Gavi
The Vaccine Alliance

COLD CHAIN EQUIPMENT OPTIMISATION PLATFORM

TECHNOLOGY GUIDE

Current as of October 2023

ABOUT THIS GUIDE

This guide aims to provide you with clear advice on new CCE technologies to help you make purchasing decisions. It is intended for use in health facilities and lower levels of the immunization supply chain.

In addition, it overviews the CCE devices that comply with platform requirements and will help countries choose the cold chain solutions that match the needs of your country's health facilities.

IF YOU HAVE QUESTIONS OR IF YOU WOULD LIKE MORE INFORMATION, PLEASE CONTACT CCEPLATFORM@GAVI.ORG OR VISIT › www.gavi.org

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COLD CHAIN EQUIPMENT OPTIMISATION PLATFORM TECHNOLOGY GUIDE

This guide is current as of October 2023. As information and platform eligible equipment will be updated periodically, please reference https://www.gavi.org/our-support/guidelines to check for the latest version.

INTRODUCTION

The Challenge:

Under the CCEOP, from 2017-2023 eligible countries made tremendous progress upgrading and expanding their cold chain capacity at the health facility level; however, significant need for new CCE still remains as of 2023, especially to help reach zero dose populations.

Gavi established the Cold Chain Equipment Optimization Platform (CCEOP) in June 2015 as a strategic and targeted approach to address the challenges of upgrading and expanding the vaccine cold chain with higher-performing cold chain equipment (CCE). Functional CCE is a critical input to strengthening immunisation supply chains and immunisation programmes, and contributes to supporting the Alliance's coverage and equity goal, ultimately reaching more children with lifesaving vaccines and protecting them against deadly diseases.

The initial CCEOP programme was a $250 million co-investment funding scheme over the 2016-2020 Gavi strategic period ('Gavi 4.0') (with 2017-2023 as the procurement period) and aimed at improving the availability and installation of high-performing CCE in Gavi-supported countries, particularly for health facilities. The success of the CCEOP in improving countries' cold chains led to the continuation of the CCEOP platform into the 2021 – 2025 Gavi strategic period ('Gavi 5.0'). An additional $150M is being invested in CCEOP during Gavi 5.0, with country joint investments adding to this funding. The CCEOP continues to be a joint investment model: for countries to benefit from Gavi CCEOP funding support, they are required to jointly invest in equipment as well as make clear investment commitments to cold chain management and maintenance. UNICEF Supply Division (SD) is the procurement agency for the CCEOP.

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

During the 5.0 period, CCEOP aims to contribute to Gavi's goal of reaching zero-dose populations with immunisation, namely reducing the number of zero-dose children by 25% by 2025. The CCEOP will aim to strengthen immunization supply chains (iSC) that reach the largest groups of zero-dose children, specifically: the urban poor, remote rural communities, and children affected by conflict. Strengthening iSCs is critical to enabling delivery of services to underserved communities, ensuring vaccine availability and potency, and maximizing efficiency where possible. CCEOP will focus on addressing the unmet CCE needs in eligible countries, with countries tailoring strategies to their specific needs and context in each location with a focus on deploying CCE that contributes to equity and reaching zero-dose children.

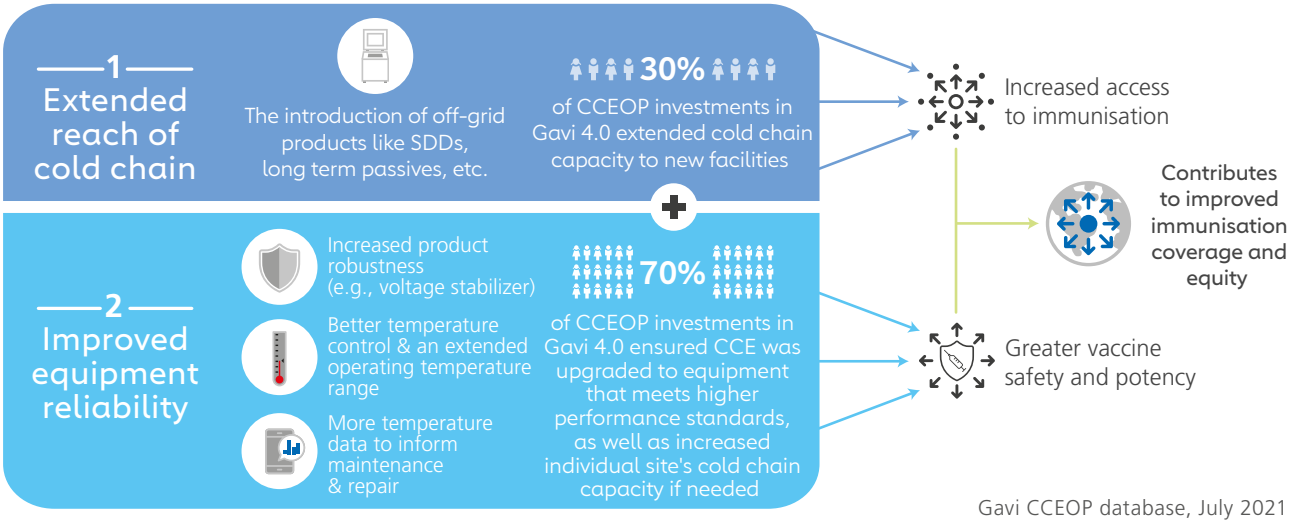
The CCEOP programme in 2021-2025 will focus on the following four goals:

- *Fulfil unmet CCE needs in eligible countries:* The CCEOP aims to fulfill a large portion of unmet needs in line with Gavi's equity goals and reaching zero dose communities (both urban and rural) and tailored to countries specific contexts and strategies.
- *Improve systems strengthening:* Ensure that CCE investments lead to improvements in CCE maintenance, visibility of CCE uptime, increased collection and use of performance data and energy access, and improved use of cold chain performance data for planning, maintenance and informing future procurements, as well as 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:* Market shaping to improve the health of the ILR/SDD market, both sustaining and building on the market health gains from Gavi 4.0, with a focus on the development and uptake of critical innovations and collection and use of field performance data. In 2023, the Alliance is also developing a market shaping strategy to improve the health of the CCE performance monitoring devices (PMD) market, namely the markets for 30-DTRs, RTMDs, and (forthcoming) EMS products.

In addition to CCE funding through the CCEOP, the COVID-19 pandemic led to the creation of the COVID-19 Vaccines Global Access (COVAX) Facility aimed at ensuring equitable access to COVID-19 vaccines. Through COVAX, Gavi invested $50M in cold chain and aimed to ensure countries had adequate cold chain capacity at the upper levels of the cold chain, where impact on storage capacities for COVID-19 vaccines at the height of the pandemic was most acute. Following the acute phase of the COVID-19 pandemic, the intention is for this CCE to be redeployed to support countries' routine immunisation systems. The CCEOP continues to target cold chain for routine immunisation needs.

The CCEOP requires all CCE to meet World Health Organization (WHO) Performance, Quality and Safety (PQS) standards and also requires CCE to be "platform-eligible", which in some cases entails a higher-level of technology and performance standards than current PQS standards. These additional attributes are derived from earlier WHO Target Product Profiles (TPP). The CCEOP also requires product procurement for Ice-Lined Refrigerators (ILR), Solar Direct Drive (SDD) refrigerators and remote temperature monitoring devices (RTMD) to be accompanied by delivery, installation, and training (on CCE maintenance and/or use of RTMDs) – a "service bundle", which suppliers are responsible to implement, helping ensure CCE is installed and maintained properly. Notably, country ownership of any data generated by CCE products procured with Gavi funding was added to the CCEOP platform eligibility requirements in 2020.

IMPROVED CCE CONTRIBUTES TO COVERAGE AND EQUITY OF VACCINES



Gavi CCEOP database, July 2021

Improved CCE available and being implemented in countries through the CCEOP have important capabilities to improve performance and safety, such as:

- Mains-powered ILR fridges and freezers that keep vaccines cool and safe even if the power is intermittent or out for multiple days;
- SDD fridges and freezers that do not need batteries while keeping vaccines cool and safe;
- Grade A freeze protection and freeze preventive technology that makes accidental freezing of vaccines in storage and transport very unlikely, contributing to reductions in closed vial wastage;
- Temperature and CCE performance monitoring devices (built in and standalone) (e.g., RTMDs, EMS - once available) that send automatic alerts to health facility staff and/or national maintenance centers when fridges and freezers are not working properly, helping ensure that equipment receives quick attention so that vaccines stay protected;
- SDDs with energy harvesting control (EHC) that provide extra electricity for charging or powering accessories such as cell-phones, lighting and fans;
- Voltage protection for mains-powered refrigerators, which is more reliable and robust to challenging power conditions;
- Passive devices such as vaccine carriers and cold boxes that cannot accidently freeze vaccines.

WHO PQS published new Target Product Profiles (TPPs) for ILRs and SDDs in 2022. The TPPs consist of desirable future product design characteristics, features, or enhanced performance functions. In the future, we expect to see new products come to market that have these TPP features.

The WHO TPPs are available here.

DEVICES COVERED

This guide covers equipment that are used at both the higher levels of the cold chain (e.g., sub-national and district levels) and at service delivery points (e.g., health facilities and hospitals) or small cold stores, and which meet the specified platform-eligibility requirements. Larger scale storage (such as walk-in cold rooms and freezer rooms) are excluded. Specifically, you will find information about the following types of devices:

- **Ice-lined refrigerators (ILRs):** these vaccine refrigerators run on mains electricity or power from a generator. The latest models are designed with longer holdover times to keep vaccines cool during prolonged periods of power outage (often for more than two days). During normal conditions, many of these new ILR models require only eight hours of power per day to keep vaccines within the required temperature 2-8 degrees C range. However, less than eight hours of power per day may reduce holdover time, and individual model characteristics to ensure appropriateness or procurement of SDDs should be considered in these situations.
- **On-grid freezers:** these vaccine and ice-pack freezers run on mains electricity or power from a generator. They are designed to have better temperature control and reliability than standard domestic freezers.
- **Solar direct drive (SDD) refrigerators and freezers:** these vaccine refrigerators and freezers run on solar power. In the latest generation, each one of these devices comes with a solar panel that is mounted on either a pole or on the roof of the health facility, and is connected to the device by a power cable. They require less maintenance than earlier versions of solar plus battery appliances. Some SDDs come with integrated energy harvesting control (EHC), which allows extra solar power to be available for a variety of uses at the health facility, including charging cell phones, laptops, radios and battery-powered lanterns, or power devices such as RTMD, fans and lighting. Some SDD fridges also come with a freezer compartment for freezing ice packs.
- **Long-term passive devices:** these vaccine storage devices are designed to keep vaccines cold for long periods without any source of power. They do not require direct solar panels, batteries, electricity, gas or other fuels. They typically have limited vaccine storage capacities (of 10 L or less) and keep vaccines cool using a set of ice packs that must be refrozen every three to five weeks.
- **Freeze-preventive cold boxes and vaccine carriers:** these insulated containers are used to transport vaccines between facilities or during field immunisation sessions. These devices prevent freeze damage to vaccines and do not require user-intervention such as ice pack preconditioning to do so, which saves time when preparing vaccines for transport.
- **Temperature monitoring devices (TMDs):** these devices are used to continuously measure and record temperature readings from cold chain equipment. They display current temperature readings and instances of temperature excursions beyond the acceptable limit. 30-day temperature recorders (30-DTRs) log temperatures and alarms locally on the device. RTMDs can be standalone or integrated. The CCEOP now supports procurement of RTMDs for both refrigerators and walk-in cold rooms (WICRs). In addition, next generation Equipment Monitoring Systems (EMS), which monitor more aspects of CCE performance than temperature, will also be platform eligible as these products become available.

- **Voltage stabilizers:** these devices are used to protect refrigerators and freezers powered by mains electricity from damage caused by fluctuations in the electricity supply. They protect the refrigerators and freezers from voltage and frequency levels that are either too low or too high for reliable functioning, as well as from lightning strikes. Some refrigerator and freezer manufacturers choose to integrate voltage stabilizers in the bodies of their devices, while others choose to use a standalone, external voltage stabilizer with their devices. This guide only lists voltage stabilizers of the external type, since integrated stabilizers are a de facto option determined by the refrigerator or freezer manufacturer. In addition, this guide only includes extended voltage stabilizers.

For details about cold chain devices that are not included in this Guide, please reference the World Health Organization (WHO) performance quality safety (PQS) catalogue.

In addition to supporting procurement of devices, the CCEOP now supports the procurement of additional standalone trainings for relevant equipment, as well as the cost of annual renewals for existing RTMD subscriptions and data.

This guide focuses on equipment selection primarily for service delivery points (e.g., health facilities). Equipment selection for higher levels of the health system (e.g., national or regional stores) involves additional considerations for vaccine storage and transportation and is not addressed here.

OTHER AVAILABLE TOOLS

While this guide is about choosing the right technology to meet your country's cold chain needs, additional tools are available to help you in other ways.

- **WHO performance quality safety (PQS) catalogue:** 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 Vaccine Volume Calculator:** this tool determines the total supply chain storage volume needed for the set of vaccines included in a country's vaccination programme.
- **WHO Cold Chain Equipment Inventory (CCI) and Gap Analysis Tool:** WHO's planning tool for conducting and analysing a cold chain equipment inventory. It's capabilities include recording and analysis of cold chain equipment inventory data; generating facility segmentation for appropriate cold chain equipment to match facility profile; planning for equipment replacement based on typology, working status and age; and, estimating maintenance and running cost of the existing cold chain equipment.
- **WHO Effective Vaccine Management (EVM) initiative:** this website provides materials and tools to manage, monitor, and assess vaccine supply chains and help countries to improve supply chain performance. It includes background and training resources, EVM standard operating procedures, EVM assessment tools and user guides, and lessons learned from EVM country assessments. It also contains the Vaccine Management Handbook (below).
- **WHO Vaccine Management Handbook:** this handbook provides technical advice on immunisation logistics, including the use of cold boxes, vaccine carriers and coolant

packs for transport and outreach, and how to monitor temperatures in the supply chain.

- **PATH total cost of ownership (TCO) tool:** this tool calculates purchase, delivery, installation and operating costs for a variety of cold chain devices over their expected lifetimes. This tool was developed with input from numerous partners and experts and is hosted on the PATH website. This is the only tool in use today that has been approved by Gavi. There may be other tools in use but these are independent of Gavi or the CCEOP. It is essential that countries conduct the total cost of ownership analysis with the PATH TCO tool during planning and budgeting of their CCEOP applications. TCO varies by country due to country specific factors such as labour and energy costs. Therefore, this tool should be customized by using country-specific inputs to produce TCO estimates that correspond to their country context. For further details, please refer to P. 26 in this Technology Guide.
- **General procurement guidelines for CCE:** these documents provide commercial and technical guidance for different cold chain product categories such as cold/freezer rooms, mains powered & 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 Supply Division.
- **UNICEF supply catalogue:** in its "Cold Chain Equipment" section, this online catalogue contains many types of CCE devices, accessories and spare parts, and includes technical specifications and pricing for each one.
- **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.
- **TechNet-21 Cold Chain Equipment area:** Extensive information on specific WHO PQS-prequalified products including installation and maintenance guides, training resources, brochures, videos, photos, as well as product feedback from TechNet members.
- **"Introducing solar-powered vaccine refrigerator and freezer systems" guide:** this document, created by WHO and UNICEF, provides managers in national immunisation programmes with guidance on how to implement solar-powered vaccine refrigerator and freezer systems.
- **Freeze-preventive passive devices guide:** this interim guidance on selecting, commissioning and using freeze-preventative vaccine carriers was created by WHO and UNICEF to guide countries on the selection of freeze-preventive vaccine carriers or standard vaccine carriers based on local context to maintain vaccine quality, especially at service delivery points.
- **Immunization Supply Chain Interventions:** this report addresses challenges faced in immunization supply chains which target underserved communities, providing strategies and interventions on how to overcome them. This report includes eight cross-cutting strategies including adjusted forecasting, stratified budgeting, leveraging CTC, utilizing alternative vaccine presentations, increasing storage capacity and solarization, optimizing cold/cool/warm life30, planning appropriate human resources based on weight(mass) of cold boxes, and integrating supply chains into microplans to strengthen the system. Additionally,

programmatic interventions are provided directed at the most underserved groups, the remote rural, the urban poor, and the conflict-affected child.

- **WHO EPI Supply Chain Tools:** 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.
- **WHO EPI Supply Chain guidance:** This page contains a repository of immunization supply chain guidance and tools produced by WHO and is organized into the following topics: COVID-19 key resources; COVID-19 documents; Supply chain publications; EVM Good Practice; Vaccine Management Handbook; WHO-UNICEF joint statements; Vaccine vial monitor.
- **WHO-UNICEF Joint Statement on temperature-sensitive health products in the Expanded Programme on Immunization cold chain:** 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 planning tools and other existing mechanisms to design and implement a safe and efficient integrated cold chain system.
- **UNICEF RTMD Maturity Level Assessment Tool** (Forthcoming/currently piloted): This assessment tool is intended for countries to conduct a self-assessment with regards to their current level and capacity to utilize 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. The RTMD Maturity Level Assessment tool is anticipated to become a required component of CCEOP applications going forward.
- **Country Device Selection Tool (Forthcoming):** The Alliance is developing a new tool that will help countries assess between their different CCE product options. The tool will include more details on products than are contained in this Technology Guide, to allow countries to better understand the added value of different products and features. This tool is expected to be available in early 2024.

OVERVIEW OF HOW TO MAKE PURCHASING DECISIONS

This guide is designed to help you think through which equipment to purchase.
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.

Step 3: Choose your device models

For each type of device, see what models are currently available in the lists for each CCE product, and weigh trade-offs.

Additional steps and considerations are also outlined for selection of passive devices used for transport or long-term storage of vaccines

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 purchasing decisions, it is necessary to update your country's existing cold chain equipment 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 makes and models will 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) or for new locations (existing or planned to be built) where cold chain equipment may be deployed for the first time.

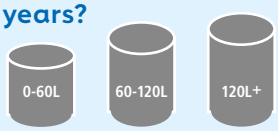
Choosing the correct cold chain solutions for your country's health facilities and cold storage points will require you to assess each location's characteristics. For purchasing fixed storage devices (i.e., non-portable devices such as refrigerators, freezers and long-term passive devices), the following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

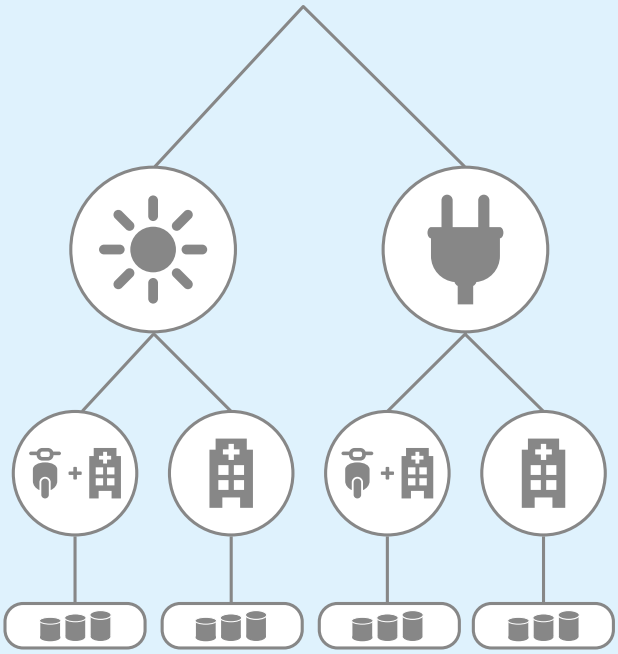
3 **What is the required vaccine* storage capacity of the location over the next 5-10 years?**



*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 cost of ownership (TCO) and appropriately budget for CCE operating costs. To note, TCO is a key consideration, but it should not be the sole decision making criterion for determining what CCE is most appropriate for your country (see below for the full set of criteria to consider).

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 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. When considering individual models, it is important to first check how many hours of electricity each model requires. Planning conservatively is key,

as actual conditions where a device is used may be more demanding than those where it was tested, and in some locations, devices may need more hours of electricity per day than their supplier rating indicates.

Length of power outages should also be taken into account. Choose devices that have a holdover time longer than expected power outages. 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 select 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?

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.

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, including non-infant immunisations such as human papillomavirus (HPV) vaccines;
- Improved coverage targets;
- Supplemental immunisation activities, such as campaigns.
- 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 and the WHO series of modules on immunisation training for Mid-level Managers.

PURCHASING IMPLICATIONS

If you are making purchases for multiple sites, it will be useful to group devices into storage capacity bands, or size segments (0-60L, 60-120L, and 120L+). 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 10, before selecting the correct CCE for your health facilities and cold storage points please consider the following additional factors:

- **Ambient temperature range:** It will be important to select a device that is PQS tested to operate across the full range of temperatures in the area where the device is being used.
- **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 CCEOP application and requested to UNICEF Supply Division at the time of tendering.
- **Remote temperature monitoring:** Some cold chain storage points will require remote temperature monitoring as outlined in the CCEOP application guidelines. If any of the fridges selected are intended to have remote temperature monitoring (as aligned with the CCEOP guidance), you should ensure that the fridge is selected to come with either a bundled standalone RTMD or an integrated RTDM. All fridges in the CCEOP can come with a bundled standalone or integrated RTMD if requested.
- **Ability to use solar devices:** Solar devices are not suitable for all locations. Some sites might be surrounded by buildings or trees that would block solar panels from receiving direct sunlight. Others may not have strong enough sunlight all year round. If you are considering purchasing solar devices, having a site evaluation conducted will help you determine whether a solar device will receive enough power. Solar panels can be mounted on either the roof of the building, if strong enough and receives adequate sunlight during the day, or on a separate mounting pole. While a separate mounting pole may mean additional costs, it offers more flexibility for panel placement. When preparing an operational deployment plan, it is critical to note whether a pole or roof mount will be necessary at a given location' based on site evaluations and the distance from the pole mount to the intended installation point of the refrigerator. The number of pole and roof mount installations should be specified in the operational deployment plan so that appropriate resources can be mobilized for installation.
- **Maturity level assessment for remote data monitoring:** For countries planning to procure RTMDs (and in the future EMS Level 3) 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 (whether integrated or a standalone device) 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 find that none of the options in this guide are appropriate for a particular site, a WHO PQS representative or UNICEF SD representative can help you choose the right device.
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 TRANSPORT DEVICES FOR YOUR IMMUNISATION PROGRAMME

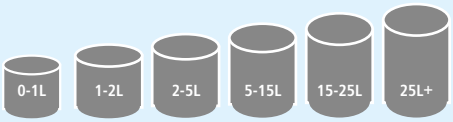
Vaccine carriers and cold boxes are a vital part of immunisation cold chains. The CCEOP only supports Grade A 'freeze preventive' vaccine carriers and cold boxes. Choosing the correct Grade A passive cold chain solution for your country's facility supply chain transport needs will require you to assess the specific transport 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. For purchasing freeze preventive transport solutions, the following two questions will help you categorize 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 vaccine carriers and cold boxes for transport or outreach, consider the following factors in your decision:

- Compliance with platform requirements, which determines eligibility for platform 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);
- 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;
- Fully loaded weight of the vaccine carrier or cold box to ensure that healthcare workers are able to comfortably and safely carry and walk with the vaccine carrier and/or lift the cold box;
- Size, type and number of coolant packs required, and their compatibility with other coolant packs used in the country.

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.

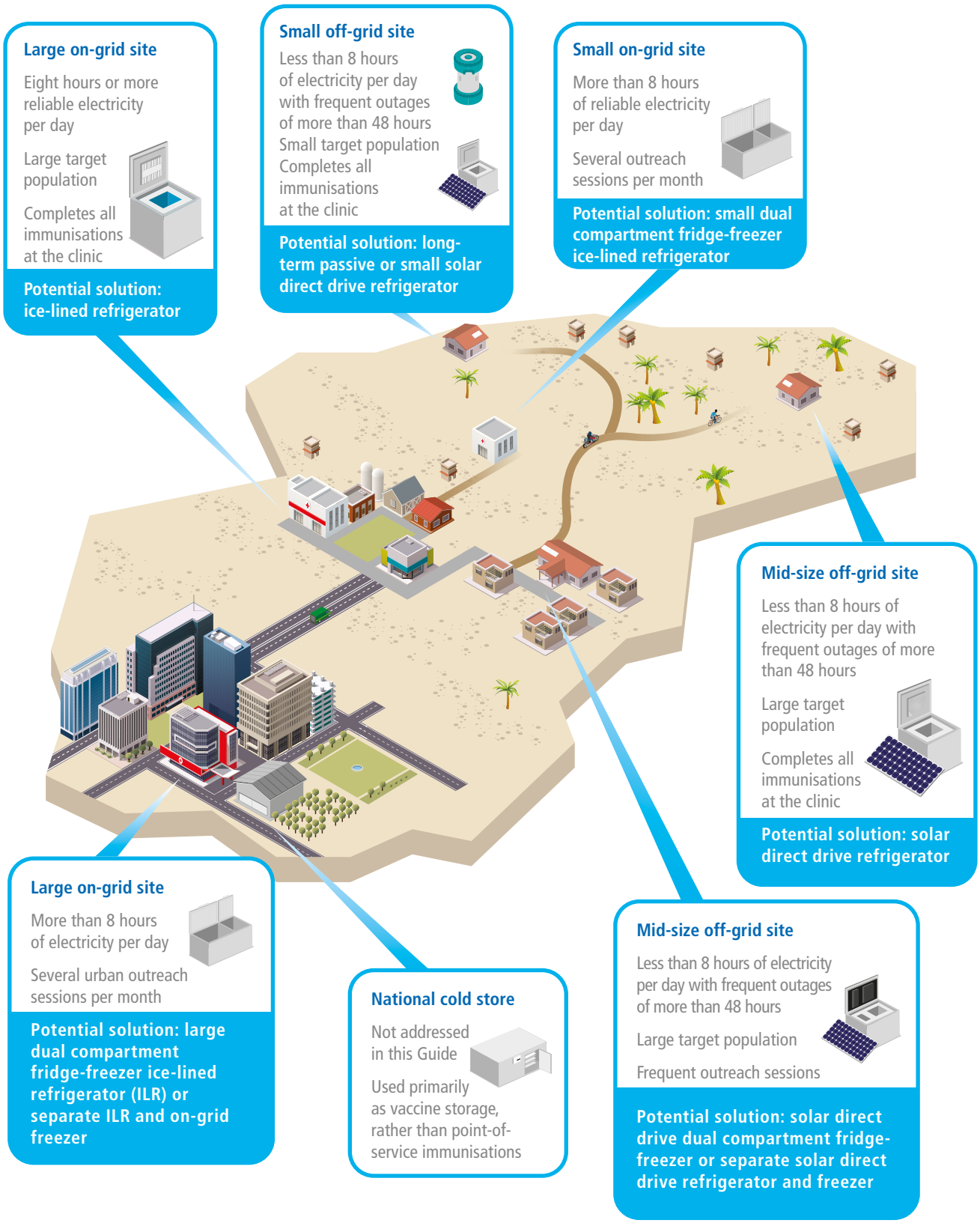
If either one of these requirements is not met, there is a risk for vaccine wastage as well as for interruptions in immunisation service at the facilities served by the delivery hub.

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, and then specific device models. 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.



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

_____

☐☐☐

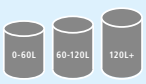
Immunisation only

_____

☐☐☐

Immunisation and outreach

_____



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Immunisation only

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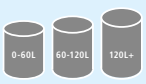


☐☐☐

STEP 2

CHOOSING YOUR DEVICE TYPES, THEN YOUR DEVICE MODELS

CCEOP REQUIREMENTS

Through the CCEOP, 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). The CCEOP subsidises equipment that is Grade A only, ie, not requiring any user intervention to prevent freezing;
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;
3. **Temperature monitoring and logging:** The platform currently requires Type 1 (the most basic) temperature monitoring devices to be provided with all refrigerators. All refrigerators intended for higher levels of the cold chain (i.e., district level and higher) must be procured with an integrated or bundled RTMD (Type 3 or Type 4) (and in the future EMS Level 3), while at the lower levels of the cold chain (i.e., health facility level), a sub-set of refrigerators must include integrated or bundled RTMDs (and in the future, EMS Level 3). However, the platform subsidises Types 1, 2, 3, and . A maturity level assessment for use of remote data that is part of the CCEOP application will also be conducted to determine if any sites / countries should not yet be equipped with RTMDs at the lower levels of the cold chain;
4. **Extended voltage stabilizing (for on-grid devices only):** WHO PQS requires every on-grid ILR to be provided with a PQS pre-qualified voltage stabilizer and the CCEOP requires that all voltage stabilizers procured through the platform are extended voltage stabilizers; and
5. **Country ownership of data:** Countries are considered the owners of data generated by CCE procured using Gavi support including CCEOP.

1. USER-INDEPENDENT FREEZE PROTECTION

This feature ensures that vaccines are not exposed to freezing temperatures.
WHO PQS certifies devices for Grade A freeze protection.

USER INDEPENDENT FREEZE PROTECTION		MEETS PLATFORM REQUIREMENT
GRADE A	When the device is used within its rated ambient temperature range, the user does not need to perform any actions to protect vaccines from freezing temperatures. For example, the device would not require removable baskets to protect vaccines from freezing. However, baskets may still be used to sort vaccines in the device.	✓
GRADE B	When the device is used within its rated ambient temperature range, the user must perform one action to protect vaccines from freezing temperatures.	✗
GRADE C	When the device is used within its rated ambient temperature range, the user must perform more than one action to protect vaccines from freezing temperatures.	✗

2. EXTENDED OPERATING TEMPERATURE RANGE

This feature keeps the equipment operating correctly even during large changes in ambient temperature.

EXTENDED OPERATING TEMPERATURE RANGE		MEETS PLATFORM REQUIREMENT
MODERATE	The device operates at a steady 27 °C ambient temperature and over a 27 °C/10 °C day/night cycling temperature range.	✗
TEMPERATE	The device operates at a steady 32 °C ambient temperature and over a 32 °C/15 °C day/night cycling temperature range.	✗
HOT	The device operates at a steady 43 °C ambient temperature and over a 43 °C/25 °C day/night cycling temperature range.	✗
EXTENDED	The device satisfies the requirements for hot zone operation above (43 °C), and can also operate at a continuous rated minimum ambient temperature of at most 10 °C.	✓

Note: for freeze-preventive cold boxes and freeze-preventive vaccine carriers, the required extended operating temperature range is +15C to +43C, in accordance to PQS standards. 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

Once in the field, the refrigerator compartment must be equipped with a temperature recording device that supports the transfer of data to a logistics management information system (LMIS) for analysis. This device can be provided in two ways: 1) as a fully integrated part of the refrigerator or 2) as a separate, standalone device, but shipped along with the refrigerator.

All CCEOP equipment comes bundled with a Type 1 logger (30-DTR). In addition, in Gavi 5.0, the CCEOP is implementing a new requirement around inclusion of RTMDs (Type 3 or Type 4) with refrigerators. All refrigerators intended for higher levels of the cold chain (i.e., district level and higher) must be procured with an integrated or bundled RTMD. At the lower levels of the cold chain (i.e., health facility level), a sub-set of refrigerators must include integrated or bundled RTMDs informed by the maturity level assessment for use of remote temperature monitoring data. Countries can also equip existing fridges with standalone RTMDs as part of CCEOP support in 5.0. Please see the CCEOP application guidelines, budget template, and ODP template for further details on the sampling approach. Please note that once EMS is available, refrigerators can be equipped with EMS that remotely transmits the data instead of an RTMD.

Temperature monitoring and logging		Meets platform requirement
TYPE 1 Standalone Logger	The device includes a country-selected and pre-qualified disposable 30-day temperature logger.	✓
TYPE 2 Integrated Logger	The device includes a supplier-selected and fully-integrated 30-day temperature logger built into the refrigerator body.	✓
TYPE 3 Standalone Remote Temperature Monitoring Device	The device includes a country-selected and pre-qualified remote temperature monitoring device, which in addition to temperature monitoring and logging, can also send SMS alarm messages.	✓
TYPE 4 Integrated Remote Temperature Monitoring Device	The device includes a supplier-selected and fully-integrated remote temperature monitoring device, which in addition to temperature monitoring and logging, can also send SMS alarm messages.	✓

4. VOLTAGE STABILIZATION/STABILIZER (FOR ON-GRID DEVICES ONLY)

This feature protects equipment from electrical damage. All voltage stabilizers must meet WHO PQS certification requirements. Only extended voltage stabilizers are platform-eligible.

Voltage stabilizers are used between the electric power outlet and the refrigerator or freezer. Stabilizers are designed to protect AC-powered appliances from a range of power-related issues, including voltage or frequency fluctuation (e.g., when using a generator) or voltage surges (e.g., due to power transmission issues in the grid). This protection from AC power issues can safeguard a refrigerator's or freezer's electronic control unit (ECU), compressor, fuses, and other electronic components from damage, and can thereby increase the refrigerator's and freezer's lifetime in the cold chain. A built-in or stand-alone voltage stabilizer must always be used when connecting an on-grid refrigerator or freezer to mains power.

Voltage Stabilization/Stabilizer (for on-grid devices only)		Meets platform requirement
STANDALONE	A separate voltage stabilizer is bundled with the purchase of a refrigerator or freezer.	✓
INTEGRATED	A voltage stabilizer is built into the refrigerator or freezer.	✓

After a power cut, all voltage stabilizers have a delay in restarting. This delay, which can range from three to six minutes, protects equipment from voltage fluctuations as the power grid re-stabilizes. WHO PQS published updated requirements for voltage stabilizers in July 2022. Voltage stabilizer devices are evaluated and pre-qualified against specifications and testing protocols found here.

5. COUNTRY OWNERSHIP OF DATA

Countries are considered the owners of data generated by CCE procured through the CCEOP, 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.

Manufacturers' can access relevant data for the maintenance or fulfillment of CCE warranties, as they have default access to data as part of operating RTM portals, equipment monitoring systems (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 market, 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. 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 for platform compliance, but it is an innovative new feature offered on some SDD devices – and that several other suppliers are considering incorporating into future models.

Frequently, the solar panels installed with an SDD generate more power than is needed to run a fridge or freezer unit. Energy harvesting allows health facilities to use excess power from solar panels for other purposes. Depending on voltage specifications, health workers can use devices with energy radios, medical devices, battery-powered lanterns, or power devices such as fans and lighting. This excess power may be made available via power outlets located on the SDD or via standalone devices that are connected to the SDD systems. Standalone energy harvesting devices are not currently CCEOP eligible.

Solar energy harvesting is an especially promising capability, as it can evolve an SDD device from a cold chain solution to a potential power hub for other devices at an off-grid clinic.

As of May 2017, WHO PQS has updated requirements for devices offering energy harvesting. SDDs featuring energy harvesting technology are evaluated using the specifications and testing protocols found here. Additional guidance on EHC can be found here.

HEALTH FACILITY SOLAR ELECTRIFICATION: LOOKING TO THE FUTURE

In the next few years, the CCEOP platform may be expanded to include solar energy systems beyond SDDs that aid in solar electrification of facilities, pending the outcomes of planned pilot projects. Such an inclusion would leverage the CCEOP planning and implementation processes, though funding would likely need to include domestic or other donor funding. Options for HFSE need to be selected based on health facility power needs and that will need to be validated in the health facility site selection and ODP process. Solar energy systems will likely range from 5-10kWp capabilities to provide solar power to facilities for services including basic lighting needs, maternal and child health equipment, labour room equipment, and lab/diagnostic equipment in addition to vaccine CCE needs. Under the CCEOP, countries would identify their solar energy system needs and will be provided with an appropriate solar energy system solution for health facilities. However, equipment for health facilities beyond vaccine CCE and solar energy systems would not be available for procurement via the CCEOP.

OVERVIEW OF FUTURE DEVICES

The platform gives countries the opportunity to upgrade their cold chains with the best and most appropriate equipment available today. Looking ahead, additional exciting cold chain technologies are expected to arrive on the market in the coming years. These devices and features are designed to address user needs and better protect vaccines.

This guide includes a brief summary of expected new CCE devices or device features that are still in design and testing phases or in the pipeline for future platform-eligibility. There are also emerging technologies and new device categories that are not mentioned in this guide because their development and commercialisation timelines are still uncertain.

New platform-eligible equipment will be added to this guide as they becomes available.

STEP 3

DEVICE SELECTION

In the previous section, the worksheet on page 17 helped you to divide your health facilities into categories based on electricity access, outreach activities and storage capacity requirements. In the pages that follow, you can identify the various devices that meet the needs of each group.

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 of their desired cold chain equipment during the CCEOP application stage.

The below TCO tool was developed by PATH and is the only tool currently in use that has been approved for use by the Alliance. All TCO figures for Gavi CCEOP eligible products should be calculated using the PATH TCO Tool.

Download the tool here or access an online version here.

Please note the online version does not yet offer the customisation to change assumptions or inputs compared to the excel version of the TCO tool (as of October 2023).

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. Kit installation costs are also included with service bundles. This Guide includes estimated ranges of the service bundle cost.
- 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. Opex costs can be calculated using the PATH TCO tool and are not included in this Guide.

The excel and online version of the TCO tool include default estimates for installation costs. The excel TCO tool 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.

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

DEVICE SELECTION

Please check the UNICEF SD Catalogue for accurate and up-to-date purchase prices for CCEOP-eligible equipment. If pricing information is not found in the UNICEF SD catalogue, please refer to the CCEOP application budget template as a second reference. Also, the device tables offer two volume ranges (price per unit for orders of 1-9 units and 200-499 units respectively), as all suppliers currently offer volume based discounts. Please refer to the UNICEF SD catalogue to view the full list (11 volume ranges) of volume based discounts.

The CCEOP is implementing a new approach to CCE product selection for applications and procurement. In the new approach, countries will be asked to note 3 equipment models from within each product and volume category they select. More information on this approach is detailed in the CCEOP application guidelines.

In addition, the CCEOP is also implementing a new requirement around inclusion of RTMDs with refrigerators. All refrigerators intended for higher levels of the cold chain (i.e., district level and higher) must be procured with an integrated or bundled RTMD. At the lower levels of the cold chain (i.e., health facility level), a sub-set of refrigerators must include integrated or bundled RTMDs. Please see the CCEOP application guidelines, budget template, and ODP template for further details on the sampling approach. An RTMD Maturity Level Assessment tool is being developed by UNICEF for the Alliance that will help determine if countries may have any sites that merit exception to the RTMD requirement.

The volume bands used to segment ILR and SDD storage sizes have been consolidated for Gavi 5.0 to 3 segments: 0-60L, 60-120L and 120L+, with CCE suppliers including one product per volume band in most cases. This has resulted in less products being included in this Guide (and the CCEOP platform) than were previously eligible in Gavi 4.0. This consolidation is meant help make it easier to pick the CCE that works well in a given context across a variety of settings and will help increase the planning and efficiency of CCE manufacturers, which should ultimately reduce product lead times and costs. However, there may continue to be limited demand for equipment that is no longer included in this Guide. In these selected cases, please contact UNICEF Supply Division to discuss additional CCE product options.

For the information in the device tables, please note the following considerations.

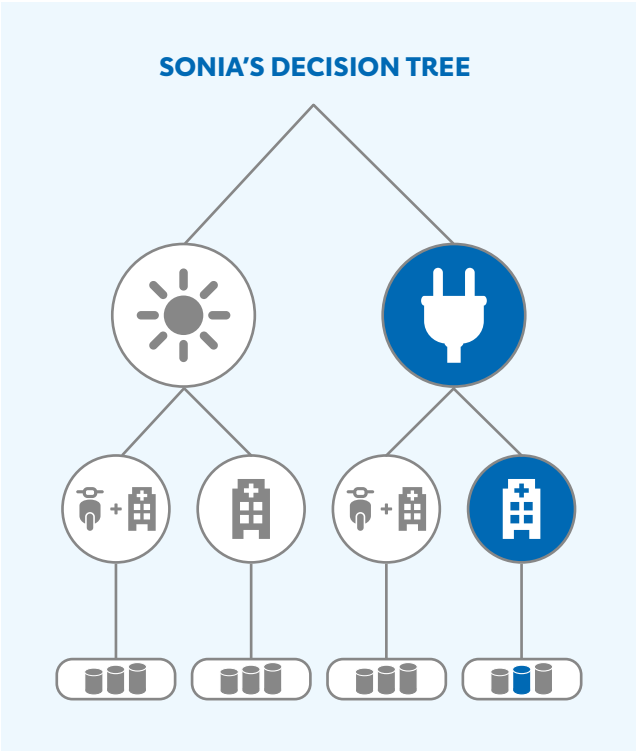
- **Freeze protection:** All refrigerators that are CCEOP platform eligible have been verified by WHO to meet the PQS Grade A freeze protection protocol.
- **Voltage Stabilizing:** All extended voltage stabilizers that are CCEOP platform eligible have been verified by WHO to meet the PQS protocol. Only PQS-prequalified voltage stabilizers may be purchased for use with

on-grid, mains-powered CCE. All mains powered equipment procured through the CCEOP comes bundled with a PQS-prequalified extended voltage stabilizer.

- **Equipment pricing:**
  - Device pricing is provided by UNICEF SD. If not available from UNICEF SD, the prices are sourced from the latest WHO PQS catalogue. These price points are cross referenced against manufacturers' direct quotes.
  - All pricing is based on orders of 1-9 units, and 200-499 units (unless otherwise noted), FCA INCOTERMS and plywood packaging.
  - The exchange rate used in this Guide is 1 USD = 0.885 Euro. All pricing is in US Dollars (USD).
  - Prices for each device include the cost of a temperature monitoring device and an extended voltage stabilizer (where applicable).
  - The prices of fridges with bundled or integrated RTMDs are listed in the product tables. Please note these include an estimate of 3 years of subscription and data costs, but that actual costs may vary on a country by country basis, and UNICEF SD will need to confirm the actual cost.
  - Prices do not include any additional fees incurred when ordering from the UNICEF supply catalogue.
- **Service bundle costs:** estimated service bundle costs represent an expected range, but actual costs will vary by country (including intra-country variation). Service bundle costs include the estimated cost of in-country delivery, training and installations.
- **RTMD subscription renewal costs:** The average annual costs for standalone RTMDs are included in the product tables. Please note that the actual costs may vary on a country by country basis, and UNICEF SD will need to confirm the actual cost.
- **Portable devices:** for vaccine carriers, this guide only shows purchase price, since delivery and operational costs will vary by country and device use.
- **Two-mode devices:** some single-compartment ILRs can be set to operate as either a fridge or a freezer.
- **Operating costs:** Opex costs can be estimated using the PATH TCO tool and are not included in this Guide.
- **Warranty:** all ILRs and SDDs come with a three-year supplier guaranteed warranty. In some cases the supplier may offer an extended warranty. Please contact UNICEF Supply Division for further details on the Terms & Conditions of each product's warranty.

DEVICE SELECTION

EXAMPLE 1



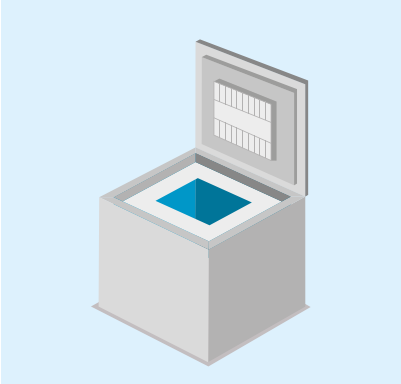
Sonia is a country-level decision maker who has to determine what device will be best for several large, on-grid facilities. These facilities conduct very little outreach and are not distribution points for vaccines or ice packs.

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.

Equipment Selection Process – New Approach: Sonia notes that there is a new CCEOP application and procurement approach that requires countries to include three options for each type of equipment they need. Under this approach, she selects and budgets out three different equipment models from three different suppliers within each product category and volume band as required in the country funding application. Sonia knows that while the CCEOP will try to fulfill country's first preference, by listing these three models she agrees the country could receive any of them. In case she could not find three models within her chosen volume band, Sonia knows UNICEF SD will be available to help her identify appropriate additional solutions.



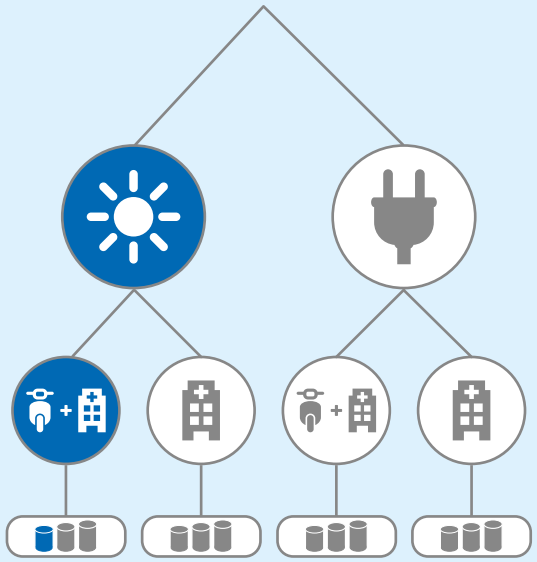
Final Selection: In line with new CCEOP application guidance, Sonia chooses three platform compliant ILRs with storage capacity between 60 and 120 L for each facility. All ILRs are rated to operate with only

eight hours of electricity per day. With long holdover times, they can easily withstand power outages that last more than one day, and up to three or four days with some products. The ILRs also have a much lower TCO than similarly sized solar devices. Since platform-compliant devices have Grade A user-independent freeze protection, Sonia knows there is minimal chance of vaccine wastage due to freezing. All ILRs come with high quality bundled or integrated voltage stabilizers to protect them from damage by power surges. All ILRs (and SDDs) also come bundled with a 30-DTR in order to 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. Sonia also complies with the RTMD requirement (once she has completed the maturity level assessment and checked for network connectivity), and ensures the required sub-set of equipment are requested to come bundled with an RTMD device (or integrated RTMD).

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 [SIAs]), and ice deliveries are too expensive. These facilities require devices with a freezer compartment that can freeze ice packs.

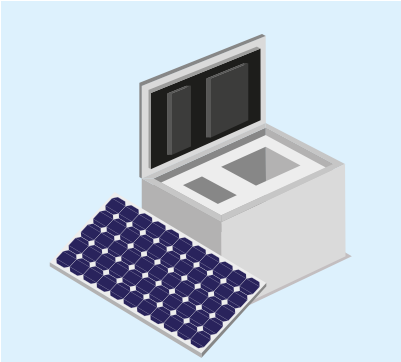
Olamide determines that he needs devices with at least 30 L in vaccine storage capacity. This capacity would require four to six long-term passive devices per facility, but only one 30 L or larger SDD device. Given the need for freezer capability, the optimal solution would be either dual compartment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

Final Selection: Olamide decides to purchase a platform-compliant 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 CCEOP application requirements, he selects three dual compartment SDDs within the 0-60L volume band that have more than 30L of vaccine storage capacity, knowing the country may receive any one of these three SDDs.

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.



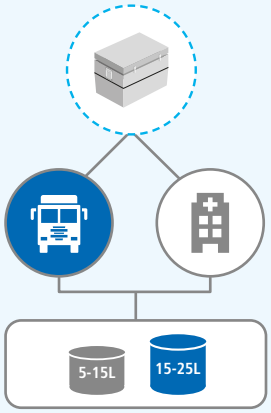
In addition, the freezer compartment of the SDD devices he purchases should be able to store the same size of ice packs (either 0.4 L or 0.6 L) that the vaccine carriers use for outreach.

He also ensure that, following the maturity level assessment, he has selected RTMDs (bundled or integrated) for at least 25% of the equipment at the health facility level.

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:

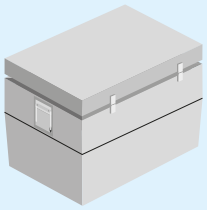
1. Use of old styrofoam containers with no insulation between the ice and vaccines;
2. Inconsistent ice pack conditioning practices by staff.

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 is 15 L and the largest is 30 L. To address differing route capacity requirements, he chooses two 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 15 L for use in delivery from regional stores to districts, with each regional store to receive two 15 L boxes.



HOW TO SELECT MODELS

More than one model likely will meet the needs of your health facilities or cold storage points. The following factors can help you narrow down your selection to the three models that should be included in the CCEOP application template. Within the template you will be able to indicate their first preference but should keep in mind you may receive any of the three models indicated.

Individual device characteristics:

- Compliance with platform requirements, which determines eligibility for platform funding and reflects a model's higher level of technological capability
- TCO, including purchase price of equipment, delivery, installation, and training, as well as lifetime operating costs (as calculated using the PATH TCO tool with your country-specific inputs)
- Holdover time for ILRs based on a facility's power reliability
  - ***– Devices with extended holdover time are preferable for facilities with less or unreliable electricity***
- Autonomy time for SDD devices based on regional climate factors
  - ***– Devices with extended autonomy time are preferable for facilities in regions with long periods of low sunlight***
- Freezer capacity for ice pack production
  - ***– Devices with a freezer compartment or a separate freezer are preferable for locations that need ice packs for outreach or transport***
- Ease of use, including:
  - ***– Readability of control panels and displays by a standing health worker***
  - ***– Use of internal storage racks, boxes or drawers to help organise vaccines and separate other medicines that are stored in the equipment***
- Voltage stabilizer location
  - ***– Devices with integrated voltage stabilizers ensure voltage stabilizer security, but may present maintenance and repair challenges***
  - ***– Devices relying on standalone voltage stabilizers can be easily replaced if needed, but security of the voltage stabilizer must be considered***

- SDDs with solar energy harvesting capabilities
- Equipment with minimal environmental impacts

  – Devices that use solar as a power source, refrigerant gas with lowest Global Warming Potential (GWP), or high efficiency ILRs.

Additional considerations:

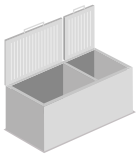
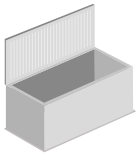
- Access to professional in-country installation and maintenance support, including availability of spare parts
- Quality and experience of after-sales support from the supplier, including training for device users
- The need for remote temperature monitoring (bundled or integrated) aligned to the Gavi 5.0 approach should also be taken into consideration
- Length and scope of the device's warranty. WHO requires a three year warranty for devices to be PQS prequalified; please note that warranties differ in terms and conditions, and countries should refer to the manufacturer for more information on terms and conditions covered under each warranty

PLATFORM COMPLIANCE

The CCEOP invests only in products that meet full platform compliance. This Guide lists only fully compliant products that are included on Long Term Agreement (LTAs) contracts between the manufacturer and UNICEF SD. The criteria for full platform compliance are the following:

- Grade A freeze protection: WHO-verified
- Extended operating temperature
- Extended temperature monitoring/logging
- Extended standalone voltage stabilizers
- Integrated voltage stabilizers
- Country ownership of data generated by CCE

ON-GRID DEVICES

	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, unless verified safe to cool water packs in the vaccine compartment	Supports low/medium levels of outreach	Supports high levels of outreach
VACCINE STORAGE CAPACITY	**(26-242 L)**	**(30-120 L)**	**Only selected models currently recommended for vaccine storage. All models can be used for ice pack freezing and storage.**
NUMBER OF CURRENT PLATFORM-COMPLIANT DEVICES	16	4	7
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 stabilizer 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 stabilizer	This device has an ice-making capability for outreach All models can be used to store freezable vaccines (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 It should always be installed with a voltage stabilizer

FUTURE DEVICES

Several suppliers are developing new mains-powered refrigerators and freezers expected to arrive on the market in the coming years. Future devices in development and/or testing include features such as longer holdover times, new models across different volume band sizes, and dual compartment fridge and freezer models.

Additional features such as integrated RTMD or EMS, AC/DC dual models, and AC-DC voltage stabilizers are also expected soon in some ILRs currently available through the platform. Following PQS certification and addition to UNICEF LTAs, new platform-eligible equipment will be added to this.

ICE-LINED REFRIGERATORS

The table below shows prices for platform-eligible products. The estimated range of service bundle costs is between USD 400 and USD 1,350. Estimated operating costs will vary by country and product, and are not included but can be estimated using PATH's TCO tool. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Holdover (days)	Voltage Stabilizer	UNICEF indicative price 1-9 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	UNICEF indicative price 200-499 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	RTMD type
Vaccine storage capacity, 120 L+									
Vestfrost	VLS 504A AC	242	2,3	Integrated	2588	3797	2485	3693	Own - intergated
Dulas	VC 225 ILR	203,2	3,9	Standalone	3689	4762	3121	4194	B Wireless ICE3 BC141 (integrated)
Haier	HBC-260	211	2,6	Standalone	1320	1780	1265	1725	Haier U-Cool (bundled)
Godrej & Boyce (Sure Chill)	GVR 225 AC	225	2,3	Integrated*	1280	*Forthcoming*	1280	*Forthcoming*	*Bundled (Model Forthcoming)*
Coolfinity	Coolfinity IceVolt 300P	241	1	Integrated	2915	*Forthcoming*	2915	*Forthcoming*	*Bundled (Model Forthcoming)*
B Medical	TCW 4000 AC	240	3,2	Standalone	5261	5261	4748	4748	Own - intergated
Vaccine storage capacity, 60-120 L									
Godrej & Boyce (Sure Chill)	GVR 99 Lite AC	98,5	2,5	Integrated*	1095	*Forthcoming*	1082	*Forthcoming*	*Bundled (Model Forthcoming)*
Haier	HBC-120	100	5,4	Standalone	1765	2225	1650	2110	Haier U-Cool (bundled)
Vestfrost	VLS 304A AC	98	2,3	Integrated	1678	2886	1678	2886	Own - intergated
Haier	HBC-80	61	2,5	Standalone	810	1270	700	1160	Haier U-Cool (bundled)
Godrej & Boyce (Sure Chill)	GVR 75 Lite AC	72,5	3,4	Integrated*	1052	*Forthcoming*	1040	*Forthcoming*	*Bundled (Model Forthcoming)*
B Medical	TCW 80 AC	81	3	Integrated	3960	3960	3507	3507	Own - intergated
Vestfrost	VLS 204A AC	60	2,3	Integrated	1532	2741	1532	2741	Own - intergated
Vaccine storage capacity, 0-60 L									
B Medical	TCW 40R AC	36,5	4,6	Integrated	3677	3677	3254	3254	Own - intergated
Godrej & Boyce (Sure Chill)	GVR 51 Lite AC	51	3,7	Integrated*	1024	*Forthcoming*	1012	*Forthcoming*	*Bundled (Model Forthcoming)*
Vestfrost	VLS 174A AC	38	2,4	Integrated	1477	2685	1418	2626	Own - intergated

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

*Sure Chill models available with either integrated or standalone voltage stabilizers

DUAL-COMPARTMENT ICE-LINED REFRIGERATOR-FREEZERS

The table below shows prices for platform-eligible products. The estimated range of service bundle costs is between USD 400 and USD 1,350. Estimated operating costs will vary by country and product, and are not included but can be estimated using PATH's TCO tool. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Waterpack storage capacity (L)	Waterpack freezing capacity (kg/24hr)	Freezer gross volume (L)	Holdover (days)	Voltage stabilizer	UNICEF indicative price 1-9 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	UNICEF indicative price 200-499 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	RTMD type
Vaccine storage capacity, 60-120 L												
B Medical	TCW120AC	120	22 x 0.6L	>1.6	28	3	Integrated	5572	5572	5006	5006	Own - intergated
Vaccine storage capacity, 0-60 L												
Haier	HBCD-90	30	16	4	32	2,7	Standalone	1520	1980	1420	1880	Haier U-Cool (bundled)
Vestfrost	VLS 064 RF AC	52,5	6 x 0.6	1,6	5,1	2	Integrated	1666	2875	1549	2758	Own - intergated
Godrej & Boyce (Sure Chill)	GVR 55 FF AC	58	14,4	2,4	44	4,7	Integrated*	1405	*Forthcoming*	1345	*Forthcoming*	*Bundled (model forthcoming)*

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

*Sure Chill models available with either integrated or standalone voltage stabilizers

ON-GRID FREEZERS

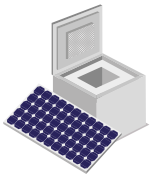
The table below shows prices for platform-eligible products. The estimated range of service bundle costs is between USD 400 and USD 1,350. Estimated operating costs will vary by country and product, and are not included but can be estimated using PATH's TCO tool. Additional costs such as procurement agency fees are not included.

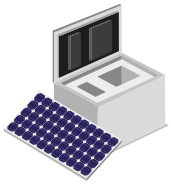
Supplier	Model	Gross volume (L)	Waterpack storage capacity (L)	Waterpack freezing capacity (kg/24hr)	Holdover (days)	Voltage Stabilizer	UNICEF indicative price 1-9 units, USD	UNICEF indicative price including RTMD (integrated or bundled)	UNICEF indicative price 200-499 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	RTMD type
Gross storage capacity, 120 L+											
Vestfrost	MF 114	105	64 x 0.6	7,2	0,1	Integrated	1048	2256	1006	2214	Own - intergated
Aucma	DW-25W300	300	74 x 0.6	38,3	2,4	Integrated	713	1923	713	1923	B Wireless ICE3 BC141
Vestfrost	MF 314	281	256 x 0.6	7,2	0,2	Integrated	1246	2455	1196	2405	Own - intergated
Haier	HBD-86	86	61	17,6	0,3	Standalone	1144	1604	1047	1507	Haier U-Cool (bundled)
Haier	HBD 265	265	210	32,4	0,5	Standalone	1514	1974	1384	1844	Haier U-Cool (bundled)
Aucma	DW-25W147	147	32 x 0.6	14,5	0,3	Integrated	623	1833	623	1833	B Wireless ICE3 BC141
Gross storage capacity, 60-120 L											
Aucma	DW-25W147	147	32 x 0.6	14,5	0,3	Integrated	623	1833	623	1833	B Wireless ICE3 BC141

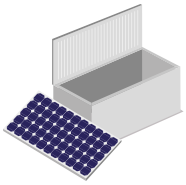
Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

OFF-GRID SOLAR DEVICES

Noting that all fridge/combos can be integrated with a stand alone RTMD (if fridge does not already have an integrated RTMD and that installation would be bundled) The RTMD would be a brand of supplier choice.







	SOLAR DIRECT DRIVE (SDD) REFRIGERATORS	DUAL COMPARTMENT FRIDGE-FREEZER SDD DEVICES	SDD ICE PACK FREEZERS
KEY FEATURES	This device is powered by solar panels It requires less maintenance than a solar battery refrigerator	This device is powered by solar panels It requires less maintenance than a solar battery fridge-freezer It has dual fridge and freezer compartments to support outreach	This device is powered by solar panels It requires less maintenance than a solar battery freezer
OUTREACH CAPABILITY	Supports high/low levels of outreach when accompanied by an ice pack freezer or compartment for chilling cool water packs*	Supports low/medium levels of outreach	Supports medium levels of outreach using ice packs
VACCINE STORAGE CAPACITY	**(36-220 L)**	**(36-120 L)**	**Models only to be used for ice pack freezing and storage**
NUMBER OF CURRENT PLATFORM-COMPLIANT DEVICES	15	11	3
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

*Depending on freezer capacity when paired with a vaccine refrigerator.

FUTURE DEVICES

Several suppliers are developing new SDDs expected to arrive on the market in the coming years. Future devices in development and/or testing include features such as longer autonomy time, upright SDD frames, larger storage capacity, and additional models with energy harvesting capabilities. Additional features such as integrated energy harvesting capabilities and integrated RTMD or EMS (Levels 1, 2, 3) are also expected soon in some SDDs currently available through the platform. Following PQS certification and addition to UNICEF LTAs, new platform-eligible equipment will be added to this Guide on a regular basis.

SOLAR DIRECT DRIVE REFRIGERATORS

The table below shows prices for platform-eligible products. The estimated range of service bundle costs is between USD 650 and USD 2,150. Estimated operating costs will vary by country and product, and are not included but can be estimated using PATH's TCO tool. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Autonomy (days)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	UNICEF indicative price 200-499 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	RTMD type
Vaccine storage capacity, 120 L+								
Dulas	VC 200 SDD	132	3,3	4677	5750	4552	5625	B Wireless ICE3 BC141 (integrated)
Vestfrost	VLS 154A SDD	170	3,1	4932	6140	4587	5795	Own - intergated
Haier	HTC-240	200	3,9	3804	4264	3594	4054	Haier U-Cool (bundled)
B Medical	TCW 4000 SDD	220	3,8	9026	9026	8081	8081	Own - intergated
Vaccine storage capacity, 60-120 L								
Vestfrost	VLS 094A SDD	92	3,23	3814	5022	3343	4551	Own - intergated
Godrej & Boyce (Sure Chill)	GVR 100 DC	99	7,3	3830	*Forthcoming*	3335	*Forthcoming*	*Bundled (Model Forthcoming)*
Haier	HTC-120	100	4,7	3400	3860	3200	3660	Haier U-Cool (bundled)
B Medical	TCW80SDD	80,5	3,0	7549	7549	6763	6763	Own - intergated
Dulas	VC 88 SDD	88	3,3	4426	5499	4245	5318	B Wireless ICE3 BC141 (integrated)
Vaccine storage capacity, 0-60 L								
B Medical	TCW 40R SDD	36	3,4	6895	6895	5975	5975	Own - intergated
Godrej & Boyce (Sure Chill)	GVR 50 DC	46,5	5,6	3285	*Forthcoming*	3135	*Forthcoming*	*Bundled (Model Forthcoming)*
Aucma	CFD-50 SDD*	50	5	3060	4270	3060	4270	B Wireless ICE3 BC141
Dulas	VC 50 SDD	52,5	3,1	3280	4353	3036	4109	B Wireless ICE3 BC141 (integrated)
Vestfrost	VLS 054A SDD	55,5	3,7	3421	4630	2998	4206	Own - intergated
Haier	HTC 110 SDD	59	4	2650	3110	2450	2910	Haier U-Cool (bundled)

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

* SDD includes PQS certified Integrated Energy Harvesting capabilities

DUAL-COMPARTMENT SOLAR DIRECT DRIVE REFRIGERATOR-FREEZERS

The table below shows prices for platform-eligible products. The estimated range of service bundle costs is between USD 650 and USD 2,150. Estimated operating costs will vary by country and product, and are not included but can be estimated using PATH's TCO tool. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Waterpack storage capacity (L)	Waterpack freezing capacity (kg/24hr)	Freezer gross volume (L)	Autonomy (days)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	UNICEF indicative price 200-499 units, USD	UNICEF indicative price including RTMD (integrated or bundled), USD	RTMD type
Vaccine storage capacity 120 L +											
B Medical	TCW120SDD	120	13,2	>1.6	28	3,4	12563	12563	11277	11277	Own - intergated
Vaccine storage capacity, 60-120 L											
Haier	HTCD 160 SDD	100	18 x 0.6	2,08	40	5,1	5800	6260	5570	6030	Haier U-Cool (bundled)
Dulas	VC 150 SDD	102	20 x 0.6	2,4	42,9	3,2	6299	7372	6186	7259	B Wireless ICE3 BC141 (integrated)
B Medical	TCW 2043 SDD	70	10.5 kg	2,5	42	3,1	12053	12053	10823	10823	Own - intergated
Vestfrost	VLS 096A RF SDD	110	28 X 0.6	2,4	50	4,8	7008,60	8217,38	6520,58	7729,36	Own - intergated
Vaccine storage capacity, 0-60 L											
B Medical	TCW 40 SDD	36	3.6 kg	1,89	4,8	3,4	7253	7253	6500	6500	Own - intergated
Vestfrost	VLS 056 RF SDD	36	29 x 0.6	1,8	49,3	3	5732	6941	5331	6540	Own - intergated
Haier	HTCD 90 SDD	37,5	20 x 0.6	2,08	32	4,8	4150	4610	3920	4380	Haier U-Cool (bundled)
Dulas	VC 60 SDD	57	23 x 0.6	2,4	24	3,5	5278	6351	5164	6237	B Wireless ICE3 BC141 (integrated)
Aucma	TCD-100	48	18x0.6	2	38	7,9	2550	3760	2520	3730	B Wireless ICE3 BC141
Godrej & Boyce (Sure Chill)	GVR 55 FF DC	58	24 x 0.6	2,4	44	11,8	5120	*Forthcoming*	4830	*Forthcoming*	*Bundled (Model Forthcoming)*

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

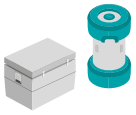
SOLAR DIRECT DRIVE WATER PACK FREEZERS

The table below shows prices for platform-eligible products. The estimated range of service bundle costs is between USD 650 and USD 2,150. Estimated operating costs will vary by country and product, and are not included but can be estimated using PATH's TCO tool. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Waterpack storage capacity (L)"	Waterpack freezing capacity (kg/24hr)	Autonomy (days)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price 200-499 units, USD
Vestfrost	VFS 048 SDD	34,3	29x0.6	1,6	2	3018	2894
Haier	HTD 40 SDD	NA	16,8	2,4	5	2320	2190
B Medical	TFW 40 SDD	N/A	11.24 kg	2,16	5	6222	5538

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

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)**
NUMBER OF CURRENT PLATFORM-COMPLIANT DEVICES	1
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)

LONG-TERM PASSIVE DEVICES

Supplier	Model	Vaccine storage capacity (L)	Ice Required (L)	Cold life at +43 °C (days)	UNICEF indicative price 1-15 units, USD
Aucma	Arktek YBC - 5	5,4	8	35	2393

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

Note: Coolant packs needed for the Arktek are available for USD $9

Note: The Arktek-YBC-5 requires conditioning of its ice packs before insertion, and is therefore not considered to have Grade A user independent freeze protection. Given the key features of the Arktek and its potential to satisfy specific supply chain needs, the platform will support its purchase on an exceptional basis

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 DEVICES

	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	15-20 L
NUMBER OF CURRENT PLATFORM-COMPLIANT DEVICES	7	2
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.

FUTURE DEVICES

Several suppliers are developing new portable devices and these are expected to arrive on the market in the coming years. Future devices in development and/or testing include both large and small freeze preventive cold boxes and other portable storage containers with between 7-50 L storage capacity and a cold life of 2-5 days. Other suppliers are also developing additional freeze preventive vaccine carriers with lighter weight and others with storage capacity larger than 2L.

In addition, some products under development intend to include remote temperature monitoring capability of the passive device during transport and use. Following PQS certification and addition to UNICEF LTAs, new platform-eligible equipment will be added to this Guide on a regular basis.

FREEZE-PREVENTIVE VACCINE CARRIERS

The table below shows prices for platform-eligible products. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Weight fully loaded (kg)	Cold life at +43 °C (days)	Size of coolant packs (L)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price 200-499 units, USD
AOV International	AFVC-46	1,5	8	1,4	0,6	27 (sea) 27 (air)	29
AOV International	AFVC 44	1,18	5,6	1,14	0,4	32 (sea) 29 (air)	27
Qingdao Leff	FFVC-1.7L	1,7	8	1,4	0,6	34	33
Blowkings	BK-VC-FF 1.6L	1,6	6,4	1,25	0,4	37 (sea) 37 (air)	34 (sea) 34 (air)
Blowkings	BK-VC-FF 2.4L	2,4	8,0	1,6	0,6	37 (sea) 47 (air)	45 (sea) 45 (air)
Nilkamal	BCVC46LFF	1,5	7,6	1,4	0,6	28	28
B Medical	RCW1*	1,04	7,6	1,3	0,6	268 (sea) 221 (air)	190 (sea) 186 (air)

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

* RCW1 requires a minimum order of 20 units

FREEZE-PREVENTIVE COLD BOXES

The table below shows prices for platform-eligible products. Additional costs such as procurement agency fees are not included.

Supplier	Model	Vaccine storage capacity (L)	Weight fully loaded (kg)	Cold life at +43 °C (days)	Size of coolant packs (L)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price 200-499 units, USD
Qingdao Leff	FFCB-20L	20	49,2	3	0,6	234	229
Qingdao Leff	FFCB-15L	15,4	49,9	4,4	0,6	239	234

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

NEW PQS PRODUCT CATEGORY: TRANSPORTABLE, POWERED VACCINE STORAGE APPLIANCES

In mid-2021 WHO PQS released a new product category called 'Transportable, powered vaccine storage appliances' (TPVS). This new category will include transportable, chargeable appliances with a minimum cold life of 12 hours at 43 C ambient temperature, generally intended for temporary storage and transport of vaccines. These devices may be best suited to settings with unreliable ice supply, where logistical flexibility is needed, or when extended cold life is valuable to allow for longer outreach sessions. Power sources to charge the device's internal energy storage mechanism could include mains electricity, generator, solar power, or battery. Products are just beginning to be prequalified, and several additional products are in development or in field testing and are also expected to be submitted for PQS prequalification soon. Examples of these products recently prequalified, under development or in testing include:

- A recently prequalified small vaccine storage device that is portable, monitorable, and is powered by a rechargeable battery and includes remote temperature monitoring and 12 hours of cold life.
- A portable vaccine transport system designed and engineered to address the challenges of performing outreach in the most inaccessible location. This device aims to safely store vaccines between 2 °C and 8 °C in 43 °C ambient environments for at least five days, without external power once fully charged. The display shows temperature, alarms, and estimated remaining cold life, and data can be downloaded via USB.
- A portable device powered by solar panels that will include remote temperature monitoring.

TEMPERATURE MONITORING DEVICES

Temperature monitoring devices (TMDs) are used to monitor the performance of CCE in maintaining the safe 2-8 °C range. Modern TMDs are designed to provide both a view of the current storage temperature, as well as a digital record of the temperatures – and high-risk events – over time.

In order to maintain vaccine quality, it is essential to monitor the temperature of vaccines throughout the supply chain. When done properly, this monitoring achieves the following goals:

- Identifies malfunctioning cold chain equipment, reducing risk to vaccines.
- Alerts health workers and supervisors to high-risk temperature exposures, so that corrective vaccine management and CCE maintenance actions can be taken (e.g., testing/disposal of vaccines, repair of CCE).
- Having a TMD is critical for achieving these goals.

30-DAY TEMPERATURE RECORDERS (30-DTRS)

For health facilities and subnational stores, WHO recommends the 30-day temperature recorders (30-DTRs)[1]. These devices display a) the current temperature, and b) a rolling 30-day history of all high-risk freezing and heat events[2]. This is a significant improvement over stem thermometers, which fail to alert health workers to events occurring between routine monitoring checks.

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

Note: 30-DTRs are battery powered, with devices lasting between two to five years (depending on model). As such, it is important to anticipate future procurement to replace units with run-down batteries within broader cold chain planning.

[1] Refer to the WHO Vaccine Management Handbook Module on How to Monitor Temperatures in the Vaccine Supply Chain 2015) (Module VMH-E2-01.1) for detailed guidance.

[2] 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]

30-DAY TEMPERATURE RECORDERS (DTRs)

Supplier	Model	Data download and interface	Battery life (months)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price 200-499 units, USD
Haier	HETL-01	USB	36 months from manufacture date	23	21
Berlinger	Fridge-tag 2 E*	USB, Varo app via connector cable	66 months from manufacturing date	90.30 external sensor 68.30 internal sensor	84.90 external sensor 62.90 internal sensor
LogTag	Vaxtag (TRID30-7FW)	USB	48	22,5	20,8
LogTag	LogTag USB Cradle	N/A	N/A	22	18

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

Note: All devices have a visual alarm and non-replaceable batteries

* Berlinger Fridge-Tag 2E requires a minimum order of 20 units

LogTag Devices Note: Battery Life (months) includes both storage and active life.

VARO APP

Varo is a free mobile app that helps access cold chain data from 30DTR loggers and turn it 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 30DTR 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.

Varo report data is only shared with the email recipient chosen by the app user. Varo reports can be created even when cellular networks are not available. Email recipients can also use an additional free web app called Pogo LT to automatically process numerous Varo reports from their email inbox to create a single summary spreadsheet.

REMOTE TEMPERATURE MONITORING DEVICES (RTMDS)

In addition to 30-DTRs, the platform also covers remote temperature monitoring devices (RTMDs) for use in fridges and walk-in cold rooms (WICRs). The addition of RTMDs for WICRs to the CCEOP platform is new as of 2022. These devices use mobile phone networks to transmit temperature data to the cloud. The data can be accessed through a supplier-provided web portal. This allows countries and fridge suppliers to quickly identify fridges that have performance issues, and to direct their in-country service delivery partners to perform required repairs quickly.

The platform also covers integrated RTMDs, which are RTMDs built into the fridge or freezer. Countries may consider selecting such devices when programmatic and budgeting requirements for the recurring fees are met. Additional temperature monitoring devices including new standalone RTMDs are expected on the market in the coming years. Following PQS certification and addition to UNICEF LTAs, new platform-eligible equipment will be added to this Guide on a regular basis.

RTMDs for fridges or WICRs are contracted with 3 years of access to online portals for remote management and tracking of equipment performance and data fees for transmitting of data from the equipment to these servers. This access also includes features such as remote SMS alerts to registered users for temperature alarms, among other features

Estimate range of installation and train costs will vary by country, and are estimated at between $200-$400 in most settings. Estimated data and operating costs will also vary by country and product. Additional costs such as procurement agency fees are not included. Countries should also consider budgeting for RTMD recurring costs after the initial 3-years of data and subscription costs are completed.

Please note most countries are expected to have costs at the lower end of the ranges provided in below table, but this should be confirmed with UNICEF Supply Division. **The values provided in the CCEOP Budget Template include the hardware cost, a point estimate for subscription costs per year, as well as the total estimated cost that encompasses the RTMD hardware + 3 years of subscription fees. This may not be reflective of the actual costs to your country or variations between local and global SIM data costs (should your country opt for a local rather than global SIM).** Countries should contact UNICEF Supply Division Cold Chain Unit to obtain country-specific subscription costs and subsequently update the RTMD total cost estimate in the budget template accordingly.

Selection of RTMDs (standalone or integrated) for new refrigerators purchased through the CCEOP should be done in alignment with the guidance included in the CCEOP applications.

REMOTE TEMPERATURE MONITORING DEVICES (RTMDs) FOR REFRIGERATORS

Estimated data and subscription costs are included for 3 years (with either global SIM cards or local SIM cards), will vary by country and product.

Supplier	Model	UNICEF indicative hardware price 1-9 units, USD	Estimated annual subscription fee (Global SIM card) USD per year†*	Total cost - hardware + 3 years' subscription fee, USD
Beyond Wireless	ICE3 (BC141)	250	320	1210
Haier	Haier U-Cool	101	90 - 150	371 - 551
Ikhaya	VM 1000	226	240**	946
Nexleaf	CTX	249**	80**	489**
Parsyl	Trek Pro	347	27	429
Berlinger	SmartMonitor SITE L	325**	*Forthcoming*	*Forthcoming*

Note:

1) **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

2) RTMDs procured through the CCEOP come with 3 years of subscription / data fees included (e.g., the total cost is the hardware + 3 x annual subscription fee)

† Where range is indicated, the prices differ by country, the range represents the lowest and highest price quoted. Recurring fees are expected to fall toward the lower estimate in the majority of countries; please contact UNICEF Supply Division to confirm costs for your country

* RTMDs are supplied bundled with the Global SIM card including all data transfer and SMS alarming requirements during the defined subscription period. The SIM card is supplied and managed by the manufacturer. For local subscription/SIM cards contact the supplier directly

** Pricing is from the PQS catalogue

REMOTE TEMPERATURE MONITORING DEVICES (RTMDs) FOR WALK-IN COLD ROOMS

Estimated data and subscription costs are included for 3 years (with either global SIM cards or local SIM cards), will vary by country and product.

Supplier	Model	UNICEF indicative hardware price† 1-9 units, USD	Estimated annual subscription fee (Global SIM card) USD per year†*	Total cost - hardware + 3 years' subscription fee, USD
Beyond Wireless	ICE3 (BC141)	500	365	1595
Beyond Wireless	ICE3 EXTRA - MODEL BC440 (3 WICR Model)	1350	485	2805
Beyond Wireless	ICE3 EXTRA - MODEL BC440 (2 WICR Model)	975	425	2250
Ikhaya	VM 1000 (2 WICR Model)	664 (8 x 15m probes)	212 - 1539	876 - 2203
Ikhaya	VM 1000	351 (4 x 15m probes)	212 - 1539	563 - 1890

Notes:

1) **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

2) RTMDs procured through the CCEOP come with 3 years of subscription / data fees included (e.g., the total cost is the hardware + 3 x annual subscription fee)

3) RTMDs can be made available for 1, 2, and 3 WICRs or more at a time. Please contact UNICEF SD with specific technical requirements for more exact price quotes

† Where range is indicated, the prices differ by country, the range represents the lowest and highest price quoted. Recurring fees are expected to fall toward the lower estimate in the majority of countries; please contact UNICEF Supply Division to confirm costs for your country

* RTMDs are supplied bundled with the Global SIM card including all data transfer and SMS alarming requirements during the defined subscription period. The SIM card is supplied and managed by the manufacturer. For local subscription/SIM cards contact the supplier directly

FUTURE DEVICES

Several suppliers are developing new RTMDs expected to arrive on the market in the coming years. Following PQS certification and addition to UNICEF LTAs, new platform-eligible equipment will be added to this Guide on a regular basis.

EQUIPMENT MONITORING SYSTEMS (EMS)

Beyond the current 30-DTR and RTMD devices, new devices are coming onto the market with additional performance monitoring functionalities which combine and extend the best features from both 30-DTRs and RTMDs. These new devices will be categorized under a new WHO PQS category of CCE performance monitoring technologies and requirements: "Equipment Monitoring Systems (EMS)".

EMS has three main sets of features that support increasing levels of functionality (Levels 1, 2 and 3) to meet the preferences and needs of immunization programmes:

1) Level 1: The sensors and components within a fridge (or other CCE) that monitor and record the equipment's performance data, along with a connection interface (USB port) that allows data to be downloaded in a standard format by a standalone EMD (see below), laptop or phone. At level 1, there is local data access via download only but no screen on which to view the data
2) Level 2: This has all of the functional of Level 1 and adds a device with a screen that displays the performance data and has audible alarms, called an Equipment Monitoring Device (EMD). The EMD can either be integrated into the fridge (or other CCE) or be a standalone device (similar to RTMDs). Data can also be locally downloaded via the EMD. Level 2 offers local data access only (no remote monitoring), though some Level 2 devices will be able to be remotely upgraded to activate remote monitoring (with a paid subscription).
3) Level 3: This has all of the functionality of Level 1 and 2 and adds a remote monitoring capability, where data is transmitted through a cellular or online connection, enabling email/phone alerts and data visibility via online dashboards (requires a subscription). Level 3 devices are expected to function as Level 2 devices should the subscription for remote monitoring and online dashboards expire / not be renewed.

There are three main goals of EMS:

- Generate, record, and communicate data and audible alarms to on-site health care workers and remote EPI management to drive actions that ensure vaccine safety and cold chain network performance
- Help turn CCE performance data into actionable insights for end-users, cold chain managers, and technicians to predict, diagnose and respond to equipment failures promptly
- Provide EPI programs direct access to CCE performance, environmental and device usage data both locally and remotely to facilitate maintenance planning and troubleshooting. In the longer term it is envisioned that EMS capabilities will begin to allow for predictive analysis and forecasting of potential future CCE failure or maintenance needs.

Key EMS functions and features include:

- **More aspects of CCE performance monitored:** In addition to monitoring vaccine compartment temperature, the standard monitored data available from the fridge will also include 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 dance (compressor runtime, error codes). Suppliers can also choose to have EMS monitor more aspects of the fridge's performance such as the compressor or other internal components. These parameters will facilitate troubleshooting and broader understanding of how the cold chain is functioning.
- **PQS basic requirement – standardized refrigerator monitoring and local user data access (EMS Level 1):** In the future, PQS will require all fridges come equipped

with built-in sensors and a data access port for local download and use of data, including standardized raw data and summary reports. This is known as EMS Level 1, as described above.

- **Integrated or Standalone EMS:** It will be up to the supplier to decide if the fridge will have integrated or standalone EMD to view and access the data (similar to integrated vs. standalone RTMDs). The CCEOP aims to maintain both options as available to countries, to allow countries to select the products that best meet their needs.
- **Essential local communications with remote option:** All EMS Level 2 & 3 will have an on-site display and essential audio-visual alarms that include vaccine compartment heat and freeze conditions, extended door openings, and extended loss of power availability for mains and solar. EMS Level 3 fridges will also have remote transmission of data via internet-based software systems. This would include remote transmission of performance data and alarm alerts (e.g., data transmitted to online portals, SMS alerts).
- **Upgradeable EMDs:** EMS is intended to provide the flexibility to upgrade local and remote communication devices as monitoring technology evolves over time. Fridges may last for ten (10) years but EMDs (standalone) may be added or upgraded as innovation continues and programs desire new monitoring features. Another option may be to purchase a fridge with the EMS Level 3, but only activate and pay for the remote monitoring and online portal data subscription once the country is read to utilize the remote monitoring functionality (e.g., utilize Level 2 functionality but the EMD is able to be remotely upgraded to Level 3 once the country is ready).
- **Information system integration:** remote software systems and standardized CCE data will be compatible with program management information systems, e.g., eLMIS. For the EMS that remotely transmit data, routine data delivery from EMS data service providers to EPI program software systems will be required in addition to the sharing of service provider APIs.

The ultimate success of EMS or any temperature monitoring technology will be a function of the people, processes, and systems setup to optimize its features. Similar to 30-DTRs and RTMDs, EMS does not replace the need for interventions to achieve vaccine safety and cold chain management, but rather enhances EPI programme ability to do so with more advanced features and functions. More information on EMS and approved products will be available in subsequent updates of this Guide.

Given varied EPI programme demands, PQS will be able to prequalify the following EMS types:

- Local, downloadable data access only, no EMD or display/alarms (EMS Level 1)
- Local data access only, integrated EMD with display and audible alarms (Level 2)
- Local data access only, external EMD with display and audible alarms (Level 2)
- Local + Remote data access, integrated EMD with display and audible alarms (Level 3)
- Local + Remote data access, external EMD with display and audible alarms (Level 3)

CCEOP Requirement: The Gavi / CCEOP requirement for EMS is expected to be provided in the coming months. The requirement would be expected to take effect as 2026.

VOLTAGE STABILIZERS

Voltage stabilizers are used to protect on-grid, mains-powered refrigerators and freezers from damage caused by fluctuations in the electricity supply. They protect the refrigerator or freezer's control unit, compressor, fuses and other electronic components against damage resulting from power fluctuations such as:

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

Some refrigerator and freezer manufacturers choose to integrate voltage stabilizers into the bodies of their devices, while others choose to provide a stand-alone, external voltage stabilizer along with their devices. This Guide only includes voltage stabilizers of the external type, since integrated stabilizers are a de facto option determined by the refrigerator or freezer manufacturer. In addition, only extended range voltage stabilizers are platform eligible.

It is critical that all on-grid refrigerators and freezers are only used in combination with a PQS prequalified voltage stabilizer, as power fluctuations can substantially reduce the reliability and lifetime of this type of equipment, as well as increase its maintenance costs.

Additional voltage stabilizers, including both standard and extended range, are currently under development and/or testing, and expected on the market in the coming years. Following PQS certification and addition to UNICEF LTAs, new platform-eligible equipment will be added to this Guide on a regular basis.

VOLTAGE STABILIZERS

Supplier	Model	Nominal Input/Output Voltage Type	Input Regulation Range Type	Input Voltage Regulation Range	Power Rating (VA)	UNICEF indicative price 1-9 units, USD	UNICEF indicative price 200-499 units, USD
Haier	HVS-1000E	230V/50-60Hz	Extended	110-280V	1000	112	109
Sollatek	SVS04-22E 4A	230V/50-60Hz	Extended	100-290V	1000	110	110

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

STANDALONE TRAININGS

Gavi has expanded the scope of existing trainings included with the Service Bundle that will be supported by the CCEOP. These additional trainings will help build capacity for maintenance and use of RTMD data for decision making. Trainings will be delivered by refrigerator/freezer or RTMD suppliers and/or their contracted Service Bundle Provider's and can be delivered in-person or remotely based on a country's training requirements. The RTMD training requirement is new under the CCEOP in Gavi 5.0. Countries also have the option to plan for refresher trainings during the course of implementation of their CCEOP grants. Three categories of trainings have been introduced below in addition to the existing end-user training provided at the point of installation.

CENTRAL LEVEL ILR/SDD TRAININGS

- In person training for refrigerators and freezers installation, maintenance and repair central training (TOT): This training remains optional and is available for countries with capacity gaps to manage and maintain CCE at higher levels of the Supply Chain (district, regional, national)

RTMD TRAININGS

- In person or remote trainings for technicians and general training on RTMD systems for refrigerators and freezers: The training is required for countries that procure RTMDs for refrigerators and freezers. Additional trainings can be requested for equipment already in the country.
- In person or remote trainings for technician and general central training on RTMD systems for WICRs/WIFRs: The training is required for countries that procure RTMDs for existing WICs/WIFRs. Additional trainings can be requested for equipment already in the country.

STANDALONE TRAININGS

Type of training	Number of participants	Cost (USD)	Notes
In-person refrigerators and freezers installation, maintenance, and repair Central Training (ToT).	20	18500	This training is optional and is available for countries with capacity gaps to manage and maintenance at higher levels of the Supply Chain (district, regional, national)
In-person RTMD system, technician and general trainings on Refrigerators and freezers (ToT).	20	8000	The training (remote or in person) is required for countries that procure RTMDs to be equipped in refrigerators and freezers.
Remote RTMD system, technician and general trainings on Refrigerators and freezers.	20	2500	
In-person RTMD system, technician and general Central training on WICRs/ WIFRs.	20	8000	This training (optional or remote) is required for countries that procure RTMDs to be equipped in existing WICs/ WIFRs.
Remote RTMD system, technician and general Central training on WICRs/ WIFRs.	20	3000	

Note: **This table uses a projected exchange rate of: $1.00 USD = 0.885 EUR**

CONCLUSION

Gavi's CCEOP 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 the drastically reducing of the risk of freezing. Third, the products should remain functional in challenging operating conditions for longer periods of time; additionally, recorded temperature data 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.

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, 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

CCEOP
Cold Chain Equipment Optimisation Platform

CFCC
Climate Friendly Cold Chains

EHC
Energy harvesting control

EMD
Equipment monitoring device

EMS
Equipment monitoring system

ESMAP
Energy Sector Management Assistance Program

EVM
Effective vaccine management

GAVI
Gavi, the Vaccine Alliance

HFSE
Health Facility Solar Electrification

ILR
Ice-lined refrigerator

LTA
Long Term Agreement

PQS
Performance, Quality and Safety

RTMD
Remote Temperature Monitoring Device

SDD
Solar direct drive

TCO
Total cost of ownership

TMD
Temperature Monitoring Devices

UN
United Nations

UNICEF
United Nations Children's Fund

WHO
World Health Organization

DEFINITIONS

Autonomy: The autonomy of a solar refrigerator measures the ability of the equipment to store vaccine during periods of heavy cloud. It is defined as the maximum number of days during which the refrigerator can maintain a full vaccine load at a temperature between 2 °C and 8 °C when the photovoltaic panels are not generating electricity.

Holdover time: In the event of power failure, the time in hours during which all points in the vaccine compartment of a vaccine refrigerator remain below 10 °C, at the maximum ambient temperature of the temperature zone for which the appliance is rated, after the power supply has been disconnected. For vaccine freezers, the holdover time is the time in hours during which the vaccine compartment remains below -5 °C.

Cold life and cool life for cold boxes and vaccine carriers: Cold life applies when fully frozen water packs are used as the coolant. These will continue to be used for transporting oral polio vaccine and single antigen freeze-dried vaccines. Cool life applies when cool water packs are used.

- ***Cold life with frozen water packs:*** Cold life is measured from the moment when the container lid is closed until the temperature of the warmest point in the vaccine storage compartment first reaches 10 °C, at a constant ambient temperature of 43 °C.
- ***Cool life with cool water packs at 5 °C:*** Cool life is measured from the moment when the container is closed, until the temperature of the warmest point inside the vaccine storage compartment first reaches 20 °C, at a constant ambient temperature of 43 °C.

THE COLD CHAIN EQUIPMENT OPTIMISATION PLATFORM HAS BEEN DEVELOPED THROUGH THE COLLABORATION OF THE FOLLOWING VACCINE ALLIANCE PARTNERS:

Gavi The Vaccine Alliance

Bill & Melinda Gates foundation

unicef

World Health Organization

PATH

Clinton Health Access Initiative

Gavi
The Vaccine Alliance

www.gavi.org
Together,
we make #vaccineswork

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