gavi 6.0, the application and procurement approach is now 'brandless' and based on technical requirements. Under this approach, she aligns on the technical requirements needed (e.g., product category, equipment size, EMS L2 or L3) rather than selecting specific CCE brands or models, as required in the country funding application.



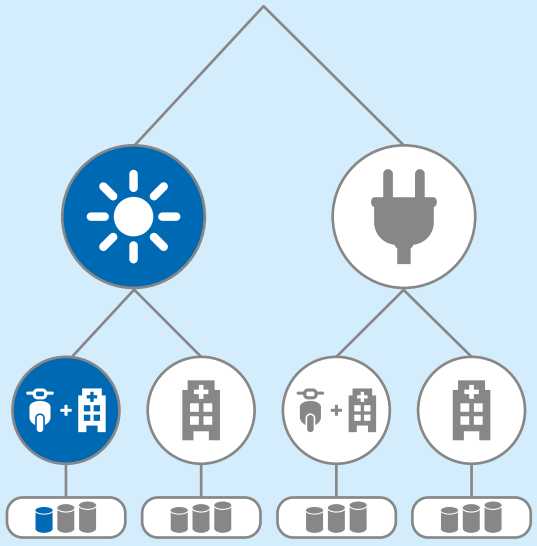
Final Selection: In line with new Cash Budget application guidance and CCE Minimum Floors approach, Sonia chooses ILRs with storage capacity between 60 and 120 L for each facility and notes the number of equipment required. She selects ILRs given her countries facilities

have access to more than eight hours of reliable electricity per day. All ILRs will come with EMS Level 2 (local functionality) to monitor the fridge performance, and will help health care workers know if the temperature is within the acceptable range and to help track the performance of the refrigerator, including the need to call for maintenance, if required. As such, Sonia ensures that she notes the number of equipment that should come with EMS Level 3 (remote monitoring, in addition to local functionality) and verifies that any sites for which she is requesting EMS Level 3 have network connectivity and are able to transmit data.

DEVICE SELECTION

EXAMPLE 2

OLAMIDE'S DECISION TREE



Olamide is a country-level decision maker who has to determine what devices are best for a group of mid-size, off-grid facilities that complete weekly outreach sessions.

Decision process: these facilities rarely have access to more than a few hours of electricity each week. When they can access electricity, it is inconsistent and unpredictable. Only an SDD or a long-term passive device will keep vaccines at appropriate temperatures throughout these long periods without power.

Health workers at these facilities engage in weekly outreach activities in their communities. In most cases, there are no places nearby where workers can freeze ice packs (especially during Supplementary Immunisation Activities), and ice deliveries are too expensive. These facilities require devices with a freezer compartment that can freeze ice packs.

Olamide determines that he needs devices with at least 30 L in vaccine storage capacity. This capacity would require four to six long-term passive devices per facility, but only one 30 L or larger SDD device. Given the need for freezer capability, the optimal solution would be either dual compartment SDD fridge-freezers or separate SDD refrigerators and SDD freezers.

Final Selection: Olamide selects the category of dual compartment SDD fridge-freezer for each facility. These devices can produce ice packs to support the facility's outreach sessions. Since they are solar powered, they are not affected by the lack of reliable electricity. Olamide also calculates that purchasing

a dual compartment SDD fridge-freezer has a lower TCO than purchasing a separate SDD fridge and SDD freezer for each facility. In line with the new Cash Budget application and CCE Minimum Floors requirement, Olamide lists the number of equipment he requires for SDD combined refrigerator-freezer between 30–60 L. These SDDs will come with EMS Level 2 by default, and he must note if any of the equipment should come with EMS L3 instead.

Additional considerations: to ensure solar compatibility, Olamide must have his sites evaluated for:

- Sufficient sun exposure for the SDD device to function correctly;
- A roof that can support solar panels and any special solar panel mounting equipment required;
- The length of cable required between solar panels and the device;
- Access to qualified installation, maintenance and repair service providers.

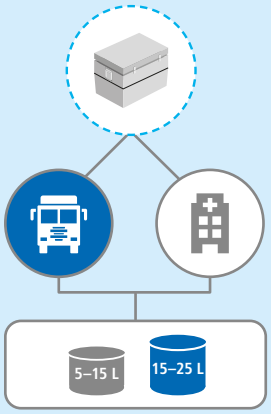
In addition, the freezer compartment of the SDD devices should be able to store the same size of ice packs (either 0.4 L or 0.6 L) that the vaccine carriers use for outreach. He notes this technical requirement to UNICEF SD through the Operational Deployment Plan tool.

He also ensures that, if he has selected any sites to receive EMS Level 3 in the operational deployment plan based on the maturity level assessment, that these sites have reliable network connectivity.

DEVICE SELECTION

EXAMPLE 3

MICHAEL'S DECISION TREE

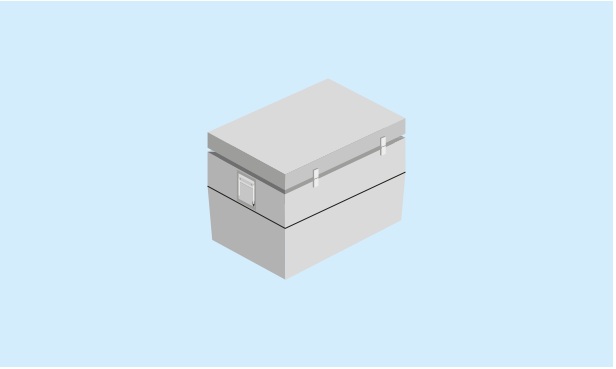


Michael is a country-level decision maker who has to determine how to address freezing risk when transporting vaccines regionally.

Decision process: a recent temperature monitoring study found that a number of shipments leaving the regional stores exposed vaccines to dangerous freezing conditions. The main contributors were:

1. Use of old styrofoam containers with no insulation between the ice and vaccines;
2. Inconsistent ice pack conditioning practices by staff.

To prevent vaccine freezing, Michael initially considers switching to cool water packs as a lower-cost option. However, per the WHO guidance for mid-level delivery, cool water packs do not provide enough cold life for heat-sensitive vaccines on long delivery routes. For this reason, Michael decides to look at freeze-preventive cold boxes to ensure vaccine safety.



He needs to figure out the appropriate volume of the cold boxes, and how to account for different delivery routes. To collect this information, Michael surveys each regional store, and determines both the smallest and largest deliveries they make on a regular basis. On average, the smallest delivery is 15 L and the largest is 30 L. To address differing route capacity requirements, he chooses two freeze-preventive cold boxes so that the smaller and larger capacity routes can be served by one or two boxes respectively.

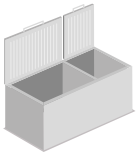
Final selection: Michael picks a capacity of 20 L for use in delivery from regional stores to districts, with each regional store to receive two 20 L freeze-preventive cold boxes.

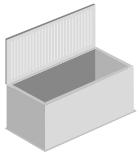
ELIGIBLE PRODUCT CATEGORIES AND SERVICES IN GAVI 6.0 CCE PROGRAMME

The below sections overview the CCE product categories and services that are eligible for procurement with Gavi CCE Minimum Floors funding. These sections overview requirements specific to each category for Gavi funding-support and note some technical aspects. For full details on technical specifications and to view the list of Gavi-eligible CCE products and pricing, please find the official list **here**. The list will be updated on a regular basis.

ON-GRID DEVICES

All mains-powered / ILR devices come with EMS Level 2 functionality by default. EMS Level 3 subscriptions are also eligible under the CCE Minimum Floors.

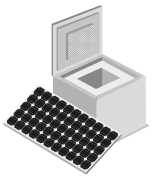


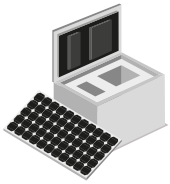


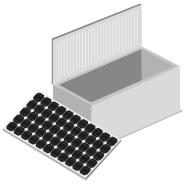
	ICE-LINED REFRIGERATORS (ILRs)	DUAL COMPARTMENT FRIDGE-FREEZER ILRs	ON-GRID FREEZERS
KEY FEATURES	This device has an internal lining of ice, ice packs or cold water-filled compartments Its internal compressor uses electricity to refreeze or re-cool its lining	This device is an ILR with a separate compartment to freeze ice packs	This device has a compression-driven system that uses electricity to create ice and freeze ice packs
OUTREACH CAPABILITY	Does not support outreach by itself	Supports low/medium levels of outreach	Supports high levels of outreach
VACCINE STORAGE CAPACITY	**30–60 L** **60–120 L** **120 L+**	**30–60 L** **60–120 L** **120 L+**	**Only selected models currently recommended for vaccine storage. All models can be used for ice pack freezing and storage.** **90–150 L** **150 L+**
ADDITIONAL CONSIDERATIONS	Most models require 8 hours of electricity per day to re-cool the ice lining Some new devices require only 4–6 hours to maintain safe storage temperature. However, more than 4–6 hours of power may be required to build longer holdover times for extended power outages This device should always be installed with a voltage stabiliser if one is not already integrated into the device Some ILRs with a single compartment can be set to operate as either a fridge or a freezer	This device has an ice-making capability for outreach Most models require at least 8 hours of electricity per day to re-cool the lining Some new devices require only 4–6 hours to maintain safe storage temperature. However, more than 4–6 hours of power may be required to build longer holdover times for extended power outages This device should always be installed with a voltage stabiliser if one is not already integrated into the device	This device has an ice-making capability for outreach Only selected models are currently recommended for vaccine storage (e.g., oral polio vaccines, some rotavirus vaccines, and some mRNA Covid-19 vaccines) It cannot be used to store vaccines that require 2–8 °C storage This device should always be installed with a voltage stabiliser if one is not already integrated into the device

OFF-GRID SOLAR DEVICES

All SDDs come with EMS Level 2 functionality by default.
EMS Level 3 subscriptions are also eligible under the CCE Minimum Floors.

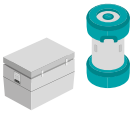






	SOLAR DIRECT DRIVE (SDD) REFRIGERATORS	DUAL COMPARTMENT FRIDGE-FREEZER SDD DEVICES	SDD ICE PACK FREEZERS
KEY FEATURES	This device is powered by solar panels Requires regular cleaning of solar panels to prevent dust build-up and ensure optimal energy generation	This device is powered by solar panels Requires regular cleaning of solar panels to prevent dust build-up and ensure optimal energy generation It has dual fridge and freezer compartments to support outreach	This device is powered by solar panels Requires regular cleaning of solar panels to prevent dust build-up and ensure optimal energy generation
OUTREACH CAPABILITY	Does not support outreach by itself, unless accompanied by an ice pack freezer	Supports low/medium levels of outreach	Supports medium levels of outreach using ice packs
VACCINE STORAGE CAPACITY	**30–60 L** **60–120 L** **120 L+**	**30–60 L** **60–120 L** **120 L+**	**Models only to be used for ice pack freezing and storage** **90–150 L** **150 L+**
ADDITIONAL CONSIDERATIONS	This device requires installation by a trained technician A site evaluation is critical to determine whether solar technology is suitable for a health facility An alternate approach might be to use pole-mounted solar panels	This device requires installation by a trained technician A site evaluation is critical to determine whether solar technology is suitable for a health facility An alternate approach might be to use pole-mounted solar panels	This device requires installation by a trained technician A site evaluation is critical to determine whether solar technology is suitable for a health facility An alternate approach might be to use pole-mounted solar panels

OFF-GRID PASSIVE DEVICES



	LONG-TERM PASSIVE DEVICES
KEY FEATURES	This device has a cold life at 43 °C of more than 30 days It requires no active energy source at the equipment location (e.g., sunlight, batteries, electricity or fuel) It has low maintenance requirements It has no special installation requirements
OUTREACH CAPABILITY	Could support outreach
VACCINE STORAGE CAPACITY	 **(5.4 L)**
ADDITIONAL CONSIDERATIONS	This device requires newly frozen ice packs monthly to maintain the appropriate storage temperature Current devices have a low storage capacity (less than 10 L) The opex cost of a long-term passive device will depend on the cold chain in your country. An estimate can be calculated based on three components: • The cost of any additional freezer equipment required at the district store; • The cost of power use to freeze ice; • The cost of labour and transport associated with picking up ice from the district store.

PORTABLE PASSIVE DEVICES

Gavi considers the 6.0 strategic period a transition phase towards the exclusive procurement of Gavi-funded freeze-preventive passive devices, with full adoption expected from Gavi 7.0 (2031). The objective during Gavi 6.0 is to strengthen the use of freeze-preventive cold boxes and vaccine carriers wherever feasible, thereby reducing the risk of accidental freezing of vaccines in the cold chain.

During Gavi 6.0, countries are required to procure freeze-preventive cold boxes and vaccine carriers. In exceptional cases, procurement of traditional cold boxes and vaccine carriers may be allowed when strong justification is provided, such as:

- A cool-water-pack policy is already in place at the last mile;
- There is no freezing capacity at the last mile for preparing ice packs;
- Funding limitations prevent full nationwide deployment of freeze-preventive passive devices.

This transitional approach allows countries to progressively scale up the use of freeze-preventive passive devices to minimise freezing risks in the cold chain, while allowing suppliers time to further improve product design, prequalify next generation products and expand the range of available options.

	FREEZE-PREVENTIVE VACCINE CARRIERS	FREEZE-PREVENTIVE COLD BOXES
KEY FEATURES	This device is an insulated container that prevents direct contact between ice packs and vaccine vials, and is used to transport and store vaccines for immunisation sessions	This device is a larger, portable, insulated container It is used for transportation between sites, storage during immunisation sessions and multi-day outreach activities, and campaigns
OUTREACH CAPABILITY	Supports high levels of outreach	Supports high levels of outreach
VACCINE STORAGE CAPACITY	**1–2 L** **>2–5 L**	**5–15 L*** **20–25 L**
ADDITIONAL CONSIDERATIONS	Coolant pack standardisation should be considered if multiple carriers are used. Before purchasing, consider the maximum acceptable fully loaded weight, durability, shape/size and how long vaccines stay cold/ cool when used with ice packs.	Coolant pack standardization should be considered if multiple cold boxes are used. Before purchasing, consider the maximum acceptable fully loaded weight, durability, shape/size and how long vaccines stay cold/ cool when used with ice packs.

* Anticipated to become available

TRANSPORTABLE, POWERED VACCINE STORAGE APPLIANCES (TPVS)

In mid-2021, WHO PQS released a new product category called TPVS. This new category differs from existing CCE product types in that devices must be both transportable and equipped with an active power source without the use of ice packs. Power sources to charge the device's internal energy storage system may include mains electricity, generator, solar power, or battery. TPVS devices are required to maintain a minimum cold life of 12 hours at 43 °C ambient temperature.

TPVS products are primarily intended for temporary storage and transport of vaccines for longer outreach and reaching zero-dose children and are not designed to replace stationary equipment. These devices are particularly for settings where ice pack availability is unreliable, where logistical flexibility is required or when extended cold life supports longer outreach sessions, such as over multiple consecutive days. Further operational guidance on TPVS product use cases will be issued by UNICEF soon.

Several TPVS products have already received WHO PQS prequalification. Additional products are currently under development and may receive WHO PQS prequalification during the Gavi 6.0 period.

TEMPERATURE MONITORING DEVICES (TMDS)

TMDs are used to monitor the performance of CCE in maintaining the required temperature ranges, typically 2–8 °C for most vaccines and –15 to –25 °C for frozen vaccines. Modern TMDs provide both real-time temperature readings and digital records of temperatures and high-risk events, supporting effective cold chain management.

In order to maintain vaccine quality, it is essential to monitor the temperature of vaccines throughout the supply chain. When done properly, this monitoring helps identify malfunctioning cold chain equipment and alerts health workers and supervisors to high-risk temperature exposures. This allows corrective vaccine management and CCE maintenance actions to take place (e.g., testing/disposal of vaccines and repair of CCE).

30-DAY TEMPERATURE RECORDERS (30-DTRS)

30-day temperature recorders (30-DTRs) are recommended for health facilities and subnational stores. These devices display a) the current temperature, and b) a rolling 30-day history of all high-risk freezing and heat events.* This is a significant improvement over stem thermometers, which failed to alert health workers to events occurring between routine monitoring checks. WHO PQS still requires a thermometer only for vaccine freezers and water freezers.

30-DTRs also facilitate more efficient reporting on CCE performance, using the monthly count of alarms. All newer, WHO PQS prequalified models allow records to be downloaded to a PC and printed by connecting the device to a PC via USB.

With the rollout of EMS-enabled fridges, a 30-DTR is not needed for fridges that are already enabled with EMS Level 2 or Level 3 functionality, provided that the country has already trained healthcare workers on use of EMS. During Gavi 6.0, countries can optionally procure 30-DTRs bundled with new EMS-enabled equipment to manage the transition to the new EMS technology. Replacement of 30-DTRs for EMS-enabled fridges is not supported by Gavi funding. Countries should specify requirements for 30-DTRs for new equipment along with existing equipment within the Cash Budget template as the 30-DTR unit prices are not incorporated into the cost of a refrigerator during Gavi 6.0 but will come as an extra cost for new refrigerators. Countries can continue to procure 30-DTRs to replace expired devices for existing equipment (e.g., non-EMS fridges).

Note: 30-DTRs are battery powered and Gavi-eligible devices come with battery life spans up to five years. As such, it is important to anticipate future procurement to replace units for the existing installed base (e.g., non-EMS fridges) with run-down batteries within broader cold chain planning. Countries are not currently recommended to stockpile 30-DTRs, however, as battery life span will begin to deplete during storage and the device will not last for the full five-year duration once deployed.

*A high risk freezing event is defined as >60 minutes below –0.5 °C. A high risk heat event is defined as >10h above 8 °C.

REMOTE TEMPERATURE MONITORING DEVICES (RTMDS)

In addition to 30-DTRs, the Gavi 6.0 CCE Programme also covers RTMD for use in existing fridges and all new and existing WICRs. These devices use mobile phone networks to transmit temperature data to the cloud or server hosting the data. The data can be accessed through a supplier-provided web portal. This allows countries and suppliers to quickly identify CCE that have performance issues, and to direct their in-country service delivery partners to perform required repairs quickly.

Starting in Gavi 6.0, Gavi only supports procurement of new RTMDs as standalone products for existing fridges and existing and new WICRs, to avoid double remote monitoring and associated costs. New fridges for which countries desire remote monitoring should be procured with an EMS Level 3 device and subscription. Countries may consider selecting RTMDs for the existing installed base of fridges when programmatic readiness and budgeting requirements for the recurring fees are met.

RTMDs for fridges and WICRs are contracted with a 1-year subscription, which includes access to the online portals for remote tracking of equipment performance, data transfer from the equipment to the cloud servers (if selecting a global SIM), data hosting on cloud servers and SMS alerts to registered users for temperature alarms, among other features. Subscriptions can be renewed annually leveraging the Cash Budget.

Estimated installation costs per unit vary by country and are generally expected to range between $200 and $400 in most settings. Estimated data and operating costs will also vary depending on the country's context and the specific product selected. Additional costs, such as procurement agency fees, are not included in these estimates. Countries should also plan for recurring RTMD costs beyond the first year, once the initial data and subscription period has ended.

The values provided for RTMDs in the Cash Budget template reflect average pricing. These figures include the hardware cost, an annual point estimate for subscription fees, and a total estimated cost covering the RTMD hardware plus one years of subscription fees. These estimates may not reflect the actual costs in your country, including potential differences between local and global SIM data pricing (if your country opts for a local rather than a global SIM). Countries are advised to contact the UNICEF SD Cold Chain Unit to obtain country-specific subscription costs and to update the RTMD total cost estimates in the budget template accordingly.

CCE data generated from RTMD-enabled enabled devices belongs to the country. No data (unprocessed, processed, generated by or entered into the RTM system), whether anonymised or not, will be shared with any third parties without explicit and informed consent by the customer.

EQUIPMENT MONITORING SYSTEMS (EMS) FOR ILRS AND SDDS

Building on the capabilities of 30-DTR and RTM devices, starting from April 2026, new refrigerators (ILRs and SDDs) will be supplied with enhanced performance monitoring functionalities that combine and extend the best features of these older technologies. These new monitoring devices are categorised under a new WHO PQS category: "Equipment Monitoring Systems", which defines the WHO PQS CCE performance monitoring technologies and requirements.

EMS devices offer three levels of functionality to meet the needs of immunization programs:

1. **Level 1:** Sensors and components within the fridge (or other CCE) monitor and record equipment performance data. A connection interface (e.g., USB port) allows data to be downloaded in a standard format by a standalone Equipment Monitoring Device (EMD), laptop, or phone. Local data access is available via download only; there is no display screen for viewing data.

2. **Level 2:** Includes all Level 1 functionality and adds an EMD with a screen that displays performance data and provides audible alarms. EMDs may be integrated into the fridge (or other CCE) or stand-alone (similar to RTMDs). EMS Level 2 offers local data access only (no remote monitoring), though some devices may be remotely upgraded to enable remote monitoring with a paid subscription. EMS Level 2 is the minimum requirement for all Gavi-funded ILRs/SDDs.
3. **Level 3:** Includes all the functionality of EMS Levels 1 and 2, and adds remote monitoring. Data is transmitted to the cloud servers via cellular or internet connections and enables email or phone alerts and online dashboard access. Level 3 devices require a subscription to have access to the remote data transmission functionality and supplier dashboard, but the EMD continues to function as a Level 2 device if the Level 3 subscription expires or is not renewed. Initial Level 3 subscriptions for data transmission and the online portal will be for three years.

The main goals of EMS are as follows:

- **Data generation and communication:** Generate, record, and communicate performance data and audible alarms to on-site health workers and remote EPI management to drive actions that ensure vaccine safety and cold chain performance
- **Actionable insights:** Help turn CCE performance data into insights for end-users, cold chain managers and technicians enabling them to predict, diagnose and respond to equipment failures promptly.
- **Data access for planning and troubleshooting:** Provide EPI programs with direct access to CCE performance, environmental and usage data both locally and remotely to support maintenance planning and troubleshooting.

In the longer term, EMS capabilities are expected to support predictive analysis and forecasting of potential future CCE failure or maintenance needs.

The key EMS functions and features include:

Extended CCE performance monitoring:

- In addition to monitoring vaccine compartment temperature, EMS standard data includes administrative information about the fridge (i.e., make, model, serial number), environmental conditions (ambient temperature, power availability), device usage data (door openings) and CCE performance data (compressor runtime, error codes). Suppliers may also monitor additional parameters. These data points support troubleshooting and provide a broader understanding of CCE performance.

Upgradeability:

- EMS is designed to provide flexibility to upgrade local and remote communication devices as monitoring technology evolves. Fridges are expected to last for at least ten years, and if needed, standalone EMDs may be added or upgraded over time as innovation continues and programs adopt new monitoring features. (Note: Gavi support may not be used for elective upgrading (replacement) of functional EMDs). One option is to procure a fridge with an upgradable EMS Level 2 device that includes a SIM card but only activate and pay for the remote monitoring and online portal data subscription when the country is ready. This allows initial use at Level 2 functionality while enabling a future upgrade to Level 3.

Level 3 subscriptions

- Countries should also plan for recurring EMS Level 3 costs beyond the first three years, once the initial data and subscription period has ended.
- The values provided for EMS Level 3 subscriptions in the Cash Budget template reflect average pricing. The values provided for EMS Level 3 subscriptions in the Cash Budget template reflect average pricing and are an annual point estimate for the subscription fees. These estimates may not reflect the actual costs in your country, including potential differences between local and global SIM data pricing (if your country opts for a local rather than a global SIM).

- Countries are advised to contact the UNICEF SD Cold Chain Unit to obtain country-specific subscription costs and to update the EMS Level 3 total subscription cost estimates in the budget template accordingly

Information system integration:

- Standardised CCE data facilitates integration with programme management information systems, such as electronic logistics management information systems (eLMIS). If integration is implemented, the system must be developed to accept and utilise routine EMS data delivered in the standardised format defined by WHO PQS. (Note: there may be additional costs associated with third-party system data integration).

The ultimate success of EMS or any temperature monitoring technology depends on the people, processes and systems established to optimise its features. Similar to 30-DTRs and RTMDs, EMS does not replace interventions needed to ensure vaccine safety and effective cold chain management. Rather, it enhances EPI programmes' ability to manage the cold chain with advanced monitoring features and functionalities. Further information on EMS and approved products will be available in subsequent updates of this Guide.

GAVI 6.0 EMS ELIGIBILITY REQUIREMENTS

For all Gavi-funded SDD/ILR equipment procurement starting April 2026:

- The minimum requirement is for all Gavi-funded mains-powered ILR refrigerators/ SDDs refrigerators to be EMS Level 2.
- EMS level 2 functionality can be achieved through either integrated or standalone EMDs.
- EMS Level 3 is recommended for all new CCE at national, regional & district levels. Health facility-level adoption is optional and should be based on maturity, digitisation pace and country prioritisation.
- Level 3 subscriptions will initially be procured for a length of three years.
- Countries have ownership of EMS data, as with all CCE data, including the right to transfer data to third party platforms as requested. (Note: such transfer of data may incur additional costs). CCE data generated from EMS-enabled devices belongs to the country. No data (unprocessed, processed, generated by or entered into the EMS system), whether anonymised or not, will be shared with any third parties without explicit and informed consent by the customer.

VARO APP

Varo is a free mobile app that helps access cold chain data from 30-DTR loggers and EMS data loggers and turns this data into action. Varo guides users step-by-step to quickly create standardized CCE performance reports using their Android smartphone. With a simple USB adaptor, Varo downloads temperature data from 30-DTR loggers and EMS data loggers and creates an email report including a photo of the equipment, timestamp, GPS location, manufacturer, model and other facility details. Varo can be used on an ongoing basis to create a full-scale monitoring program, or for one-off studies and device commissioning. The Varo app has recently been upgraded to be fully compatible with EMS data.

IRREVERSIBLE FREEZE INDICATORS (IFI)

An IFI is an electronic device designed to signal when temperatures fall below a predefined freezing point, helping detect potential cold chain breaches that could damage freeze-sensitive vaccines. These indicators are simple, reliable, and easy to use, requiring no power, which makes them particularly suitable for low-resource settings. They are placed in vaccine carriers and cold boxes during transport, used in outreach and last-mile delivery settings and kept inside refrigerators at health facilities to monitor accidental freezing. They are also important during distribution between different supply chain levels (e.g., national level to health facility) to ensure vaccines remain within safe temperature ranges.

IFIs are important because they protect vaccine potency and safety by alerting health workers to freezing events that may compromise vaccine effectiveness.

MULTI-USE, USER-PROGRAMMABLE TEMPERATURE DATA LOGGER (UTDL)

A UTDL is an electronic device that continuously records temperature over time, with configurable sampling intervals and alarm thresholds. These devices allow detailed monitoring of vaccine storage and transport conditions, providing accurate records for analysis, compliance verification, and overall cold chain performance monitoring. Multi-use loggers are reusable across multiple shipments and can be used for assessing the cold chain transport equipment performance when establishing new delivery routes, offering cost efficiency for immunization programs. Many countries are also using these devices widely for temperature mapping in cold and freezer rooms and when conducting temperature monitoring studies of part or the entire iSC.

The importance of these data loggers lies in their ability to provide evidence-based information for decision-making and corrective actions in the cold chain. Key considerations when selecting a UTDL are operating temperature range, memory capacity, battery life and ease of data retrieval (e.g., USB, software, display).

VOLTAGE STABILISERS

Voltage stabilisers protect mains-powered CCE from damage caused by fluctuations in the electricity supply. They safeguard the control unit, compressor, fuses and other electronic components from power fluctuations such as:

- Voltage levels that are either too low or too high
- Voltage spikes caused by nearby lightning strikes, switching effects, or improper grounding
- Frequency deviations

Some refrigerator and freezer manufacturers integrate voltage stabilisers into the device, while others provide them as stand-alone, external units. Only extended-range voltage stabilisers are eligible for Gavi support in 6.0.

- For existing equipment, countries should specify voltage stabiliser requirements in the Cash Budget template, as unit prices are not included in the refrigerator cost.
- For new EMS-enabled mains-powered equipment, voltage stabilisers are bundled with the device and do not need to be costed separately.

It is critical that all mains-powered refrigerators and freezers are used only with a WHO PQS prequalified voltage stabiliser, as power fluctuations can significantly reduce the equipment reliability and lifespan and increase maintenance costs.

SPARE PARTS

Countries may use Gavi CCE Minimum Floors to procure spare parts for refrigerators and freezers eligible under Gavi 6.0 support as well as for existing PQS-approved refrigerators and freezers deployed in-country. A detailed list of available spare parts can be accessed from the UNICEF SD supply catalogue. Spare parts are the property of the country. Repairs conducted by the supplier under the warranty should be conducted using spare parts provided by the supplier, and not those procured by the country.

Key guidance for spare parts procurement:

- Spare part selection should match new equipment categories requested and/or the existing installed base.
- Plan for one spare part kit for ten units of refrigerators or freezers for both new and existing CCE, if needed.
- Where spare parts consumption data exists, countries may use this data as the basis for a spare parts request instead of using a standard kit.
- For both new and existing equipment, countries should specify requirements in the Cash Budget template, as unit prices for spare parts are not included in the cost of a refrigerator or freezer.

TRAININGS

Trainings included in the Service Bundle

The Gavi 6.0 CCE Programme includes end-user training as part of the service bundle cost charged by CCE suppliers. These trainings cover the management and use of deployed CCE at each installation site, ensuring end users can operate the equipment according to the suppliers' guidance. The training also included instruction on the new EMS functionality and its use.

For country-led deployments, training can be requested and supported. In addition, countries are encouraged to utilize technical trainings available through local and regional Centers of Excellence.

Additional trainings eligible for CCE Minimum Floor Funding

Under Gavi 6.0, the scope of trainings supported through the CCE Programme has been expanded. These additional trainings aim to build capacity for maintenance and use of EMS and RTMD data in decision-making. Trainings will be delivered by refrigerator/freezer or RTMD/EMS suppliers and/or their contracted Service Bundle providers. Trainings can be conducted in-person or remotely based on country-specific requirements. Countries may also plan for refresher EMS and RTMD trainings during the course of Gavi 6.0.

In addition to the standard end-user training provided at installation sites, three categories of trainings have been introduced:

- **Central-level ILR/SDD training:** Optional in-person training on refrigerator and freezer installation, preventive maintenance and repair. Intended for countries with technician capacity gaps to manage and maintain CCE at district, regional and national levels.
- **TPVS central level user trainings:** Training on TPVS devices, covering components such as charging stations, temperature monitoring devices and device-specific operational requirements (e.g., intermittent use). Initial user training is recommended during the early stages of TPVS introduction.
- **EMS L3 / RTMD trainings:**
  - *In-person or remote trainings for technicians and general trainings on RTMD/EMS L3 systems for refrigerators and freezers:* The training is required for countries that procure RTMDs for existing equipment or EMS Level 3 for newly procured refrigerators and freezers.
  - *In-person or remote trainings for technicians and general central training on RTMD systems for WICRs/WIFRs:* The training is required for countries that procure RTMDs for existing and new WICs/WIFRs.

CONCLUSION

Gavi's CCE Programme has been designed to support countries with rehabilitating, expanding and extending the cold chain by appropriately selecting, procuring and deploying the optimised products presented in this Guide. Countries may benefit in three ways from these optimised products. First, the products should enable the cold chain to reach more facilities, including facilities that were previously hard-to-reach. Second, the products should offer improved temperature control to vaccines, including drastically reducing of the risk of freezing. Third, the products should remain functional in challenging operating conditions for longer periods of time; additionally, data on fridge performance from EMS should offer the potential to inform preventative maintenance and repair systems.

Lastly, all equipment performance data generated by the CCE should be owned and accessed by the country and transferrable to third party systems. This will contribute to overall strengthening of countries' iSCs and efforts to facilitate digital transformation of their supply chain systems.

Together, these benefits can help enable countries improve vaccine availability, increase vaccine safety, and maintain vaccine potency. As a result, more children in more locations may receive effective vaccines, contributing toward improving country immunisation coverage. This, along with the lower operating costs of many of the optimised products and efforts by the Alliance to shape healthy markets with cost-effective and innovative products and services, should support countries with implementing more cost-effective and high-impact immunisation systems.

ACRONYM KEY

30-DTRS
30-Day Temperature Recorder

CCE
Cold Chain Equipment

CCEI
Cold Chain Equipment Inventory

CCEOP
Cold Chain Equipment Optimisation Platform

EAF
Equity Accelerator Fund

EHC
Energy Harvesting Control

eLMIS
Electronic Logistics Management Information System

EMD
Equipment Monitoring Device

EMS
Equipment Monitoring System

EVM
Effective Vaccine Management

GAVI
Gavi, the Vaccine Alliance

HFSE
Health Facility Solar Electrification

HSS
Health Systems Strengthening grant

IFI
Irreversible Freeze Indicator

ILR
Ice-Lined Refrigerator

iSC
Immunisation Supply Chain

LSP
Logistics Service Provider

LTA
Long-Term Agreement

MoH
Ministry of Health

PHC
Primary Health Care

PQS
Performance, Quality and Safety

RTMD
Remote Temperature Monitoring Device

SDD
Solar Direct Drive

TCO
Total Cost of Ownership

TMD
Temperature Monitoring Devices

TPP
Target Product Profile

TPVS
Transportable, Powered Vaccine Storage Device

UN
United Nations

UNICEF
United Nations Children's Fund

UTDL
Multi-use, User-programmable Temperature Data Logger

WHO
World Health Organization

WICR
Walk-in Cold Room

WIFR
Walk-in Freezer Room

DEFINITIONS

The Automomy is the duration for which a solar-powered cold chain device (e.g., SDD) can maintain the vaccine storage temperature within the required range without solar input, relying on stored energy (e.g., thermal or battery storage), under specified test conditions.

Holdover time: The time in hours during which all points in the vaccine compartment remain between +2 °C and +8 °C, at the maximum ambient temperature of the temperature zone for which the appliance is rated, after the power supply has been disconnected. It applies to both ILRs and SDDs.

- **Cold life** is the time that a cold box or vaccine carrier can maintain its internal temperature between 0 °C and +10 °C with the lid closed, starting from a stabilized condition, under specified test conditions.
- **Cool life** is the time that the same device can maintain its internal temperature between +2 °C and +8 °C under the same conditions.

THE COLD CHAIN EQUIPMENT PROGRAMME AND TECHNOLOGY GUIDE HAS BEEN DEVELOPED THROUGH THE COLLABORATION OF THE FOLLOWING VACCINE ALLIANCE PARTNERS:

Gavi The Vaccine Alliance

Gates Foundation

unicef

World Health Organization

PATH

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